## Qualification at a glance

<table>
<thead>
<tr>
<th>Subject area</th>
<th>Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>City &amp; Guilds number</td>
<td>1255-01</td>
</tr>
<tr>
<td>Age group approved</td>
<td>16-18, 19+</td>
</tr>
<tr>
<td>Entry requirements</td>
<td>There are no formal entry requirements for candidates undertaking this qualification. However, centres must ensure that candidates have the potential and opportunity to gain the qualification successfully.</td>
</tr>
<tr>
<td>Assessment</td>
<td>Short answer question tests</td>
</tr>
<tr>
<td></td>
<td>Assignments</td>
</tr>
<tr>
<td></td>
<td>Online multiple choice test</td>
</tr>
<tr>
<td>Approvals</td>
<td>Full qualification approval required.</td>
</tr>
<tr>
<td>Support materials</td>
<td>Centre handbook</td>
</tr>
<tr>
<td>Registration and certification</td>
<td>Consult the Walled Garden/Online Catalogue for last dates.</td>
</tr>
</tbody>
</table>

### Title and level

<table>
<thead>
<tr>
<th>Title and level</th>
<th>GLH</th>
<th>TQT</th>
<th>City &amp; Guilds number</th>
<th>Accreditation number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 3 Diploma in Food and Drink Engineering Maintenance</td>
<td>1320</td>
<td>2495</td>
<td>1255-01</td>
<td>603/0355/4</td>
</tr>
</tbody>
</table>

### Version and date

<table>
<thead>
<tr>
<th>1.0 August 2016</th>
<th>Change detail</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 September 2017</td>
<td>Added TQT details</td>
<td>Qualification at a glance and Structure</td>
</tr>
<tr>
<td>Version 2 April 2019</td>
<td>Deleted QCF</td>
<td>Throughout</td>
</tr>
<tr>
<td></td>
<td>Grading table contents</td>
<td>Assessment</td>
</tr>
<tr>
<td></td>
<td>Various LO and AC content</td>
<td>Units</td>
</tr>
</tbody>
</table>
## Contents

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<th>Page</th>
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<td>Structure</td>
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<td>5 Units</td>
<td>16</td>
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<td>Unit 301</td>
<td>Food and drink engineering maintenance compliance</td>
</tr>
<tr>
<td>Unit 302</td>
<td>Food and drink engineering maintenance best practice</td>
</tr>
<tr>
<td>Unit 303</td>
<td>Materials science</td>
</tr>
<tr>
<td>Unit 304</td>
<td>Mechanical maintenance in food and drink operations</td>
</tr>
<tr>
<td>Unit 305</td>
<td>Producing replacement components for food and drink operations</td>
</tr>
<tr>
<td>Unit 306</td>
<td>Fluid power systems for food and drink operations</td>
</tr>
<tr>
<td>Unit 307</td>
<td>Welding technologies for food and drink operations</td>
</tr>
<tr>
<td>Unit 308</td>
<td>Electrical maintenance in food and drink operations</td>
</tr>
<tr>
<td>Unit 309</td>
<td>Services and utilities within food and drink operations</td>
</tr>
<tr>
<td>Unit 310</td>
<td>Thermodynamics</td>
</tr>
<tr>
<td>Unit 311</td>
<td>Maths for food and drink engineering maintenance</td>
</tr>
<tr>
<td>Unit 312</td>
<td>Monitoring mechanical maintenance for food and drink operations</td>
</tr>
<tr>
<td>Unit 313</td>
<td>Repairing and producing replacement components in food and drink operations</td>
</tr>
<tr>
<td>Unit 314</td>
<td>Welding skills for food and drink operations</td>
</tr>
<tr>
<td>Unit 315</td>
<td>Electrical maintenance and testing in food and drink operations</td>
</tr>
<tr>
<td>Unit 316</td>
<td>Automation in food and drink operations</td>
</tr>
<tr>
<td>Unit 317</td>
<td>Understand the requirements of electrical installations BS 7671 (2015)</td>
</tr>
<tr>
<td>Appendix 1</td>
<td>Sources of general information</td>
</tr>
</tbody>
</table>
## Introduction

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

<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who is the qualifications for?</td>
<td>This Diploma qualification is for learners taking a Food and Drink Maintenance Engineer apprenticeship.</td>
</tr>
<tr>
<td>What do the qualifications cover?</td>
<td>The qualification covers the knowledge, understanding and skills required of an apprentice Food and Drink Maintenance Engineer.</td>
</tr>
<tr>
<td>What opportunities for progression are there?</td>
<td>It allows learners to progress into following:</td>
</tr>
<tr>
<td></td>
<td>• Higher Apprenticeship in Advanced Manufacturing Engineering</td>
</tr>
<tr>
<td></td>
<td>• Foundation Degrees in Engineering</td>
</tr>
<tr>
<td></td>
<td>• City and Guilds Level 4 Diploma in Engineering</td>
</tr>
<tr>
<td>Who did we develop the qualification with?</td>
<td>The qualification was developed in conjunction with Food and Drink Maintenance Engineer employers.</td>
</tr>
<tr>
<td>Is it part of an apprenticeship framework or initiative?</td>
<td>This qualification is a mandatory requirement of the Food and Drink Engineering Maintenance Apprenticeship.</td>
</tr>
</tbody>
</table>
### Structure

To achieve the **Level 3 Diploma in Food and Drink Engineering Maintenance** learners must achieve 11 mandatory units 301-311. In addition, learners must achieve the relevant pathway units:

| **Mechanical pathway** units 312-314 |
| **Multi-skilled pathway** units 315-317 |

#### Level 3 Diploma in Food and Drink Engineering Maintenance (1255-01)

<table>
<thead>
<tr>
<th>UAN</th>
<th>City &amp; Guilds unit number</th>
<th>Unit title</th>
<th>GLH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mandatory</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K/507/9800</td>
<td>301</td>
<td>Food and drink engineering maintenance compliance</td>
<td>70</td>
</tr>
<tr>
<td>M/507/9801</td>
<td>302</td>
<td>Food and drink engineering maintenance best practice</td>
<td>95</td>
</tr>
<tr>
<td>T/507/9802</td>
<td>303</td>
<td>Materials science</td>
<td>70</td>
</tr>
<tr>
<td>A/507/9803</td>
<td>304</td>
<td>Mechanical maintenance in food and drink operations</td>
<td>80</td>
</tr>
<tr>
<td>F/507/9804</td>
<td>305</td>
<td>Producing replacement components for food and drink operations</td>
<td>210</td>
</tr>
<tr>
<td>J/507/9805</td>
<td>306</td>
<td>Fluid power systems for food and drink operations</td>
<td>95</td>
</tr>
<tr>
<td>L/507/9806</td>
<td>307</td>
<td>Welding technologies for food and drink operations</td>
<td>95</td>
</tr>
<tr>
<td>R/507/9807</td>
<td>308</td>
<td>Electrical maintenance in food and drink operations</td>
<td>120</td>
</tr>
<tr>
<td>Y/507/9808</td>
<td>309</td>
<td>Services and utilities within food and drink operations</td>
<td>95</td>
</tr>
<tr>
<td>D/507/9809</td>
<td>310</td>
<td>Thermodynamics</td>
<td>80</td>
</tr>
<tr>
<td>R/507/9810</td>
<td>311</td>
<td>Maths for food and drink engineering maintenance</td>
<td>100</td>
</tr>
<tr>
<td><strong>Mandatory</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y/507/9811</td>
<td>312</td>
<td>Monitoring for mechanical maintenance in food and drink operations</td>
<td>70</td>
</tr>
<tr>
<td>D/507/9812</td>
<td>313</td>
<td>Repairing and producing replacement components in food and drink operations</td>
<td>60</td>
</tr>
<tr>
<td>H/507/9813</td>
<td>314</td>
<td>Welding skills for food and drink operations</td>
<td>80</td>
</tr>
<tr>
<td><strong>Mandatory</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K/507/9814</td>
<td>315</td>
<td>Electrical maintenance and testing in food and drink operations</td>
<td>145</td>
</tr>
<tr>
<td>T/507/9816</td>
<td>316</td>
<td>Automation in food and drink operations</td>
<td>120</td>
</tr>
<tr>
<td>A/507/9817</td>
<td>317</td>
<td>Understand the requirements of electrical installations BS7671 (2015)</td>
<td>40</td>
</tr>
</tbody>
</table>
## Total Qualification Time

Total Qualification Time (TQT) is the total amount of time, in hours, expected to be spent by a Learner to achieve a qualification. It includes both guided learning hours (which are listed separately) and hours spent in preparation, study and assessment.

<table>
<thead>
<tr>
<th>Title and level</th>
<th>GLH</th>
<th>TQT</th>
<th>City &amp; Guilds qualification number</th>
<th>Ofqual accreditation number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 3 Diploma in Food and Drinks Maintenance (Mechanical pathway)</td>
<td>1320</td>
<td>2495</td>
<td>2473-02</td>
<td>603/0355/4</td>
</tr>
<tr>
<td>Level 3 Diploma in Food and Drinks Maintenance (Multi-skilled pathway)</td>
<td>1415</td>
<td>2560</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2 Centre requirements

Approval

To offer this qualification existing centres will need to gain full qualification approval. New centres will need to gain both centre and qualification approval. Please refer to the City & Guilds Centre Manual 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.

Internal Quality Assurance requirements

Staff must:

- have experience in quality management/internal verification
- or
- hold or be working towards an appropriate internal quality assurance qualification
- and
- be familiar with the occupation and technical content covered within the qualification
- be familiar with the Engineering Technician (UK spec) requirements where delivering/assessing Level 3, they will be required to provide a signed declaration confirming they have read and understood the Engineering Technician UK spec and the evidence requirements to meet the engineering technician (UK spec) criteria.

Teacher/Trainer/Lecturer/Assessor requirements

Staff must:

- have relevant experience in teaching/training/assessing
- or
- hold or be working towards an appropriate teaching/training/assessing qualification
- and
- be technically knowledgeable in the area(s) for which they are delivering training/assessing, with appropriate qualifications
- be familiar with the Engineering Technician (UK spec) requirements where delivering/assessing Level 3, they will be required to provide a signed declaration confirming they have read and understood the Engineering Technician UK spec and the evidence requirements to meet the engineering technician (UK spec) criteria.

Full details and guidance on the internal and external quality assurance requirements and procedures are provided in the Centre Manual – Supporting Customer Excellence, which can be found on the centre support pages of www.cityandguilds.com. This document also explains the tasks, activities and responsibilities of quality assurance staff.
Resource requirements

Centre staffing
Staff delivering the qualification 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, eg tutor and assessor or internal verifier, but cannot internally verify their own assessments.

Learner entry requirements

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

Age restrictions
City & Guilds cannot accept any registrations for candidates under 16 as these qualifications are 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 candidate has any specific training needs
- support and guidance they may need when working towards their qualifications
- any units they have already completed, or credit they have accumulated which is relevant to the 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 candidate, 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:

<table>
<thead>
<tr>
<th>Description</th>
<th>How to access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recording documents</td>
<td><a href="http://www.cityandguilds.com">www.cityandguilds.com</a></td>
</tr>
</tbody>
</table>

Recording documents

Candidates and centres may decide to use a paper-based or electronic method of recording evidence.

City & Guilds endorses several ePortfolio systems, including our own, Learning Assistant, an easy-to-use and secure online tool to support and evidence learners’ progress towards achieving qualifications. Further details are available at: www.cityandguilds.com/eportfolios.
4 Assessment

Summary of assessment methods

Candidates must successfully complete the designated assessment for each unit.

There are three assessment methods used for this qualification.

<table>
<thead>
<tr>
<th>Assessment method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment</td>
<td>These are set by City &amp; Guilds and marked internally. Centres will be allowed to amend the assignment within certain parameters to ensure it is appropriate to the organisation where the apprentice works.</td>
</tr>
<tr>
<td></td>
<td>Units 302 and 309 are assessed using this method and graded Fail/Pass. All other units assessed using this method will be graded Fail/Pass/Merit/Distinction.</td>
</tr>
<tr>
<td>Short answer question tests</td>
<td>City &amp; Guilds externally set SAQs. These are internally marked by the centre.</td>
</tr>
<tr>
<td></td>
<td>Units assessed using this method will be graded Fail/Pass/Merit/Distinction.</td>
</tr>
<tr>
<td>Online multiple choice test</td>
<td>City &amp; Guilds externally set and mark online multiple choice tests. These are available on demand.</td>
</tr>
<tr>
<td></td>
<td>Unit 317 is assessed using this method and graded Pass/Fail.</td>
</tr>
<tr>
<td>Unit</td>
<td>Title</td>
</tr>
<tr>
<td>------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>301</td>
<td>Food and drink engineering maintenance compliance</td>
</tr>
<tr>
<td>302</td>
<td>Food and drink engineering maintenance best practice</td>
</tr>
<tr>
<td>303</td>
<td>Materials science</td>
</tr>
<tr>
<td>304</td>
<td>Mechanical maintenance in food and drink operations</td>
</tr>
<tr>
<td>305</td>
<td>Producing replacement components for food and drink operations</td>
</tr>
<tr>
<td>306</td>
<td>Fluid power systems for food and drink operations</td>
</tr>
<tr>
<td>307</td>
<td>Welding technologies for food and drink operations</td>
</tr>
<tr>
<td>308</td>
<td>Electrical maintenance in food and drink operations</td>
</tr>
<tr>
<td>309</td>
<td>Services and utilities within food and drink operations</td>
</tr>
<tr>
<td>310</td>
<td>Thermodynamics</td>
</tr>
<tr>
<td>311</td>
<td>Maths for food and drink engineering maintenance</td>
</tr>
<tr>
<td>312</td>
<td>Monitoring for mechanical maintenance in food and drink operations</td>
</tr>
<tr>
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<td>Repairing and producing replacement components in food and drink operations</td>
</tr>
<tr>
<td>314</td>
<td>Welding skills for food and drink operations</td>
</tr>
<tr>
<td>315</td>
<td>Electrical maintenance and testing in food and drink operations</td>
</tr>
<tr>
<td>316</td>
<td>Automation in food and drink operations</td>
</tr>
<tr>
<td>317</td>
<td>Understand the requirements of electrical installations BS7671 (2015)</td>
</tr>
</tbody>
</table>
### Grading

All assessment must be achieved at a minimum pass for the qualification to be awarded. Grades above Pass are only considered when all units are achieved at Pass. The grades awarded for the units are converted to points. The points available for each assessment are shown in the following table:

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Pass</th>
<th>Merit</th>
<th>Distinction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short answer question test</strong></td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td><em>(301, 303, 310-311)</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Online multiple choice test</strong></td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>(317)</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Assignment</strong></td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>(302, 309)</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Assignment</strong></td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td><em>(305 – 308, 312 – 316)</em></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The candidate's points for each assessment are added together, and the overall grade of the **Level 3 Diploma in Food and Drink Engineering Maintenance** will then be determined using the following criteria.

<table>
<thead>
<tr>
<th>Qualification Grade</th>
<th>Mechanical Pathway</th>
<th>Multi-skilled Pathway</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum points</td>
<td></td>
</tr>
<tr>
<td>Distinction</td>
<td>100</td>
<td>Distinction</td>
</tr>
<tr>
<td>Merit</td>
<td>76</td>
<td>Merit</td>
</tr>
<tr>
<td>Pass</td>
<td>56</td>
<td>Pass</td>
</tr>
<tr>
<td></td>
<td>96</td>
<td></td>
</tr>
<tr>
<td></td>
<td>74</td>
<td></td>
</tr>
<tr>
<td></td>
<td>56</td>
<td></td>
</tr>
</tbody>
</table>
**Test specifications**

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

<table>
<thead>
<tr>
<th>Test: 301</th>
<th>Duration: 2 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome</strong></td>
<td><strong>Number of questions</strong></td>
</tr>
<tr>
<td>1 understand health and safety requirements</td>
<td>6</td>
</tr>
<tr>
<td>2 understand environmental requirements</td>
<td>5</td>
</tr>
<tr>
<td>3 understand safe working practices and procedures</td>
<td>8</td>
</tr>
<tr>
<td>4 understand how to use engineering information to ensure compliance</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24</strong></td>
</tr>
</tbody>
</table>

The grade boundaries for this test will be approximately:
- Pass: 60%
- Merit: 70%
- Distinction: 80%

<table>
<thead>
<tr>
<th>Test: 303</th>
<th>Duration: 2 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome</strong></td>
<td><strong>Number of questions</strong></td>
</tr>
<tr>
<td>1 understand the properties of materials used in food and drink operations</td>
<td>7</td>
</tr>
<tr>
<td>2 understand why engineering materials fail</td>
<td>6</td>
</tr>
<tr>
<td>3 understand suitability of engineering materials for food and drink operations</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>19</strong></td>
</tr>
</tbody>
</table>

The grade boundaries for this test will be approximately:
- Pass: 50%
- Merit: 69%
- Distinction: 87%
### Test: 310
**Duration: 2 hours and 30 minutes**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of questions</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 understand the principles of heat transfer and energy conservation</td>
<td>8</td>
<td>28</td>
</tr>
<tr>
<td>2 understand the operation of heat exchange equipment</td>
<td>7</td>
<td>28</td>
</tr>
<tr>
<td>3 understand principles of fluid flow</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>4 understand the operation of systems transporting and controlling fluids in a pipeline system</td>
<td>7</td>
<td>28</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>25</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

The grade boundaries for this test will be approximately:
- **Pass:** 50%
- **Merit:** 60%
- **Distinction:** 70%

### Test: 311
**Duration: 2 hours**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of questions</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 be able to use arithmetic methods to solve engineering problems</td>
<td>6</td>
<td>26</td>
</tr>
<tr>
<td>2 be able to use algebra to solve engineering problems</td>
<td>7</td>
<td>28</td>
</tr>
<tr>
<td>3 be able to use trigonometry to solve engineering problems</td>
<td>7</td>
<td>31</td>
</tr>
<tr>
<td>4 be able to use statistical methods to display data</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>23</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

The grade boundaries for this test will be approximately:
- **Pass:** 40%
- **Merit:** 58%
- **Distinction:** 75%
<table>
<thead>
<tr>
<th>Test: 317</th>
<th>Duration: 2 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome</strong></td>
<td><strong>Number of questions</strong></td>
</tr>
<tr>
<td>1 understand the scope, object and fundamental principles of BS7671</td>
<td>4</td>
</tr>
<tr>
<td>2 understand the definitions used within BS7671</td>
<td>2</td>
</tr>
<tr>
<td>3 understand how to assess the general characteristics of electrical installations</td>
<td>6</td>
</tr>
<tr>
<td>4 understand requirements of Protection for safety for electrical installations</td>
<td>15</td>
</tr>
<tr>
<td>5 understand the requirements for Selection and erection of equipment for electrical installations</td>
<td>14</td>
</tr>
<tr>
<td>6 be able to use statistical methods to display data</td>
<td>4</td>
</tr>
<tr>
<td>7 understand the requirements of special installations or locations as identified in BS 7671</td>
<td>10</td>
</tr>
<tr>
<td>8 understand the information contained within the appendices of BS7671</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>60</strong></td>
</tr>
</tbody>
</table>

These boundaries may be subject to slight variation to ensure fairness should any variations in the difficulty of the test be identified.
5 Units

Availability of units

All units relating to this qualification can be found in this document.
Unit 301  Food and drink engineering maintenance compliance

<table>
<thead>
<tr>
<th>UAN:</th>
<th>K/507/9800</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level:</td>
<td>Level 3</td>
</tr>
<tr>
<td>GLH:</td>
<td>70</td>
</tr>
<tr>
<td>Aim:</td>
<td>This unit is concerned with the requirements that are essential to enable food and drink engineering maintenance activities to be carried out safely and effectively in compliance with organisational, national and international standards, where appropriate. It includes dealing with statutory and organisational requirements in accordance with approved regulations, codes of practice and procedures and the use of engineering information and covers responsibilities relating to accident reporting and the identification of hazards and risks.</td>
</tr>
</tbody>
</table>

**Assessment type**  Short answer question test

**Learning outcome:**
The learner will:

1. understand health and safety requirements

**Assessment criteria**
The learner can:

1.1 describe the health and safety regulations applicable to food and drink engineering maintenance operations
1.2 state the roles, responsibilities and powers of health and safety personnel
1.3 explain employers' responsibilities to maintain health and safety
1.4 explain how the management of health and safety regulations are implemented
1.5 state the general rules for the observance of safe practices
1.6 explain the implications of documentary requirements
1.7 explain the Reportable Diseases and Dangerous Occurrences Regulations (RIDDOR) relevant to food and drink engineering maintenance
1.8 explain the procedures for reporting accidents
1.9 describe the Manual Handling Operations Regulations as they apply to engineering industries.

**Range**

**Regulations**
Health and Safety at Work Act, Control of Substances Hazardous to Health Regulations (COSHH), Provision and Use of Work Equipment Regulations (PUWER), Electricity at Work Regulations, Control of Major Accident Hazards Regulations (COMAH), Control of Noise at Work Regulations, Lifting Operations and Lifting Equipment Regulations (LOLER), Manual Handling Operations Regulations

**Health and safety personnel**
Health and Safety Advisors, Health and Safety Representatives, Health and Safety Executive Inspectors, Environmental Health Officers
**Employers’ responsibilities**
Safe: place of work, plant and equipment, system of work, working environment, methods of handling, storing and transporting goods and materials; to employees, to visitors

**Management of Health and Safety**
Including the four C’s of positive health and safety (Competence, Control, Co-operation, Communication)

**Safe practices**
Be alert, maintain personal hygiene, protect yourself and other people, know emergency procedures, report all hazards

**RIDDOR**
Information, instruction, training and supervision of employees, a health and safety policy

**Reporting accidents**
Summary of accident, name of victim(s), summary of events prior to accident, details of witnesses, information on injury or loss sustained, conclusions, recommendations, supporting material (photographs, video), diagrams, date, signature of person(s) responsible for report

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**Learning outcome**
The learner will:

2. **understand environmental requirements**

**Assessment criteria**
The learner can:

2.1 analyse the relationship between the **human and environmental conditions** in the workplace
2.2 explain how risks from **human and environmental conditions** are **controlled** in the workplace
2.3 analyse the implications of Environmental Management Systems standard ISO 14001 to food and drink operations
2.4 analyse the implications of **environmental legislation** to food and drink operations
2.5 identify the **signs and nomenclature** used for environmental issues.

**Range**

**Human conditions**: lack of management control, carelessness; improper behaviour and dress; lack of training, supervision and experience; fatigue; drug-taking and alcohol intake

**Environmental conditions**: unguarded or faulty machinery or tools; inadequate ventilation; untidy, dirty, overcrowded workplace; inadequate lighting

**Controlled**
Eliminate the hazard, replace the hazard with something less dangerous, guard the hazard, personal protection, health and safety education and publicity

**Environmental legislation**
Environmental Protection Act, Pollution Prevention and Control Act, Clean Air Act, Radioactive Substances Act, Controlled Waste Regulations, Dangerous Substances and Preparations and Chemicals Regulations, Hazardous Waste Regulations

**Signs and nomenclature**
Warning, prohibition, mandatory, information
**Learning outcome**

The learner will:

3. **understand safe working practices and procedures**

**Assessment criteria**

The learner can:

3.1 describe the range of Personal Protective Equipment (PPE) available and relate its use to the operations that will be undertaken

3.2 explain the Respiratory Protective Equipment (RPE) used when undertaking tasks involving exposure to **hazardous substances**

3.3 **assess health and safety risks**

3.4 explain the purpose and methods of use of **accessories** to lifting gear

3.5 explain the necessity of a **permit to work** procedure

3.6 describe the **safety systems** in place on machinery

3.7 describe isolation procedures

3.8 state situations in which it is unadvisable or unsafe to **work in isolation**

3.9 explain the **health and safety procedures** that prevent injury or discomfort to skin, eyes, hands and limbs

3.10 explain **extraordinary hazards** that lead to an emergency situation in a food and drink operations

3.11 describe the statutory requirements for **maintenance of equipment** in food and drink operations.

**Range**

**Hazardous substances**

Chemicals and solvents, fumes, dust or harmful particulates, heat

**Assess health and safety risks**

Identify hazards, evaluate risk, control measures to mitigate risk

**Accessories**

Hooks, slings, eyebolts, shackles, chains, rings, special-to-purpose equipment, rules for the use of slings

**Permit to work**

Purpose, description, content, types (including: ‘hot working’, electrical, maintenance operations, pressure testing), procedure for use

**Safety systems**

Guards, emergency stops, safety relays, interlocks and switches

**Work in isolation**

In confined spaces, above ground or in trenches, in close proximity to unguarded machinery, when a fire risk exists, with toxic or corrosive substances, on site

**Health and safety procedures**

Personal hygiene, skin protection and care, care of eyes, use of eye and face protectors which are to current EN specifications, use of respirators, dangers of hair and loose clothing getting caught in machinery, means of avoiding such dangers, benefits and use of protective clothing, use of safety guards, screens and fences

**Extraordinary hazards**

Ammonia, terrorist threat (trespass, exploding devices, poisons, cyber), sabotage, drowning, hypoxia
**Maintenance of equipment**
Specialist equipment (e.g., x-ray machines, metal detector and checkweigher), limits of own authority to carry out certain activities (e.g., working with electrical equipment)

**Learning outcome**
The learner will:

4. understand how to use engineering information to ensure compliance

**Assessment criteria**
The learner can:

4.1 describe the sources of standards
4.2 explain how engineering information is used for food and drink engineering maintenance activities
4.3 analyse implications of information management to food and drink operations
4.4 explain the importance of analysing all compliant engineering information before decisions are made
4.5 explain procedures for dealing with issues associated with engineering information.

**Range**

**Sources**
Legal, company, manufacturers', industry, customer

**Engineering information**
Drawings, change control documentation, risk assessments, engineering product data sheets, manufacturers' manuals, production schedules, inspection and calibration requirements, permits to work, standard operating procedures, reference charts, method statements, Critical Control Points (CCP)

**Information management**
Physical security, change control, storage, access authorisation, data protection, commercial confidentiality, security rating, cyber risks, ensuring validity

**Procedures**
Reporting, change control, authorisation and archiving

**Issues**
Discrepancies, loss, damage, currency
Unit 302  Food and drink engineering maintenance best practice

Aim: This unit develops in learners the understanding of engineering maintenance best practice in food and drink operations. It includes an understanding of different types of maintenance and how to plan maintenance of equipment for food and drink operations. It also includes an understanding of fault finding and measurement.

Assessment type: Assignment

Learning outcome:
The learner will:

1. understand types of maintenance used in food and drink operations

Assessment criteria
The learner can:

1.1 describe different types of maintenance
1.2 explain the purpose of maintenance
1.3 describe types of engineered systems used in food and drink operations
1.4 describe the plant and equipment used in food and drink operations
1.5 explain how frequency of maintenance affects production
1.6 explain the costs of maintenance for an engineered system
1.7 calculate maintenance costs for an engineered system
1.8 justify planned maintenance for a specified engineered system
1.9 describe factors affecting reliability of components and equipment
1.10 explain how the use of technology leads to efficiency and quality in maintenance
1.11 explain how to set up a line.

Range
Types of maintenance
Planned, total preventative (TPM), breakdown, scheduled, shutdown, reactive, preventative, corrective, emergency, post fault, scheduled, modification, condition-based

Purpose
Plant reliability and availability, improved quality of output, cost effectiveness, improved safety, legal requirements, reduced environmental damage, food safety

Engineered systems
Process monitoring and control, mechanical, fluid power, electrical, environmental

Plant and equipment
Gearboxes, pumps, engines, machine tools, lifting and handling equipment, valves, mechanical structures, motors, starters, switchgear, distribution panels

Production
Downtime, operating performance, product quality, customer service, effects on related equipment, systems and plant, secondary damage

**Costs**
As a proportion of total expenditure, use of frontline maintenance, maintenance contracting, lost production, financial penalties, stock control, equipment hire, safety and environmental costs

**Technology**
Administrative eg Computerised Maintenance Management Systems (CMMS), process eg sensors, testing eg self diagnosis

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**Learning outcome**
The learner will:

2. be able to plan maintenance for engineered systems in food and drink operations

**Assessment criteria**
The learner can:

2.1 explain the **content** of a maintenance plan
2.2 explain the requirements for communicating maintenance plans
2.3 describe planning techniques
2.4 describe **monitoring techniques**
2.5 explain the use of **monitoring data**
2.6 analyse monitoring data
2.7 calculate failure rates for components and equipment
2.8 interpret manufacturers' manuals for maintenance requirements of system components.

**Range**
**Content**
Tools and equipment, timelines, waste disposal, safety requirements, activities required, food safety requirements and considerations, communication, reporting and documentation, permissions, costs, handover

**Monitoring techniques**
Condition, scheduled overhaul, routine servicing, hazard studies, failure mode effect analysis (FMEA), self-diagnosis

**Monitoring data**
Operational characteristics, output quality, throughput, environmental conditions, collection points, laboratory testing data
Learning outcome
The learner will:

3. understand fault finding techniques

Assessment criteria
The learner can:

3.1 explain the importance of root cause identification and analysis in fault finding
3.2 describe models of root cause analysis
3.3 explain the risks of running equipment with faults
3.4 explain fault investigation procedures
3.5 describe how information is used for fault finding
3.6 assess the suitability of fault-finding techniques in engineered systems
3.7 describe procedures for use of aids with fault diagnosis
3.8 describe procedures for use of equipment with fault diagnosis
3.9 explain processes used to assess equipment when fault finding.

Range
Information
From operators, monitoring equipment, recording devices, sensory, plant and/or machinery records, condition of the end product, laboratory data

Fault finding techniques
Half-split, emergent problem sequence, six point, equipment self diagnostics, function/performance testing, injection and sampling, input/output, unit substitution, automation

Engineered systems
Mechanical, electrical/electronic, fluid power

Aids
Manufacturers’ manuals, algorithms, probability charts/reports, equipment self diagnostics, circuit diagrams/specifications, logic diagrams, flow charts, fault analysis charts, troubleshooting guides

Equipment
Mechanical measuring instruments, electrical/electronic measuring instruments, fluid power test equipment
Learning outcome
The learner will:

4. understand the importance of measurement in maintenance

Assessment criteria
The learner can:

4.1 describe the purposes of measurement
4.2 describe the effects of the environment on measurement
4.3 describe the effect of datum selection on measurement
4.4 describe the applications of measuring equipment
4.5 assess the suitability of measuring equipment for the required measurement
4.6 describe the importance of measuring equipment condition
4.7 explain the importance of sampling in measurement.

Range
Measuring equipment
Micrometers, Verniers, gauges, dial test indicators, coordinate measurement machines, multimeters, electrical test equipment, insulation tester

Condition
Damage, calibration, safe, useable
Unit 303  Materials science

UAN: T/507/9802
Level: Level 3
GLH: 70

Aim: This unit develops in learners an understanding of the behaviour of materials. This supports the learner in selecting the most appropriate material to satisfy requirements for different types of food and drink operations.

Assessment type: Short answer question test

Learning outcome:
The learner will:
1. understand the properties of materials in food and drink operations

Assessment criteria
The learner can:
1.1 describe the properties of materials
1.2 describe the structure of materials
1.3 explain how the materials’ structures create their properties
1.4 explain the effects of processing on the properties of materials
1.5 explain how processing of materials affects food and drink operations.

Range
Properties
Strength (compressive, tensile), hardness, toughness, ductility, malleability, elasticity, plasticity, conductivity, absorption (shock, sound), density, melting temperature, permeability, viscosity, thermal expansion, corrosive, resistivity

Materials
Low carbon steel, high carbon steel, stainless steel, aluminium, brass, bronze, specialist steels, alloys, plastic/synthetics, composites, lubricants, ceramics, copper

Structure
Periodic table, atomic structure, molecular structure, bonding mechanisms, structure (lattice, grain, crystals)

Processing: heat, alloying, cutting, joining, forming, welding, moulding, injection, sintering, cooling, coating, heat treatments

Food and drink operations: food safety, final product quality
Learning outcome
The learner will:

2. understand why engineering materials fail

Assessment criteria
The learner can:

2.1 explain the causes of engineering materials failure
2.2 explain the symptoms of engineering materials failure
2.3 explain how methods of testing show engineering materials failure
2.4 evaluate the results of tests on engineering materials.

Range
Causes: chemical, physical, design
Failure: fracture, fatigue, creep
Methods of testing: destructive (tensile, shear, hardness, toughness), non-destructive (visual, penetrant, radiographic, magnetic powder)

Learning outcome
The learner will:

3. understand the suitability of engineering materials for food and drink operations

Assessment criteria
The learner can:

3.1 describe the food and drink production applications of engineering materials
3.2 explain how properties of engineering materials support their application
3.3 explain factors affecting selection of engineering materials
3.4 identify criteria from engineering information for assessing the suitability of engineering materials for an application
3.5 select engineering materials for specific food and drink operations applications.

Range
Materials: carbon steel, stainless steel, aluminium, brass, bronze, specialist steels, alloys, plastic/synthetics, composites, lubricants, ceramics, copper
Properties: strength (compressive, tensile), hardness, toughness, ductility, malleability, elasticity, plasticity, conductivity, absorption (shock, sound), density, melting temperature, permeability, viscosity, thermal expansion, corrosive, resistivity
Factors: application, properties, environment, availability, costs, food safety
Engineering information: standard specifications (British Standards (BS), European Standards (EN), International Standards (ISO)), manufacturers’ information (data sheets, catalogues, websites)
Unit 304 Mechanical maintenance in food and drink operations

UAN: A/507/9803
Level: 3
GLH: 80
Aim: The aim of this unit is for learners to develop the knowledge and skills required to maintain mechanical systems and equipment in food and drink operations. They will learn the importance of maintaining health and safety and food safety throughout the process and the requirements, processes and equipment available to ensure they work safely throughout all maintenance activities. They will learn to use a range of maintenance techniques and procedures and how to apply these in different food and drink operations. They will also learn about how to record maintenance activities, and how to refer issues beyond their authority to the relevant personnel.

Assessment type Assignment

Learning outcome
The learner will:

1. understand the operation of mechanical equipment for food and drink operations

Assessment criteria
The learner can:

1.1 explain methods used to control hygiene food safety risks when undertaking mechanical maintenance activities
1.2 explain the implications of carrying out mechanical maintenance activities within a food and drink operation
1.3 explain the methods used to transmit movement between different types of motion
1.4 explain the methods used to change direction of transmitted movement
1.5 explain the application of mechanical systems
1.6 explain the function of mechanical components
1.7 explain the relationship between mechanical and electrical components in a system
1.8 describe maintenance checks
1.9 describe organisational procedures for safe disposal of waste.
Range
Control
Prevent, eliminate, reduce
Implications
For food safety, production efficiency
Types of motion
Rotary, linear, reciprocating, oscillating
Mechanical systems
Gears and gear drives, valves, pumps, cams and followers, chain and belt drives, clutches and brakes, transmission shafts
Mechanical components
Gears, shafts, bearings, seals, permanent fasteners, temporary fasteners, springs, cams, followers, casings
Checks
Fault reports, visual checks, measuring, movement and alignment checks, testing
Waste
Parts, lubricants, product, packaging, disposables, consumables

Learning outcome
The learner will:

2. be able to prepare for mechanical maintenance activities

Assessment criteria
The learner can:

2.1 interpret engineering information
2.2 follow maintenance schedules
2.3 plan mechanical maintenance activities to minimise disruption to food and drink production operations
2.4 communicate planned activities to relevant stakeholders to meet organisational requirements
2.5 plan how food safety risks will be controlled when carrying out mechanical maintenance activities
2.6 plan mechanical maintenance activities
2.7 assess hazards and associated risks
2.8 ensure the safe isolation of equipment
2.9 prepare work area for mechanical maintenance activities
2.10 select equipment and materials for mechanical maintenance activities
2.11 assess condition of equipment and materials for mechanical maintenance activities
2.12 prepare equipment and materials for mechanical maintenance activities
2.13 select consumables for mechanical maintenance activities
2.14 document preparation activities.
**Range**

**Engineering information**
- Drawings, specifications, schematics, manufacturers’ manuals, data sheets, retailers’ standards, operational records, standard operating procedures

**Controlled**
- Prevent, eliminate, reduce

**Plan**
- Location, date and time, parts to be used, tests required, testing points, checks to be made, permits to work required, tools and equipment required, sequence of operations, provision for waste, communications required

**Equipment**
- Mechanical, electrical, fluid

**Document**
- Risk assessment, method statement, permit to work

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**Learning outcome**

The learner will:

3. **be able to maintain mechanical equipment**

**Assessment criteria**

The learner can:

3.1 control food safety risks when carrying out mechanical maintenance activities
3.2 apply safe working practices when carrying out mechanical maintenance activities
3.3 use **maintenance procedures** on **mechanical systems**
3.4 comply with **requirements** for maintenance activities
3.5 **record** completed maintenance activities
3.6 handover equipment for operation.

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**Range**

**Maintenance procedure**
- Draining, dismantling, setting, lubricating, replacing, checking, marking/labelling, functional testing, validation

**Mechanical systems**
- Levers and linkage mechanisms, gears and gear drives, valves, pumps, cams and followers, chain and belt drives, clutches and brakes, transmission shafts

**Requirements**
- Company guidelines and codes of practice, equipment manufacturers’ operation range, BS, ISO and/or BSEN standards

**Record**
- Job cards, permits to work/formal risk assessment and/or sign on/off procedure, maintenance log or report, company specific documentation, issues with completion of maintenance activities
Unit 305  Producing replacement components for food and drink operations

**UAN:** F/507/9804  
**Level:** Level 3  
**GLH:** 210

**Aim:** This unit develops the understanding and skills required to produce mechanical components. This will involve the development of skills associated with milling, turning, fitting and grinding to produce components for maintenance of food and drink operations.

**Assessment type** Assignment

**Learning outcome:**
The learner will:

1. **understand producing replacement component activities**

**Assessment criteria**
The learner can:

1.1 explain the **implications** of carrying out machining activities for a food and drink operation
1.2 explain methods used to **control** food safety risks when producing replacement components
1.3 describe the **operation** of equipment
1.4 explain methods used to prevent damage to **equipment**
1.5 assess the suitability of **tools** for an application
1.6 explain how **tools** achieve desired outcomes
1.7 explain how to prevent damage to **tools**
1.8 describe **principles** of cutting tool geometry
1.9 assess the suitability of work holding devices for the material used
1.10 explain the methods used to produce a **thread**
1.11 describe the purpose of different **types of thread**
1.12 explain the **factors** that affect cutting feeds and speeds and depth of cut that can be taken
1.13 **calculate** speeds and feeds
1.14 explain how different **types of repair** affect the lifecycle of components
1.15 explain the application of cutting fluids for different **materials** and **processes**
1.16 explain the types of **fit** required for different activities
1.17 explain how abrasive wheels regulations apply to grinding activities
1.18 describe types and applications of grinding wheels
1.19 explain when wheels require balancing
1.20 analyse causes of defects in components
1.21 explain how emerging technologies contribute to producing replacement components in food and drink operations.

**Range**
**Implications**
For food safety, production efficiency

Control
Prevent, eliminate, reduce

Operation
Features, application

Equipment
Lathes, milling machines, grinders (pedestal, universal, portable, hand), power saws

Tools
Work holding devices, cutting tools, milling tools, grinding wheels, saws, files, chucks, drills, taps, reamers

Principles
Planes, angles, vector analysis

Thread
Internal, external

Types of thread
Vee form, square, acme, multi-start

Factors
Rigidity, machine conditions, type and size of tooling used, type of materials

Calculate
Based on type of materials, based on type of tool

Types of repair
Reforming surface by adding metal, rework surface finish, sleeving worn components, cutting new keyways, bushing worn holes, replacement of internal threads, shimming, plugging holes, filling cracks

Materials
Non-metallic, non-magnetic, steel

Processes
Milling, turning, fitting, grinding

Fit
Clearance, transition, interference
Learning outcome:
The learner will:

2. **be able to prepare for producing replacement components in food and drink operations**

Assessment criteria
The learner can:

2.1 interpret **engineering information**
2.2 establish maintenance requirements
2.3 plan machining and fitting activities to minimise disruption to food and drink production operations
2.4 communicate planned activities to relevant stakeholders to meet organisational requirements
2.5 plan how machining and fitting activities will be undertaken to **control** food safety risks
2.6 **plan** maintenance work to be carried out
2.7 produce working sketch of components
2.8 assess hazards and associated risks
2.9 prepare work area for machining and fitting activities
2.10 select **materials, tools and equipment** for machining and fitting activities
2.11 assess condition of **materials, tools and equipment** for machining and fitting activities
2.12 **prepare work holding devices and equipment** for machining and fitting activities
2.13 **document** preparation activities.

Range

**Engineering information**
Drawings, sketches, sample or damaged component to be replaced, manufacturers’ specifications, company policies and procedures for repair, maintenance log, asset register, standard operating procedures

**Control**
Prevent, eliminate, reduce

**Plan**
Location, date and time, parts to be used, tests required, testing points, checks to be made, permits to work required, tools and equipment required, sequence of operations, provision for waste, communications required

**Materials**
Non-metallic, non-magnetic, steel

**Tools**
Work holding devices, cutting tools, milling tools, grinding wheels, saws, files, chucks, drills, taps, reamers

**Equipment**
Lathes, milling machines, grinders (pedestal, hand), power saws, measuring equipment

**Prepare work holding devices and equipment**
Set work holding device, set tooling, calibrate measuring equipment, calculate speeds and feeds, sharpen tools

**Document**
Risk assessment, production plan
Learning outcome
The learner will:

3. be able to produce components in food and drink operations

Assessment criteria
The learner can:

3.1 control food safety risks when carrying out machining and fitting activities
3.2 apply machining and fitting processes
3.3 apply safe working practices when carrying out machining and fitting activities
3.4 produce features in components to required standard
3.5 select appropriate measuring instruments
3.6 measure accuracy of component features
3.7 use machine controls in line with operational procedures
3.8 adjust machine tools and feeds
3.9 use hand fitting methods
3.10 produce components in different materials
3.11 record completed maintenance activities
3.12 handover equipment for operation.

Range
Machining and fitting processes
Milling, turning, drilling, grinding

Features
External diameters, internal diameters, flat faces, parallel faces, steps/shoulders, angular/tapered surfaces, threads, slots/recesses, drilled holes, bored holes, reamed holes

Required standards
Components to be free from false tool cuts, burrs and sharp edges, general dimensional tolerance of +/-0.25mm (0.004"), reamed holes within H8, surface finish 63µin or 1.6 µm

Accuracy
Dimensions, geometric features

Hand fitting methods
Filing, sawing, drilling, marking out

Different materials
Non-metallic, non-magnetic, steel

Record
Job cards, permits to work/formal risk assessment and/or sign on/off procedure, maintenance log or report, company specific documentation, issues with completion of maintenance activities
Unit 306  Fluid power systems for food and drink operations

UAN: J/507/9805
Level: Level 3
GLH: 95

Aim: This unit enables the learner to develop the skills and understanding required for the maintenance of pneumatic, hydraulic and electro-pneumatic fluid power systems. It covers the procedures and techniques involved assembling, testing and maintaining fluid power systems.

Assessment type Assignment

Learning outcome:
The learner will:

1. understand the function of fluid power systems

Assessment criteria
The learner can:

1.1 explain methods used to control food safety risks when maintaining fluid power systems
1.2 explain the implications of carrying out fluid power systems maintenance within a food and drink operation
1.3 explain the advantages and disadvantages of different types of fluid power systems
1.4 explain types of fluid power equipment
1.5 describe the applications of different types of fluid power systems
1.6 explain how components interrelate to create a fluid power system
1.7 explain the relationships between force, pressure and area
1.8 explain procedures to minimize pressure changes in fluid power systems
1.9 explain the causes and effects of contamination in fluid power systems
1.10 identify standard symbols of components in fluid power systems
1.11 interpret schematics
1.12 explain changes in energy throughout a system
1.13 explain causes of common system faults
1.14 explain the need for safe isolation
1.15 describe procedures used to test the release of stored energy
1.16 explain the importance of fluid hygiene in food and drink operations.
Range
Control
Prevent, eliminate, reduce

Implications
To food safety, to production efficiency

Fluid power systems
Hydraulic, pneumatic, electro-pneumatic

Types of fluid power equipment
Activators, cylinders, reactors, restrictors, reservoirs, filters

Components
Compressors, motors, valves, sensors and actuators, pumps, static and dynamic seals

Calculate
Force, pressure, area, temperature

Learning outcome
The learner will:
2. be able to prepare for maintenance of fluid power systems in food and drink operations

Assessment criteria
The learner can:
2.1 interpret engineering information
2.2 determine the maintenance work required for fluid power systems
2.3 plan required activities to minimise disruption to food and drink production operations
2.4 communicate planned activities to relevant stakeholders to meet organizational requirements
2.5 plan how fluid power system maintenance activities will be undertaken to control food safety risks
2.6 plan maintenance work to be carried out
2.7 assess hazards and associated risks
2.8 prepare work area for fluid power system maintenance
2.9 select equipment and consumables for fluid power system maintenance
2.10 prepare equipment and consumables for fluid power system maintenance
2.11 document preparation activities.

Range
Engineering information
Work requisition, manufacturers' specifications, system schematics, standard operating procedures

Maintenance work
Assembly, testing, servicing, monitoring

Fluid power systems
Hydraulic, pneumatic, electro-pneumatic

Control
Prevent, eliminate, reduce

Plan
Location, date and time, parts to be used, tests required, testing points, checks to be made, permits to work required, tools and equipment required, sequence of operations, provision for waste, communication required

Prepare
Check for damage, calibration, suitability for task

Document
Risk assessment, method statement, permit to work
Learning outcome
The learner will:
3. be able to carry out maintenance tasks

Assessment criteria
The learner can:
3.1 control food safety risks when carrying out fluid power systems maintenance
3.2 safely isolate fluid power systems
3.3 safely release stored energy
3.4 apply safe working practices when carrying out fluid power maintenance activities
3.5 apply maintenance activities to fluid power systems
3.6 identify faults in fluid power systems
3.7 record completed maintenance activities
3.8 handover equipment for operation.

Range
Control
Prevent, eliminate, reduce
Fluid power systems
Hydraulic, pneumatic, electro-pneumatic
Maintenance activities
Dismantle: Releasing stored energy, supporting components, draining and removing fluids, disconnecting hoses and pipes, removing components, proof marking removed components
Replacing components: setting, aligning, adjusting
Assemble: Check components for serviceability, position equipment, align pipework, dress and secure pipes and hoses, set, align and adjust components, secure using mechanical fixings, apply screw fastener locking devices, tighten fastenings to required torque, apply hose/cable clips and fasteners, make de-energised checks, fill system, pressurise system, secure components, use specified connectors and securing devices, priming, bleeding, recharging, pressurising the system, cleaning
Validation: dimensions within specification parameters, components correctly positioned, components correctly aligned, direction and flow indicators on components are correct, components are securely held in place, connections to components are tightened to the required torque, pipework is free from ripple and creases, electrical connections are correctly made, system is leak free, functional testing of whole system (leak test, line pressure test, speed, sequence, fluid contamination, operational performance)
Record
Job cards, permits to work/formal risk assessment and/or sign on/off procedure, maintenance log or report, company specific documentation, issues with completion of maintenance activities
# Unit 307

**Welding technologies for food and drink operations**

<table>
<thead>
<tr>
<th>UAN:</th>
<th>L/507/9806</th>
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<tbody>
<tr>
<td>Level:</td>
<td>Level 3</td>
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<td>GLH:</td>
<td>95</td>
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**Aim:** This unit sets out the requirements for welding and cutting in food and drink operations. It is concerned with the technology associated with different types of welding: Metal Active Gas (MAG), Tungsten Inert Gas (TIG), Manual Metal Arc (MMA). Learners will develop an understanding of each method and develop practical skills to use one of them.

**Assessment type** Assignment

**Learning outcome:**

The learner will:

1. **understand the principles of cutting and welding in food and drink operations**

**Assessment criteria**

The learner can:

1.1 explain methods used to control food safety risks when carrying out cutting and welding activities
1.2 explain the implications of carrying out cutting and welding activities within a food and drink operation
1.3 describe the principles of different welding processes
1.4 assess the suitability of welding processes for different applications
1.5 describe changes required to equipment as a result of different applications
1.6 describe typical hazards associated with different welding processes
1.7 explain safety control measures needed to minimise risk for different types of welding processes
1.8 describe the features of welded joints
1.9 explain the consumables required for different welding processes
1.10 explain the purpose of shield gases in welding
1.11 explain how electrode coatings contribute to weld quality
1.12 evaluate the metallurgical effects of welding processes on materials
1.13 explain the techniques used to determine the integrity of welded joints
1.14 explain the techniques used to control distortion
1.15 analyse the causes of welding defects
1.16 explain how to rectify welding defects
1.17 describe typical hazards associated with cutting processes
1.18 describe gases used in thermal cutting
1.19 describe British Compressed Gas Association (BCGA) codes of practice for use of thermal equipment
1.20 describe the principles of thermal cutting
1.21 explain procedures for cutting specific materials
1.22 describe problems that can occur with cutting
1.23 explain the causes of cutting defects
1.24 explain the effect of **external agents** on the cutting process.

**Range**

**Control**
Prevent, eliminate and reduce

**Implications**
Food safety, production efficiency, gases

**Principles**
Equipment used, how equipment is used, weld sequence, welding technique

**Hazards (welding)**
Fumes, electricity, arc radiation, hot metals

**Welding processes**
MIG, TIG, MMA

**Applications**
Different types of metal, different thicknesses of materials, different joint configurations

**Safety control measures**
PPE, handling, storage, safe working area, use of equipment, closing down of equipment, earthing arrangements

**Features**
Toe, face, root (gap, face), HAZ, fillet profiles, throat thickness, leg length, fusion zone, penetration

**Consumables**
Gases, wires, electrodes, composition, size/amount

**Metallurgical effects**
Hardness, toughness, ductility, strength, stability, malleability, resistance to wear and corrosion

**Techniques (integrity)**
Non-destructive: Penetrant testing, magnetic particle testing, radiography, ultrasonic, mechanical, container
Destructive: Macrosection, nick break, bend test, tensile test

**Integrity**
Uniformity, alignment, position, weld size, profile, fusion, penetration

**Techniques (distortion)**
Jigging, clamping, offsetting, tack weld

**Distortion**
Transverse, angular, longitudinal

**Welding defects**
Inclusions, porosity, cracks (internal, surface), lack of fusion, lack of penetration, undercut, overlap, lack of continuity

**Hazards (cutting)**
Trailing hoses, naked flames, fumes and gases, explosive gas mixtures, oxygen enrichments, spatter, hot metal, enclosed spaces

**Gases**
Gas identification and colour codes, characteristics, safety procedures

**External agents**
Oil, grease, scale, dirt
Learning outcome
The learner will:

2. be able to prepare for cutting and welding in food and drink operations

Assessment criteria
The learner can:

2.1 interpret engineering information
2.2 assess welding requirements
2.3 establish welding technique required
2.4 plan required activities to minimise disruption to food and drink production operations
2.5 communicate planned activities to relevant stakeholders to meet organisational requirements
2.6 plan how cutting and welding activities will be undertaken to control food safety risks
2.7 plan maintenance work to be carried out
2.8 assess hazards and associated risks for cutting and welding activities
2.9 prepare work area for cutting and welding activities
2.10 select equipment and consumables for cutting and welding activities
2.11 assess condition of equipment and consumables for cutting and welding activities
2.12 prepare equipment and consumables for cutting and welding activities
2.13 use marking out techniques
2.14 mark out materials
2.15 document preparation activities.

Range
Interpret engineering information
Work requisition, manufacturers' specifications, standard operating procedures

Welding technique
Slope and tilt angles, arc length

Control
Prevent, eliminate, reduce

Plan
Location, date and time, parts to be used, tests required, testing points, checks to be made, permits to work required, tools and equipment required, sequence of operations, provisions for waste, communications required

Techniques
Direct marking, templates, tracing/transfer

Document
Risk assessment, method statement, permit to work
Learning outcome
The learner will:

3. be able to perform welding activities in food and drink operations

Assessment criteria
The learner can:

3.1 control food safety risks when carrying out welding activities
3.2 produce welded joints in a range of positions in accordance to BS4872 part 1 standard or equivalent
3.3 use distortion control techniques
3.4 apply post welding activities
3.5 perform visual checks on welded joints
3.6 perform thermal cutting operations to quality standards
3.7 apply safe working practices when performing welding operations
3.8 record completed maintenance activities
3.9 handover outputs for use in food and drink operations

Range
Control
Prevent, eliminate, reduce

Joints
Plate: Fillet joints (lap, tee, corner), butt joints (open, closed, single vee)

Positions
Flat, horizontal vertical, horizontal, vertical upwards

Distortion control techniques
Jigging, clamping, offsetting, tack weld

Post welding activities
Cleaning, slag removal, spatter removal, wiring brushing, removal of excess weld

Visual checks
Magnification, illumination, weld gauges

Thermal cutting operations
Straight cuts, square/rectangular shapes, round holes, square holes

Quality standards
Clean and smooth with minimal drag lies, dimensional accuracy to tolerance specified on drawing or specification or within +/- 2mm, angled cut to within specification requirements for angularity and perpendicularity

Record
Job cards, permits to work/formal risk assessment and/or sign on/off procedure, maintenance log or report, company specific documentation, issues with completion of maintenance activities
Unit 308  Electrical maintenance in food and drink operations

UAN: R/507/9807
Level: Level 3
GLH: 120
Aim: This unit enables learners to understand the underlying principles that apply across electrical maintenance engineering. The unit covers the theory of electrical technology and the requirements for electrical maintenance in food and drink operations. Through this unit, learners will develop skills needed to carry out maintenance activities on electrical components of machines.

Assessment type Assignment

Learning outcome:
The learner will:

1. understand electrical technology

Assessment criteria
The learner can:

1.1 explain methods used to control food safety risks when carrying out electrical maintenance activities
1.2 explain the implications of carrying out electrical maintenance activities within a food and drink operation
1.3 explain scientific terms
1.4 perform electrical calculations for d.c. networks
1.5 explain electricity supply systems
1.6 describe magnetism
1.7 explain the application of electrical components
1.8 explain the application of different circuit types
1.9 describe the types of cabling used for electrical maintenance activities
1.10 explain the types of earthing systems
1.11 explain different types of motors
1.12 describe types of wiring enclosures and containment systems used in electrical maintenance
1.13 explain the isolation and lock-off procedure for a 3 phase system
1.14 explain how to deal with system problems
1.15 explain procedures used to assess that components meet required specifications
1.16 describe types of luminaires
1.17 describe the application of electrical measuring instruments
1.18 explain techniques used to dismantle and assemble electrical equipment
1.19 explain the application of programmable logic control (plc) systems
1.20 explain the application of PLC controlled input/output (I/O) devices
1.21 describe the techniques used to connect PLC equipment
1.22 describe the devices and systems for storing programs
1.23 explain how ladder logic is used in plc equipment
1.24 describe the importance of making 'off-load' checks before proving the equipment with the electrical supply on
1.25 explain procedures used to identify system faults from displayed symptoms
1.26 explain the extent of authority in dealing with electrical maintenance.

**Range**

**Control**
Prevent, eliminate, reduce

**Implications**
For food safety, production efficiency

**Scientific terms**
Resistance, inductance, capacitance, voltage, current, units, sub multiples

**Electrical calculations**
Ohm's law, resistance, power, energy, current, voltage

**Supply systems**
From generation to utilisation, generation, transmission and distribution voltages, star and delta connections, single and 3 phase power

**Magnetism**
Fields and flux paths, relationship between flux, area and flux density

**Electrical components**
Contactors, relays, locking and retaining devices, capacitors, resistors, rectifiers, encoders or resolvers, inverter or servo controllers, circuit boards, thermistors or thermocouples, lighting fixtures, batteries, switches and sensors, solenoids, transformers, actuators

**Circuit types**
Ring, radial

**Cabling**
Single core, multi-core, steel wire armoured (SWA), mineral insulated (MI), screened, data/communication, fibre-optic

**Earthing systems**
TT, TN-C-S, TN-S, TN-C

**Types of motor**
Induction, synchronous, series universal, split phase, servo

**Wiring enclosures and containment systems**
Conduit, trunking, tray, basket

**System problems**
Error messages, non-responsive peripherals, faulty connecting leads and equipment

**Required specifications**
Value, tolerance, current carrying capacity, voltage rating, power rating, working temperature range

**Luminaires**
Tungsten, sodium, mercury vapour, fluorescent, LED

**Electrical measuring instruments**
Ammeter, voltmeter, insulation resistance tester, phase rotation meter, approved voltage indicator
Techniques
Plugs and sockets, soldering/de-soldering, screw fixing, clamped and crimped connections, marking, polarity

Connect
Ethernet: RS232

Faults
Earth fault, short circuit, open circuit, overload, under-voltage, earth leakage, insulation breakdown

Learning outcome
The learner will:

2. be able to prepare for electrical maintenance activities

Assessment criteria
The learner can:

2.1 interpret engineering information
2.2 plan electrical maintenance activities to minimise disruption to food and drink production operations
2.3 communicate planned activities to relevant stakeholders to meet organisational requirements
2.4 plan how electrical maintenance activities will be undertaken to control food safety
2.5 assess hazards and associated risks
2.6 ensure the safe isolation of equipment
2.7 select required tools and equipment for specified maintenance tasks.
2.8 select required materials for specified maintenance tasks
2.9 prepare work area for electrical maintenance activities
2.10 check condition of equipment and materials for electrical maintenance activities
2.11 document preparation activities.

Range
Engineering information
Drawings, specifications, schematics, manufacturers’ manuals, data sheets, retailers’ standards, operational records, standard operating procedures

Control
Prevent, eliminate, reduce

Tools and equipment
Hand tools, power tools, access systems, test equipment, safety equipment

Materials
Cables, terminations, replacement components, fixings

Document
Risk assessment, method statement, permit to work
Learning outcome
The learner will:

3. be able to carry out electrical maintenance activities

Assessment criteria
The learner can:

3.1 control food safety risks when carrying out electrical maintenance activities
3.2 apply safe working practices when carrying out electrical maintenance activities
3.3 apply electrical maintenance activities to a range of electrical equipment
3.4 ensure maintenance activities comply with requirements
3.5 inspect and test functionality of maintained electrical equipment
3.6 record completed maintenance activities
3.7 handover equipment for operation.

Range
Control
Prevent, eliminate, reduce

Maintenance activities
Disconnect and reconnect cables and wires, attach identification markers, remove electrical units/components, check components for serviceability, replace damaged/defective components, remove and replace damaged wires and cables, remove and replace wiring enclosures, set and adjust replaced components, prove PLC operation

Electrical equipment
Single-phase power supplies, direct current power supplies, single phase motors and starters, switchgear and distribution panels, control systems and components, electrical plant, wiring enclosures, luminaires

Requirements
Company guidelines and codes of practice, equipment manufacturers’ operation range, BS, ISO and/BSEN standards

Record
Job cards, permits to work, maintenance log or report, company specific documentation, issues with completion of maintenance activities
Unit 309 Services and utilities within food and drink operations

Aim: The aim of this unit is for learners to develop an understanding of the distribution of services within food and drink operations. Learners will gain knowledge of utilities and how they are identified from visual checks and scrutiny of distribution plans. They will learn about the characteristics of different types of utility and how the contribute to the creation of heating, lighting and power.

Assessment type Assignment

Learning outcome
The learner will:

1. know services and utilities in food and drink operations

Assessment criteria
The learner can:

1.1 identify coding requirements for utility pipelines and services
1.2 describe the characteristics of different types of gas
1.3 describe the differences between electrical supply systems in food and drink operations
1.4 describe the condition of compressed air required for food and drink operations
1.5 explain the safety requirements for handling compressed gas cylinders
1.6 describe the characteristics of different types of water system
1.7 describe the risks associated with legionella in food and drink operations pipework systems
1.8 interpret services installation drawings.

Range
Coding
BS1710 or updated current equivalent

Requirements
Identification colours, size, banding, location of banding

Utility
Water, oil, gas, compressed air, steam, electrical, drainage

Characteristics
Ignition temperature, flammability range, specific gravity, flame speed, calorific values

Types of gas
Natural, LPG

Electrical supply systems
Single phase, three phase, extra low voltage
Compressed air
Individual compressor, compressed cylinder, distributed compressed air

Types of water system
Drinking, cooling, heating, waste, hydraulic power, hot water, grey water

Risks
To individuals, effects on food and drink operations, precautions, signs of legionella, causes, effects

Services
Gas, water, electric, waste

Learning outcome
The learner will:

2. understand the operation of plant for generating services

Assessment criteria
The learner can:

2.1 describe the sources of hot water in food and drink operations
2.2 describe the local methods of generating electricity used in food and drink operations
2.3 explain how steam is produced in food and drink operations
2.4 explain the operation of different types of boiler
2.5 explain the operation of a compressor
2.6 explain the operation of refrigeration/chiller units
2.7 describe the legislation for dealing with refrigerant gases
2.8 explain the operation of ventilation systems in food and drink operations
2.9 explain limits of own authority for dealing services in food and drink operations.

Range
Methods of generating electricity
Gas fired, combined heat and power units, renewable technologies

Types of boiler
Low temperature hot water, high temperature hot water, steam

Operation
Vapour compression cycle, absorption
**Learning outcome**

The learner will:

3. understand energy management in food and drink operations

**Assessment criteria**

The learner can:

3.1 show the **combustion process** as an equation
3.2 explain causes of incomplete combustion
3.3 explain **risks** associated with incomplete combustion
3.4 identify fuel types that can be used for heating or power generation
3.5 explain the need for ventilation for the combustion process
3.6 describe the potential greenhouse gases generated as a result of food and drink operations
3.7 categorise the waste generated from food and drink operations
3.8 explain the process used for waste disposal in food and drink operations
3.9 describe the legal requirements related to waste
3.10 explain the environmental impact of food and drink operations
3.11 describe the energy audit process within a food and drink operation
3.12 explain the sources of energy losses on a food and drink operations building
3.13 describe the methods used to reduce energy losses
3.14 describe methods used to monitor **energy loss and consumption**
3.15 explain the financial impact of inefficient systems.

**Range**

**Combustion process**
Incomplete combustion, complete combustion

**Risks**
To individuals, to food and drink operations, control measures

**Energy loss and consumption**
On individual pieces of equipment, on a building
This unit provides the essential knowledge required for an understanding of the way in which the principles of heat transfer are applied to problems associated with the heating and cooling of process fluids in industry and the way in which the basic principles of fluid flow are used to solve problems associated with the transport and control of fluids in pipeline systems.

**Learning outcome:**
The learner will:

1. understand the principles of heat transfer and energy conservation

**Assessment criteria**
The learner can:

1.1 explain the modes of heat transfer
1.2 explain how different factors affect rates of heat transfer
1.3 describe the differences between natural and forced convection
1.4 explain the importance of restricting heat losses from surfaces of industrial processing equipment
1.5 describe methods of minimizing heat losses from hot surfaces
1.6 explain the principle of energy conservation in a thermodynamic system
1.7 describe Boyle’s law
1.8 describe the ideal gas law
1.9 calculate heating and cooling rates associated with different equipment
1.10 calculate latent heat energy
1.11 calculate the insulation required for a thermodynamic system
1.12 explain the insulation properties of common lagging materials
1.13 identify the thermal capacity of a material.

**Range**

**Heat transfer**
By conduction, by convection, by radiation

**Factors**
Area through which heat is transferred, thickness of material, temperature difference across the medium, thermal conductivity of material, surface temperature, temperature of surroundings, nature of surface (emissivity/absorptivity), layers of lagging, static layers of fluid, fouling deposits on surfaces

**Methods**
Use of lagging, use of surfaces which reduce radiation, air gaps and vacuum, restriction of convection currents

**Lagging materials**
Magnesia, slag wool, fibre glass, aluminium foil, sheet and paint

**Equipment**
Pressure vessels, pipes, cooling units
Latent heat energy
Absorbed, released

**Learning outcome**
The learner will:

2. **understand the operation of heat exchange equipment**

**Assessment criteria**
The learner can:

2.1 describe the **construction** of heat exchangers
2.2 describe the operating principles of heat exchangers
2.3 compare the function of different **types of heat exchangers**
2.4 explain **factors** that affect the efficient operation of heat exchangers
2.5 describe how **heat exchange fluids** are applied in a heat exchange system
2.6 explain the principles of **water cooling systems**
2.7 describe the **management of water** used in water cooling systems
2.8 explain the principles of refrigeration
2.9 explain the function of primary and secondary refrigerants.

**Range**

**Construction**
Double pipe, shell and tube, single and multiple pass, hairpin types, floating head types, air fin types, reboilers

**Types of heat exchangers**
Heaters, coolers, condensers, reboilers, pre-heaters, space heaters, boilers, waste heat boilers

**Factors**
Scaling, fouling, corrosion

**Heat exchange fluids**
Water, steam, superheated steam, oils, gases, liquefied gases, molten salts, molten metals, solutions

**Water cooling systems**
Open evaporative, forced air

**Management of water**
Algae and bacteria removal, removal of dissolved solids, removal of suspended solids, pH control

**Components**
Compressor, condenser, expansion valve, evaporator, oil filter

**Learning outcome**
The learner will:

3. **understand principles of fluid flow**

**Assessment criteria**
The learner can:

3.1 explain how different **factors** affect the flow of fluids in pipes and tubes
3.2 describe the significance of Reynold's numbers in pumping and heat transfer operations
3.3 use Bernouilli's equation to solve **problems** relating to fluids flowing in pipes
3.4 explain the effect of cavitation on the efficiency of a pump.
Range
Factors
Fluid viscosity, fluid temperature, pressure head, pressure difference, cross-sectional area of tube, fluid density, bends, contractions and constrictions in pipes, obstructions and fittings in pipework, pump capacity, volumetric efficiency

Problems
Changes in height, changes in cross-sectional area, power and energy requirements

Learning outcome
The learner will:

4. understand operation of systems transporting and controlling fluids in a pipeline system

Assessment criteria
The learner can:

4.1 describe the application of different types of pump
4.2 describe the application of shaft seals
4.3 explain the need for lubrication in systems transporting fluids
4.4 describe equipment used for lubrication of seals and bearings
4.5 describe the application of pumps used for transferring gases
4.6 describe methods of preventing deposition of solid materials in pipelines
4.7 describe methods of cleaning pipelines.

Range
Types of pump
Centrifugal, displacement

Shaft seals
Simple stuffing box/packed seal, lantern ring, mechanical seal, liquid and gas seals

Equipment
Oil pots, slinger/oil rings, pumped lubrication

Pumps (transferring gases)
Reciprocating piston types, rotary blowers (vane, lobe), centrifugal blowers, radial flow fans, axial flow fans, multi-stage units

Methods of preventing deposition
Steam tracing, electrical tracing, steam/water jackets

Methods of cleaning pipelines
High pressure jet cleaning, rotary bushes, pigging, use of solvents
Unit 311  Maths for food and drink engineering maintenance

**UAN:** R/507/9810

**Level:** Level 3

**GLH:** 100

**Aim:** This unit develops in learners an ability to apply mathematical techniques to solve engineering problems. Learners will be able to use arithmetic, algebra, trigonometry and statistical techniques to solve problems typically encountered by food and drink maintenance engineers.

**Assessment type**  Short answer test

**Learning outcome:**

The learner will:

1. **Be able to use arithmetic methods to solve engineering problems**

The learner can:

1.1 define mathematical terms
1.2 convert numbers between bases
1.3 use mathematical operations in different bases
1.4 express decimal fractions in standard form
1.5 calculate approximations and estimations
1.6 evaluate numerical expressions containing combined positive, negative and fractional indices
1.7 construct mathematical tables
1.8 calculate areas of shapes
1.9 calculate volumes
1.10 calculate flow rates.

**Range**

**Terms**
Base, index, power, root, reciprocal, logarithms

**Bases**
Denary, binary, hexadecimal

**Mathematical tables**
Imperial units to metric and vice versa, Fahrenheit to Celsius and vice versa, mass and volume using density values

**Shapes**
Triangle, square, rectangle, parallelogram, circle, trapezium

**Volume**
Cylinders, spheres, cones
Learning outcome:
The learner will:

2. Be able to use algebra to solve engineering problems

The learner can:
2.1 determine a logarithm as a power applied to a base number
2.2 use logarithms to simplify calculations
2.3 analyse straight line graphs
2.4 evaluate linear simultaneous equations
2.5 solve quadratic equations
2.6 determine the root of an equation
2.7 transpose terms with indices
2.8 transpose engineering formulae.

Range
Logarithms
Log, anti-log, log linear, log-log

Analyse
Rectangular and Cartesian coordinate points, gradient, slope, ratio of change, points of intercept

Evaluate
Graphical methods, using substitution rule

Learning outcome
The learner will:

3. Be able to use trigonometry to solve engineering problems

Assessment criteria
The learner can:
3.1 perform calculations involving trigonometric ratios for the four quadrants
3.2 apply the sine rule to practical problems
3.3 apply the cosine rule to practical problems
3.4 use trigonometry to determine properties
3.5 differentiate between different trigonometric identities
3.6 evaluate complex numbers
3.7 explain the graphical representation of different types of quantities.

Range
Sine rule
\[
\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}
\]

Cosine rule
\[
\cos A = \frac{b^2 + c^2 - a^2}{2bc}
\]

Properties
non right-angled triangles, angles between lines, true length of lines, true angle between planes

Trigonometric identities
\[
tan = \frac{\sin}{\cos}, \cot = \frac{1}{\tan}, \sec = \frac{1}{\cos}, cosec = \frac{1}{\sin}
\]

Complex numbers
Rectangular, Argand

Quantities
Vector (complex numbers, modulus, argument), polar (complex numbers, argand diagrams, rotating vector, polar to Cartesian form and vice versa)
Learning outcome
The learner will:

4. Be able to use statistical methods to display data

Assessment criteria
The learner can:

4.1 define statistical terms
4.2 calculate the standard deviation for a sample of engineering components
4.3 interpret statistical diagrams.

Range
Statistical terms
Probability, dependent and independent events, addition and multiplication laws of probability, permutations and combinations applied to probability, normal probability distribution, confidence limits, statistical testing, average (mean, median, mode), sample, population, frequency, standard deviation

Statistical diagrams
Bar charts, pie charts, frequency distributions, frequency tables, histograms, cumulative frequency curves
Unit 312  Monitoring mechanical maintenance for food and drink operations

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<tr>
<td>Level:</td>
<td>3</td>
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<td>GLH:</td>
<td>70</td>
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<td>Aim:</td>
<td>The aim of this unit is for learners to develop the skills required to maintain systems and equipment in food and drink operations. They will learn to use a range of maintenance techniques and procedures including fault finding and condition monitoring.</td>
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</table>

**Assessment type**  Assignment

**Learning outcome**

The learner will:

1. be able to prepare for mechanical maintenance activities in food and drink operations

**Assessment criteria**

The learner can:

1.1 interpret **engineering information**
1.2 apply maintenance schedules
1.3 plan mechanical maintenance activities to minimise disruption to food and drink production operations
1.4 communicate planned activities to relevant stakeholders to meet organisational requirements
1.5 plan how mechanical maintenance activities will be undertaken to **control** food safety risks
1.6 assess hazards and associated risks
1.7 ensure the safe isolation of **equipment**
1.8 prepare work area for mechanical maintenance activities
1.9 select equipment and materials for mechanical maintenance activities
1.10 assess condition of equipment and materials for mechanical maintenance activities
1.11 prepare equipment and materials for mechanical maintenance activities
1.12 select consumables for mechanical maintenance activities
1.13 **document** preparation activities.
**Range**
**Engineering information**
Drawings, specifications, schematics, manufacturers’ manuals, data sheets, retailers’ standards, operational records, standard operating procedures

**Control**
Prevent, eliminate, reduce

**Equipment**
Mechanical, electrical, gas, fluids

**Document**
Risk assessment, method statement, permit to work

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**Learning outcome**
The learner will:

2. **be able to maintain mechanical equipment in food and drink operations**

**Assessment criteria**
The learner can:

2.1 **control** food safety risks when carrying out mechanical maintenance activities
2.2 apply safe working practices when carrying out mechanical maintenance activities
2.3 apply planned **maintenance procedures** to **mechanical equipment**
2.4 comply with **requirements** for maintenance activities
2.5 **record** completed maintenance activities
2.6 handover equipment for operation.

---

**Range**
**Maintenance procedure**
Sealing, aligning, tensioning, fitting, refitting, bending

**Mechanical equipment**
Levers and linkage mechanisms, gears and gear drives, valves, pumps, cams and followers, chain and belt drives, clutches and brakes, transmission shafts

**Requirements**
Company guidelines and codes of practice, equipment manufacturers’ operation range, BS, ISO and/or BSEN standards

**Record**
Job cards, permits to work/formal risk assessment and/or sign on/off procedure, maintenance log or report, company specific documentation, issues with completion of maintenance activities

**Handover**
Check hygiene, no components
Learning outcome
The learner will:

3. be able to monitor mechanical equipment

Assessment criteria
The learner can:

3.1 measure mechanical components
3.2 identify issues from operational information
3.3 identify faults in mechanical equipment
3.4 assess serviceability of mechanical equipment
3.5 apply condition monitoring techniques to mechanical systems.

Range
Measure
For wear, tool locations and positions, size, temperature, movement

Operational information
Output records, wastage records, maintenance records, asset register, lubricant usage, tool change frequencies

Mechanical equipment
Levers and linkage mechanisms, gears and gear drives, cams and followers, chain and belt drives, clutches and brakes, transmission shafts

Serviceability
Correct operation of moving parts, correct working clearance of parts, backlash in gears, belt/chain tension, bearing loading, torque loading, operational performance, shaft alignment, overheating
Unit 313  
Reparing and producing replacement components in food and drink operations

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<tr>
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**Aim:** This unit develops the skills required to produce and repair mechanical components. This will involve the development of skills associated with milling, turning, fitting and grinding to produce and repair components for maintenance of food and drink operations. Learners will use techniques relate to fault finding and condition monitoring.

**Assessment type**  
Assignment

---

**Learning outcome:**

The learner will:

1. **be able to prepare for producing replacement components**

**Assessment criteria**

The learner can:

1.1 interpret **engineering information**
1.2 plan machining and fitting activities to minimise disruption to food and drink production operations
1.3 communicate planned activities to relevant stakeholders to meet organisational requirements
1.4 plan how machining and fitting activities will be undertaken to **control** food safety risks
1.5 produce working sketches of component
1.6 assess hazards and associated risks
1.7 prepare work area for machining and fitting activities
1.8 select **materials, tools and equipment**
1.9 assess condition of **materials, tools and equipment** for machining and fitting activities
1.10 **prepare work holding devices and equipment**
1.11 prepare components for repair
1.12 **document** preparation activities.
Range

Engineering information
Drawings, sketches, sample or damaged component to be replaced, manufacturers’ specifications, company policies and procedures for repair, maintenance log, asset register, standard operating procedures

Control
Prevent, eliminate, reduce

Materials
Non-metallic, non-magnetic, steel

Tools
Work holding devices, cutting tools, milling tools, grinding wheels, saws, files, chucks, drills, taps, reamers

Equipment
Lathes, milling machines, grinders (pedestal, surface, universal, hand), power saws, measuring equipment

Prepare work holding devices and equipment
Set work holding device, set tooling, calibrate measuring equipment, calculate speeds and feeds, sharpen tools

Document
Risk assessment, method statement, permit to work

Learning outcome
The learner will:

2. be able to produce components to meet specifications

Assessment criteria
The learner can:

2.1 control food safety risks when carrying out machining and fitting activities
2.2 apply safe working practices when carrying out machining and fitting activities
2.3 produce features in components to required standard
2.4 select appropriate measuring instruments
2.5 measure accuracy of component features
2.6 use machine controls in line with operational procedures
2.7 adjust machine tools and feeds
2.8 use hand fitting methods
2.9 produce components in different materials
2.10 repair components to required standard
2.11 inspect components for fitness for purpose
2.12 measure accuracy of component features
2.13 record completed maintenance activities
2.14 handover components for use in food and drink operations.
**Range**

**Features**
External diameters, internal diameters, flat faces, parallel faces, steps/shoulders, angular/tapered surfaces, threads, slots/recesses, drilled holes, bored holes, reamed holes

**Required standards**
Components to be free from false tool cuts, burrs and sharp edges, dimensional tolerance of +/- 0.05mm or (0.002”), reamed holes within H8, surface finish 32µin or 0.8 µm, bench fitting +/- 0.05mm or (0.002”)

**Repair**

**Welding:** Reform component surface by adding metal, plugging holes, dealing with cracks (stopping runs, filling)

**Machining and fitting:** making stepped dowels or studs, cutting new keyways, making new or stepped keys, replacement of internal threads, rework surface finish, sleeve worn components, bushing worn holes, rework fit (shimming)

**Different materials**
Non-metallic, non-magnetic, steel

**Record**
Job cards, permits to work/formal risk assessment and/or sign on/off procedure, maintenance log or report, company specific documentation, issues with completion of maintenance activities
Unit 314  Welding skills for food and drink operations

**UAN:** H/507/9813

**Level:** Level 3

**GLH:** 80

**Aim:** This unit develops in learners the skills to use three different welding techniques in food and drink operations: Metal Active Gas (MAG), Tungsten Inert Gas (TIG), Manual Metal Arc (MMA). Skills developed will enable learners to carry out complex welding activities. They will also develop skills to cut shapes using thermal cutting equipment.

**Assessment type** Assignment

**Learning outcome**
The learner will:

1. **be able to prepare for cutting and welding in food and drink operations**

**Assessment criteria**
The learner can:

1.1 interpret engineering information
1.2 assess welding requirements
1.3 establish welding technique
1.4 plan required activities to minimise disruption to food and drink production operations
1.5 communicate planned activities to relevant stakeholders to meet organisational requirements
1.6 plan how cutting and welding activities will be undertaken to control food safety risks
1.7 plan maintenance work to be carried out
1.8 assess hazards and associated risks for cutting and welding activities
1.9 prepare work area for cutting and welding activities
1.10 select equipment and consumables for cutting and welding activities
1.11 assess condition of equipment and consumables for cutting and welding activities
1.12 prepare equipment and consumables for cutting and welding activities
1.13 use marking out techniques
1.14 mark out materials
1.15 document preparation activities.

**Range**

**Interpret engineering information**
Work requisition, manufacturers' specifications, standard operating procedures

**Welding technique**
Slope and tilt angles, arc length
Plan
Location, date and time, parts to be used, tests required, testing points, checks to be made, permits to work required, tools and equipment required, sequence of operations, provisions for waste, communications required

Techniques
Direct marking, templates, tracing/transfer

Document
Risk assessment, method statement, permit to work

Learning outcome
The learner will:

2. be able to perform cutting and welding activities in food and drink operations

Assessment criteria
The learner can:

2.1 control food safety risks when carrying out welding activities
2.2 produce complex welded joints in a range of positions in accordance to BS4872 part 1 standard or equivalent
2.3 weld with different materials
2.4 use distortion control techniques
2.5 perform visual checks on welded joints
2.6 perform thermal cutting operations to quality standards
2.7 apply safe working practices when performing welding operations
2.8 record completed maintenance activities.

Range
Control
Prevent, eliminate and reduce
Metals
Carbon steel, stainless steel
Joints
Plate/sheet: Fillet joints (lap, tee, corner), butt joints (open, closed, single vee)
Pipe: Branch connection, butt joints (closed, single vee)
Positions
Horizontal vertical, horizontal, vertical upwards, vertical downwards, overhead, inclined
Distortion control techniques
Jigging, clamping, offsetting, tack weld
Thermal cutting operations
Freehand straight cuts, track guided straight cuts, radial cuts, angled cuts, bevelled edges
Quality standards
Clean and smooth without adhering dross and with minimal drag lies, dimensional accuracy to tolerance specified on drawing or specification or within +/- 2mm, angled cut to within specification requirements for angularity and perpendicularity
Record
Job cards, permits to work/formal risk assessment and/or sign on/off procedure, maintenance log or report, company specific documentation, issues with completion of maintenance activities
Learning outcome
The learner will:

3. be able to review welded activities

Assessment criteria
The learner can:

3.1 assess quality of welded joints against specification requirements
3.2 test welded joints
3.3 apply post welding activities
3.4 document maintenance activities
3.5 handover outputs for use in food and drink operations.

Range
Quality
Dimensional accuracy, alignment/squareness, size and profile of weld, number of runs
Tests
Visual, dye penetrant, macroscopic examination, nick break tests, bend tests
Post welding activities
Cleaning, slag removal, spatter removal, wiring brushing, removal of excess weld
Document
Equipment maintained, type of maintenance, repairs, replaced parts and consumables, time, outstanding issues
Unit 315  Electrical maintenance and testing in food and drink operations

UAN: K/507/9814
Level: Level 3
GLH: 145

Aim: This unit enables learners to understand the underlying principles that apply across three phase motors and speed drives in electrical maintenance engineering. It also covers the principles associated with the testing of electrical circuits. Learners will develop the skills needed to apply their understanding to the maintenance and testing of electrical components of machines in food and drink operations.

Assessment type Assignment

Learning outcome:
The learner will:

1. understand the principles of electrical machines

Assessment criteria
The learner can:

1.1 explain the operating principle of d.c. machines
1.2 state the applications of d.c. machines
1.3 explain the operating principle of single phase a.c. machines
1.4 state the applications of single phase a.c. machines
1.5 explain the operating principle of three phase a.c. machines
1.6 state the applications of three phase a.c. machines
1.7 calculate values of voltage and current in configured systems
1.8 determine the neutral current in a three phase and neutral supply
1.9 calculate the characteristics of three phase motors
1.10 explain methods used for starting motors
1.11 explain levels of motor protection required
1.12 explain types of protection devices
1.13 describe different types of control systems
1.14 explain the application of electrical control components
1.15 explain the integration of servo motors into a typically industrial automation system
1.16 understand the factors effecting the location of servo systems
1.17 explain the applications of variable speed drives
1.18 explain how to use intelligent test equipment to determine the nature and position of faults.
Range

d.c machines
d.c generator, series motor, shunt motor, compound motor

Applications (d.c machines)
Generation, motors for domestic, commercial, industrial applications

Single phase a.c machines
a.c. generator, split phase induction motor, capacitor start induction motor, capacitor start and run induction motor, universal motor

Three phase a.c machines
a.c generator, cage induction motor, wound rotor motor, synchronous

Voltage
Line voltage, phase voltage

Current
Line current, phase current

Configured systems
Star, delta

Neutral current
Balanced load, unbalanced load

Characteristics
Poles, speed, torque, power, efficiency, slip

Methods
Direct on – line, Star – Delta, rotor resistance, soft start, variable frequency, inverters, Programmable Logic Converters.

Motor protection
Thermal overload, vibration, noise

Protection devices
Fuses, circuit breakers, residual current devices (RCDs), residual current breakers with overload (RCBO),

Control systems
Supervisory control and data acquisition (SCADA), distributive control system (DCS), proportional integral derivative (PID)

Electrical control components
Diodes, diacs, triacs, thyristors, rectifiers, transistors, invertors solenoids

Factors
Degree of protection (IP), installation in hazardous areas, supply voltages, type of construction (IM B3 mounting IMB3 flange mounting), maximum torque from the load cycle profile and average torque

Application
Integration into intelligent network, energy regeneration, safety
Learning outcome
The learner will:

2. understand the principles of testing electrical equipment and circuits

Assessment criteria
The learner can:

2.1 describe the procedures that apply to electrical testing activities
2.2 describe the specific safety precautions to be taken when carrying out formal inspection and testing of electrical equipment
2.3 assess the suitability of different types of test equipment for different types of tests
2.4 explain how to connect the appropriate test equipment for the measurement
2.5 describe the various testing methods and procedures for parameters, as recommended in approved electrical codes of practice
2.6 explain the operation of testing methods in different operating conditions
2.7 describe the problems that may occur and which could affect the test results, and how they can be avoided
2.8 describe the extent of their own authority in testing electrical equipment and circuits.

Range
Procedures
Equipment isolation and lock-off procedure or permit-to-work

Types of test equipment
Low resistance ohmmeter, insulation resistance tester, approved voltage indicator, earth fault loop impedance tester, phase rotation meter, prospective fault current tester

Measurement
Resistance, current, voltage, power, capacitance, inductance, frequency, power factor, protective device disconnection/trip times

Parameters
Continuity, insulation resistance, polarity, earth fault loop impedance, prospective fault current, RCD operation, phase sequence

Problems
Parallel paths, voltage sensitive devices, uncalibrated equipment, defective equipment, contact resistance
Learning outcome
The learner will:

3. be able to prepare for electrical maintenance activities

Assessment criteria
The learner can:

3.1 interpret engineering information
3.2 determine electrical maintenance activities required
3.3 plan electrical maintenance activities to minimise disruption to food and drink production operations
3.4 communicate planned activities to relevant stakeholders to meet organisational requirements
3.5 plan how electrical maintenance activities will be undertaken to control food safety
3.6 assess hazards and associated risks
3.7 ensure the safe isolation of equipment
3.8 select required tools and equipment for specified maintenance tasks.
3.9 select required materials for specified maintenance tasks
3.10 prepare work area for electrical maintenance activities
3.11 assess condition of equipment and materials for mechanical maintenance activities
3.12 document preparation activities.

Range
Engineering information
Drawings, specifications, schematics, manufacturers’ manuals, data sheets, retailers’ standards, operational records, IET wiring regulations, standard operating procedures

Control
Prevent, eliminate, reduce

Equipment
Mechanical, electrical, fluid power

Tools and equipment
Hand tools, power tools, access systems, test equipment, safety equipment

Materials
Cables, terminations, replacement components, fixings

Document
Risk assessment, method statement, permit to work
Learning outcome
The learner will:

4. Be able to carry out electrical maintenance activities

Assessment criteria
The learner can:

4.1 control food safety risks when carrying out electrical maintenance activities
4.2 apply safe working practices when carrying out electrical maintenance activities
4.3 apply electrical maintenance activities to a range of electrical equipment
4.4 ensure maintenance activities comply with requirements
4.5 inspect and test functionality of maintained electrical equipment
4.6 use techniques to diagnose faults
4.7 apply condition monitoring to electrical equipment
4.8 record completed maintenance activities
4.9 handover equipment for operation.

Range
Control
Prevent, eliminate, reduce
Maintenance activities
Disconnect and reconnect cables and wires, attach identification markers, remove electrical units/components, check components for serviceability, replace damaged/defective components, remove and replace damaged wires and cables, remove and replace wiring enclosures, set and adjust replaced components, prove PLC operation
Electrical equipment
Single-phase power supplies, three-phase power supplies, direct current power supplies, three phase motors and starters, switchgear and distribution panels, control systems and components, electrical plant, wiring enclosures, servos, variable speed/frequency drives, PLC systems, sensors, actuators
Requirements
Company guidelines and codes of practice, equipment manufacturers’ operation range, BS, ISO and/BSEN standards
Test
Protective conductor resistance values, insulation resistance values, load current, voltage levels, impedance, continuity, polarity, power rating, resistance, capacitance, frequency values, RCD disconnection time, specialised tests (such as speed, sound, light, temperature)
Faults
Loss of supply, overload, short-circuit and earth fault, transient voltage, loss of phase/line, incorrect phase rotation, high resistance joints, component, accessory or equipment faults
Record
Job cards, permits to work, maintenance log or report, company specific documentation
Unit 316  Automation in food and drink operations

UAN: T/507/9816
Level: Level 3
GLH: 120
Aim: Through this unit, the learner will develop an understanding of process controller equipment working in an integrated system involving two or more interactive technologies. They will develop skills required to carry out maintenance on process controller systems in food and drink operations.

Assessment type Assignment

Learning outcome:
The learner will:

1. Understand the operation of process controllers within an engineered system

Assessment criteria
The learner can:

1.1 explain the procedures used to eliminate electrostatic discharge hazards
1.2 explain how process controllers function
1.3 describe the procedures used to maintain programs
1.4 explain the applications of different types of interface cards
1.5 explain how to search a program within a programmable logic controller (plc)
1.6 describe the numbering system and codes used for identification of inputs and outputs in a given plc
1.7 describe the programming techniques used in plcs
1.8 describe the techniques involved in working with lines of logic
1.9 describe the procedure to follow for off line and on line programming
1.10 explain the operation of instrumentation systems
1.11 explain signal transmission methods
1.12 describe the equipment used to measure product variables
1.13 explain logic functions performed by basic plc instructions
1.14 explain how to address input and outputs of plcs
1.15 identify the range of input/output (i/o) modules available
1.16 explain the principles of process control systems
1.17 identify the capabilities of controllers from their exterior markings
1.18 explain the limitations of auto tuning
1.19 explain the difference between analogue digital i/o devices
1.20 explain the purpose of industrial instrument buses.

Range
Procedures
Storage, backing up
Programming techniques
Interlocking, timers, counters, sub-routines

**Techniques**
Editing, entering, removing

**Instrumentation systems**
Electrical, hydraulic, pneumatic, electro-pneumatic

**Signal transmission**
Electric 4 to 20mA, Pneumatic 0.2 to 1.0 bar

**Product variables**
Temperature, pressure, levels, flow, conductivity, pH, turbidity, compressed air, refrigeration

**Process control systems**
MES, SCADA, PID

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**Learning outcome**
The learner will:

2. **Be able to prepare for automation maintenance activities**

**Assessment criteria**
The learner can:

2.1 interpret **engineering information**
2.2 identify automation maintenance activities required
2.3 plan automation maintenance activities to minimise disruption to food and drink production operations
2.4 communicate planned activities to relevant stakeholders to meet organisational requirements
2.5 plan how automation maintenance activities will be undertaken to **control** food safety
2.6 assess hazards and associated risks
2.7 ensure the safe isolation of **equipment**
2.8 Select required tools and equipment for specified maintenance tasks.
2.9 Select required materials for specified maintenance tasks
2.10 prepare work area for automation maintenance activities
2.11 assess condition of equipment and materials for automation maintenance activities
2.12 **document** preparation activities.

**Range**
**Engineering information**
Drawings, specifications, schematics, manufacturers’ manuals, data sheets, retailers’ standards, operational records, ladder logic, statement lists, system flowcharts, standard operating procedures

**Control**
Prevent, eliminate, reduce

**Equipment**
Mechanical, electrical, fluid power

**Document**
Risk assessment, method statement, permit to work
Learning outcome

The learner will:

3. Be able to carry out automation maintenance activities

Assessment criteria

The learner can:

3.1 control food safety risks when carrying out automation maintenance activities
3.2 apply safe working practices when carrying out electrical maintenance activities
3.3 carry out program maintenance activities
3.4 apply maintenance activities to a range of automation equipment
3.5 ensure maintenance activities comply with requirements
3.6 inspect and test serviceability of maintained automation equipment components
3.7 identify faults in automation equipment
3.8 carry out condition monitoring of automation equipment
3.9 record completed maintenance activities
3.10 handover equipment for operation.

Range

Control
Prevent, eliminate, reduce

Program maintenance activities
Force contacts on and off, edit, enter and remove contacts from lines of logic, alter counter and timer settings, use ‘on’ and ‘off-line’ programming, carry out on-line monitoring of programs, load, read and save programs, produce back-ups of completed programs, programme by computer based authoring (to include sub-routines), use single-step mode of operation, modify program parameters

Maintenance activities
Calibrate sensors, use program full-run modes of operation, change or add circuit boards, replace power supplies, replace peripherals (such as sensors, actuators, relays, switches), replace process controller units, replace back-up batteries, functionally test the system, manually tune electronic controllers, connect, commission and maintain measuring devices

Equipment
Electrical, mechanical, fluid power

Requirements
Company guidelines and codes of practice, equipment manufacturers’ operation range, BS, ISO and/BSEN standards

Record
Job cards, permits to work, maintenance log or report, company specific documentation, issues with completion of maintenance activities
Unit 317  
Understand the requirements of electrical installations BS 7671 (2015)

**Aim:** This unit gives the learner an understanding of the full content of BS7671, and how this applies to electrical installations within its scope.

**Assessment type** Multiple choice test

**Learning outcome:**
The learner will:

1. **Understand the scope, object and fundamental principles of BS7671.**

**Assessment criteria**
The learner can:

1.1 identify the scope of BS7671  
1.2 identify the object of BS7671  
1.3 identify the fundamental principles of BS7671.

**Learning outcome**
The learner will:

2. **Understand the definitions used within BS7671**

**Assessment criteria**
The learner can:

2.1 interpret the definitions used within BS7671  
2.2 relate the definitions to the regulations and appendices of BS7671.

**Learning outcome**
The learner will:

3. **Understand how to assess the general characteristics of electrical installations**

**Assessment criteria**
The learner can:

3.1 interpret the requirements of assessing the general characteristics of electrical installations within the scope of BS7671.
**Learning outcome:**
The learner will:

4. **Understand requirements of protection for safety for electrical installations**

**Assessment criteria**
The learner can:

4.1 identify the requirements of protection for safety within the scope of BS7671
4.2 interpret how this applies to electrical installations within the scope of BS7671 to include:
   - protection against electric shock
   - protection against thermal effects
   - protection against overcurrent
   - protection against voltage disturbances and electromagnetic disturbances.

---

**Learning outcome**
The learner will:

5. **Understand the requirements for selection and erection of equipment for electrical installations**

**Assessment criteria**
The learner can:

5.1 identify the requirements for selecting and erecting equipment, within the scope of BS7671
5.2 interpret how this applies to electrical installations within the scope of BS7671 to include:
   - common rules
   - selection and erection of wiring systems
   - protection, isolation, switching, control and monitoring
   - earthing arrangements and protective conductors
   - other equipment.

---

**Learning outcome**
The learner will:

6. **Understand the requirements of Inspection and testing of electrical installations**

**Assessment criteria**
The learner can:

6.1 identify the requirements for inspection and testing
6.2 interpret how this applies to electrical installations.
Learning outcome:
The learner will:

7. Understand the requirements of Special installations or locations as identified in BS7671

Assessment criteria
The learner can:
7.1 identify the requirements for special installations and locations
7.2 interpret how these effect the general requirements of the regulations.

Learning outcome
The learner will:

8. Understand the requirements for selection and erection of equipment for electrical installations

Assessment criteria
The learner can:
8.1 identify the information in the appendices of BS7671
8.2 specify how the information contained in the appendices is used to support electrical installation activities.
Appendix 1  Sources of general information

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

City & Guilds Centre Manual contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve ‘approved centre’ status, or to offer a particular qualification, as well as updates and good practice exemplars for City & Guilds assessment and policy issues. Specifically, the document includes sections on:
- The centre and qualification approval process
- Assessment, internal quality assurance and examination roles at the centre
- Registration and certification of candidates
- Non-compliance
- Complaints and appeals
- Equal opportunities
- Data protection
- Management systems
- Maintaining records
- Assessment
- Internal quality assurance
- External quality assurance.

Our Quality Assurance Requirements encompasses all of the relevant requirements of key regulatory documents such as:
- SQA Awarding Body Criteria (2007)
- NVQ Code of Practice (2006)
and sets out the criteria that centres should adhere to pre and post centre and qualification approval.
**Access to Assessment & Qualifications** 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 homepage** section of the City & Guilds website also contains useful information on such things as:
- **Walled Garden**: how to register and certificate candidates on line
- **Events**: dates and information on the latest Centre events
- **Online assessment**: how to register for e-assessments.

**Centre Guide – Delivering International Qualifications** contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve ‘approved centre’ status, or to offer a particular qualification. Specifically, the document includes sections on:
- The centre and qualification approval process and forms
- Assessment, verification and examination roles at the centre
- Registration and certification of candidates
- Non-compliance
- Complaints and appeals
- Equal opportunities
- Data protection
- Frequently asked questions.

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## Useful contacts

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