



# **Qualification Specification**

## **DPH-010**

**BPEC Level 3 Diploma in Plumbing  
Foundation**

Qualification Number – **600/9353/5**

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## About BPEC

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BPEC Certification Ltd was initially established in 1997 to act as an accredited certification body to oversee competence assessment of individuals working in the gas industry. It has extended its coverage and now offers a range of assessment and certification services to meet the needs of operatives working in the Building Services Sector.

In 2010 BPEC established a recognised Awarding Organisation, offering a suite of regulated qualifications. These have been developed with the input of industry and learning providers to meet the skills needs of the Building Services Engineering sector.

The Company is committed to high levels of customer service and providing support to organisations who deliver our qualifications. We are also committed to offering qualifications, assessments and learning materials, which meet the needs of employers, learners, and training providers on an ongoing basis.

BPEC Certification is a not-for-profit company, and any surplus funds are gift aided to the BPEC Charity. The focus of the Charity is to raise the knowledge and skills of those who work in the UK plumbing and heating industry and support associated projects, grants, and awards.

Should you wish to learn more about BPEC (including our charity work) please contact:

BPEC Certification Ltd  
1-2 Mallard Way  
Pride Park  
Derby  
DE24 8GX

Tel: 01332 376000

Or visit our website at:

[www.bpec.org.uk](http://www.bpec.org.uk)

# 1. Introduction to the Qualification

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## 1.1. Qualification Overview

|                                  |     |  |     |                |    |
|----------------------------------|-----|--|-----|----------------|----|
| <b>Qualification Title</b>       |     | BPEC Level 3 Diploma in Plumbing Foundation                              |     |                |    |
| <b>Qualification Number (QN)</b> |     | 600/9353/5   |     |                |    |
| <b>BPEC Qualification Code</b>   |     | DPH-010  |     |                |    |
| <b>Assessment Method/s</b>       |     | Online MCT's, Written Design Assignment, In Centre Practical Assessments |     |                |    |
| <b>Entry Requirements</b>        |     | Learners must be 16 years old or over                                    |     |                |    |
| <b>GLH</b>                       | 450 | <b>TQT</b>   | 530 | <b>Credits</b> | 53 |
| <b>Mandatory Units</b>           |     | 6  |     |                |    |
| <b>Last Registration Date</b>    |     | 30/09/2024   |     |                |    |
| <b>Last Certification Date</b>   |     | 30/09/2027   |     |                |    |

## 1.2. Who this Qualification is for?

This qualification is for those learners wishing to gain an in-depth knowledge of plumbing who may be thinking of entering the Plumbing/Heating/Building Services Engineering industry. It assumes prior learning of Plumbing at Level 2.

## 1.3. The Purpose of the Qualification

Learners will develop advanced skills, knowledge, and disciplines of plumbing, allowing further progression onto higher levels of Building Services Engineering qualifications or full NVQ plumbing qualifications if the learner secures a position in the Plumbing industry.

## 1.4. Support and Accreditation

This qualification is supported by industry and regulated by OFQUAL.

## 1.5. Relationship to Other Qualifications

This Level 3 qualification is part of a suite of three (3) BPEC Diploma qualifications in plumbing.

Successful completion of the qualification allows progression onto Phase 3 of the Level 3 Diploma in Plumbing and Domestic Heating, giving exemption from Phases 1 and 2, and the Phase 3 Design assignment. However, Unit 13 of the Level 3 Diploma in Plumbing and Domestic Heating must be completed in full during Phases 3 and 4.

Successful completion of this qualification also allows Learners to pursue a Higher National Certificate (Level 4 HNC) or Higher National Diploma (Level 5 HND) in Building Services Engineering (mechanical).

## 1.6. Qualification Limitations

The holder of this qualification is NOT recognised as a plumber. However, successful completion the qualification presents the learner with specific pathways into further learning within the plumbing and heating industry.

## 1.7. Pre-requisites for the qualification

The Learner must have completed a Level 2 Diploma in Plumbing Foundation or equivalent.

## 2. Qualification Structure

This is a Level 3 qualification of 53 credits and 450 guided learning hours consisting of 6 mandatory units. ALL units must be achieved to achieve the overall qualification.

The qualification and unit details are shown below:

| Unit Ref.  | Unit Type | Unit Title  | Level | Credit Value | TQT | GLH |
|------------|-----------|---|-------|--------------|-----|-----|
| R/602/2498 | K         | Understand how to organise resources within BSE   | 3     | 3            | 530 | 26  |
| K/502/8930 | K/P       | Understand and apply domestic cold water system installation, commissioning, service, and maintenance techniques      | 3     | 9            |     | 76  |
| K/502/9155 | K/P       | Understand and apply domestic hot water system installation, commissioning, service, and maintenance techniques       | 3     | 9            |     | 76  |
| M/502/9156 | K/P       | Understand and apply domestic central heating system installation, commissioning, service, and maintenance techniques | 3     | 12           |     | 98  |
| T/502/9157 | K/P       | Understand and carry out electrical work on domestic plumbing and heating systems and components                      | 3     | 12           |     | 102 |
| D/502/9296 | K/P       | Understand and apply domestic sanitation system installation, commissioning, service, and maintenance techniques      | 3     | 8            |     | 72  |
| Totals     |           |   | ---   | 53           | 530 | 450 |

### 3. The Learners

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#### 3.1. Qualifications that the Learner must have completed before taking the Qualification

None that are applicable

#### 3.2. Knowledge, skills or understanding that the Learner is required to have before taking the qualification

##### a) Specific

None that are applicable

##### b) General

The centre should:

- Undertake initial assessment of each Learner to ensure that they have the minimum levels of numeracy and literacy to comply with the health and safety aspects of the qualification and the completion of the Learning Outcomes and assessments.
- Establish if the Learner has any specific training needs
- Identify any support and guidance the Learner may require when working towards the qualification.

#### 3.3. The Units the Learner must have completed before the Qualification will be awarded

Learners will need to complete all 9 mandatory Units.

#### 3.4. Any other requirements which a Learner must have satisfied before the Learner will be assessed or before the Qualification is awarded

None identified

#### 3.5. Qualification achievement

The Qualification will be awarded when all necessary Units have been completed.

## 4. Delivery requirements

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### 4.1. Centre Recognition

Centres wishing to deliver this qualification will need to gain Centre Recognition and Qualification Approval. For full details of the recognition process please contact:

BPEC Certification

1-2 Mallard Way

Pride Park

Derby

DE24 8GX

Tel: 01332 376000

[aoadmin@bpec.org.uk](mailto:aoadmin@bpec.org.uk)

### 4.2. Qualification Approval

- Centres wishing to deliver this Qualification who are already recognised (see 5.1) should complete and submit a Qualification Approval Form to BPEC Certification Ltd.
- Before submission, centres should ensure that they can meet the delivery requirements.
- Centres who are approved to deliver this qualification and wish to extend delivery to satellite sites must seek approval for each additional site.

### 4.3. Physical Resources

- General – Centres must provide a safe environment for Learners and staff with appropriate policies and procedures in place which are adhered to.
- Teaching Provision – Centres must provide adequate facilities and equipment to allow the effective teaching of the qualification including any practical provision.
- Assessments/Exam Provision – Centres must provide facilities and equipment which allow assessments and exams to be conducted in accordance with the assessment criteria/guidance and exam procedures.

### 4.4. Assessor/Trainer Requirements

Assessors must:

- Hold, or be working towards TAQA (A1/A2 – D32/33 updated) standards and continue to practice to these standards and possess CPD evidence of personally maintaining these standards, or
- Have other suitable equivalent assessor qualifications endorsed by BPEC.
- ‘Candidate assessors’ who are working towards their assessor qualifications must always be supervised by a qualified assessor. They should have a clear action plan for achieving the assessor qualification(s), (assessor approval will be withdrawn if the assessor qualification/units have not been attained within a period of 18 months).

#### **4.4.1. Assessor occupational competence**

For the purposes of this qualification, occupational competence will be deemed to have been demonstrated by the verifiable evidence of all the following:

- A relevant level 3 plumbing qualification:
  - If older qualifications are held – such as city & guilds craft or advanced craft certificates – the assessor must be able to evidence through CPD activity a thorough knowledge of the qualification standards and requirements
  - If other MES-related NVQ/SVQ qualifications are held – such as domestic gas (wet central heating), heating and ventilation installation (domestic), domestic heating – the assessor must be able to evidence plumbing competence through CPD activity
- A relevant, current CPD record including relevant qualifications
- A verifiable CV of industry experience and current knowledge of industry practice and techniques relevant to the occupational area in which they assess
- A thorough knowledge and understanding of the qualification standards and requirements.

#### **4.4.2. Assessor continuing professional development**

The occupational competence of assessors must be updated on a regular basis and be periodically confirmed via continuing professional development (CPD) via the Assessment Centre. Evidence of CPD will be sought by the External Quality Assurer (EQA) for all approved Assessors at the Centre.

It is the responsibility of each assessor to identify and make use of opportunities for CPD, such as industry conferences, access to trade journals, and Professional Body/Trade Association events, at least on an annual basis to enhance and upgrade their professional development and technical knowledge.

It is imperative that records are kept of all such CPD opportunities/occasions and that they provide evidence of cascading such technical knowledge and industry intelligence to all relevant colleagues.

#### **4.5. IQA occupational competence**

For the purposes of this qualification, occupational competence will be deemed to have been demonstrated by the verifiable evidence of one of the following:

- A Level 3 NVQ in Plumbing
- A related building services qualification with proven technical expertise
- A related building services qualification with access to plumbing technical expertise when undertaking IQA activities.

#### **4.6. External Quality Assurers (EQAs)**

EQAs must:

- Hold or be working towards TAQA (V2 or D36 updated)
- Hold a Level 3 NVQ in plumbing or a related building services engineering qualification.



## 5. Support Materials

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### 5.1. Qualification Specification

This Qualification Specification provides details of all Units, Learning Outcomes, Assessment Criteria and specific advice regarding the assessment process.

### 5.2. Textbooks

BPEC Qualification Textbooks are available from BPEC direct.

## 6. Unit Details

### R/602/2498 - Understand how to organise resources within BSE

|  |   |   |                     |
|--|---|---|---------------------|
| Unit level   | 3   | <i>This knowledge unit provides learning in the basic supervisory skills required to organise and co- ordinate the work of self and a small team of craft operatives in undertaking work in the building services industry.</i> |                     |
| GLH  | 26  |   |                     |
| Unit   |   |   |                     |
| R/602/2498 - Understand how to organise resources within BSE |   |   |                     |
| Learning Outcomes  |   |   | Assessment Criteria |
| LO1  | Know the responsibilities of relevant people in the building services industry                |   | 1.1 – 1.6           |
| LO2  | Know how to oversee building services work  |   | 2.1 – 2.3           |
| LO3  | Know how to produce risk assessments and method statements for the building services industry |   | 3.1 – 3.4           |
| LO4  | Know how to plan work programmes for work tasks in the building services industry             |   | 4.1 – 4.6           |

|  |   |
|--|---|
| <b>Learning Outcome 1</b>  |   |
| Know the responsibilities of relevant people in the building services industry |   |
| <b>Assessment Criteria</b>   |   |
| <b>1.1</b>   | Define the types of client that are encountered when working: <ul style="list-style-type: none"> <li>a) Private customer</li> <li>b) Direct communication</li> <li>c) Through customer representatives managing agents</li> <li>d) Contracting customer</li> <li>e) Internal customer – within same company</li> </ul>  |
| <b>1.2</b>   | Specify the types of communication that may be required with clients throughout the progress of a job   |
| <b>1.3</b>   | Specify the types of communication that may be required with the site management team: <ul style="list-style-type: none"> <li>a) Architect</li> <li>b) Quantity surveyor</li> <li>c) Buyer/Estimator</li> <li>d) Surveyor</li> <li>e) Project manager/Clerk of Works</li> <li>f) Structural engineer</li> <li>g) Building services engineer</li> <li>h) Construction manager</li> </ul> |
| <b>1.4</b>   | Define the typical site responsibilities for craft operatives in the workplace: <ul style="list-style-type: none"> <li>a) Apprentices/trainees</li> <li>b) Level 2 craft level qualified staff</li> <li>c) Limited self-responsibility</li> <li>d) Level 3 craft level qualified staff</li> <li>e) Supervision of self and other staff members</li> </ul>                               |

| <b>Learning Outcome 1</b>  |  |
|--|--|
| Know the responsibilities of relevant people in the building services industry |  |
| <b>Assessment Criteria (continued)</b>   |  |
| <b>1.5</b>   | Specify the different methods of supervising individuals that can be used: <ul style="list-style-type: none"> <li>a) Styles of supervision</li> <li>b) Methods of motivating staff</li> </ul>  |
| <b>1.6</b>   | Define the job responsibilities when supervising staff: <ul style="list-style-type: none"> <li>a) Identifying the competence of subordinates to undertake work</li> <li>b) Identifying when direct supervision or detailed direction is required</li> <li>c) Specific health and safety issues</li> <li>d) Responsibility for planning safe working for subordinates</li> <li>e) How to adjust work schedules when health and safety problems delay works</li> </ul> |

| <b>Learning Outcome 2</b>                  |  |
|--|--|
| Know how to oversee building services work |  |
| <b>Assessment Criteria</b>                 |  |
| <b>2.1</b>                                 | Specify how to deal with variations to works: <ul style="list-style-type: none"> <li>a) Prescribed by the work environment</li> <li>b) Communication to the client</li> <li>c) Agreement to extra time and costs</li> <li>d) Prescribed by the customer</li> <li>e) Agreement to extra time and costs</li> </ul> |
| <b>2.2</b>                                 | Clarify how to undertake ongoing monitoring of the work progress against the work programme to ensure: <ul style="list-style-type: none"> <li>a) Safety</li> <li>b) Cost effectiveness</li> <li>c) Quality</li> </ul>  |
| <b>2.3</b>                                 | Clarify how to deal with problems that arise with deficiencies in work performance that could affect: <ul style="list-style-type: none"> <li>a) Safety</li> <li>b) Cost effectiveness</li> <li>c) Quality</li> </ul>   |

| <b>Learning Outcome 3</b>   |   |
|---|---|
| Know how to produce risk assessments and method statements for the building services industry |   |
| <b>Assessment Criteria</b>  |   |
| <b>3.1</b>  | Define the levels of risk presented by work situations  |
| <b>3.2</b>  | Define the hazards presented by work situations   |
| <b>3.3</b>  | Specify the methods used to carry out a risk assessment for a task: <ul style="list-style-type: none"> <li>a) Methods of assessing risk</li> <li>b) Risk calculation formula</li> <li>c) Presentation of a risk assessment</li> </ul> |

| <b>Learning Outcome 3</b>   |   |
|---|---|
| Know how to produce risk assessments and method statements for the building services industry |   |
| <b>Assessment Criteria (continued)</b>  |   |
| <b>3.4</b>  | Identify how to produce a method statement for areas of work with safety risk: <ul style="list-style-type: none"> <li>a) Information to be provided in a method statement</li> <li>b) Presentation of a method statement</li> </ul> |

| <b>Learning Outcome 4</b>   |   |
|---|---|
| Know how to plan work programmes for work tasks in the building services industry |   |
| <b>Assessment Criteria</b>  |   |
| <b>4.1</b>  | Specify the types of work programme that would be used for: <ul style="list-style-type: none"> <li>a) Private installation work</li> <li>b) Private service/maintenance work</li> <li>c) New-build installation contract work</li> <li>d) Service/maintenance contract work</li> </ul>  |
| <b>4.2</b>  | State the process for planning work activities against job specifications: <ul style="list-style-type: none"> <li>a) The scope, purpose and requirements of the work</li> <li>b) Identification of work responsibilities</li> <li>c) External factors that affect timeframe</li> </ul>  |
| <b>4.3</b>  | State the process for selecting the required resources against the job specification: <ul style="list-style-type: none"> <li>a) Materials</li> <li>b) Plant</li> <li>c) Vehicles</li> <li>d) Equipment</li> </ul>   |
| <b>4.4</b>  | Specify material delivery requirements against work programmes and the impact that the non-availability of materials may have on work progress: <ul style="list-style-type: none"> <li>a) Work in private properties</li> <li>b) Work on new-build housing</li> <li>c) Work on commercial contracts</li> <li>d) Avoiding loss of materials on site (theft)</li> </ul> |
| <b>4.5</b>  | Define the factors which affect working time allocation to work activities: <ul style="list-style-type: none"> <li>a) Labour resources</li> <li>b) Planning work with other trades</li> <li>c) Material deliveries</li> </ul>   |
| <b>4.6</b>  | Identify how to produce simple work programmes: <ul style="list-style-type: none"> <li>a) Simple bar (progress) charts</li> </ul>   |

## R/602/2498 - Understand how to organise resources within BSE

|  |  |  |                     |
|--|--|--|---------------------|
| Unit level   | 3  | <i>This combination unit provides learning in the design, maintenance, and commissioning of a complex range of cold water system/component types in dwellings including those in multi-storey properties and single occupancy dwellings fed by private water supplies. The unit covers compliance with the requirements of the Water Supply (Water Fittings) Regulations and Building Regulations applicable to this type of system.</i> |                     |
| GLH  | 76   |  |                     |
| Unit   |  |  |                     |
| K/502/8930 - Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques |  |  |                     |
| Learning Outcomes  |  |  | Assessment Criteria |
| LO1  | Know the legislation relating to the installation and maintenance of cold water supplied for domestic purposes |  | 1.1 – 1.3           |
| LO2  | Know the types of cold water system layout used in multi-storey dwellings                                      |  | 2.1 – 2.4           |
| LO3  | Know the types of cold water system layout used with single occupancy dwellings fed by private water supplies  |  | 3.1 – 3.4           |
| LO4  | Know the requirements for backflow protection in plumbing systems  |  | 4.1 – 4.5           |
| LO5  | Know the uses of specialist components in cold water systems   |  | 5.1 – 5.2           |
| LO6  | Know the design techniques for cold water systems  |  | 6.1 – 6.4           |
| LO7  | Be able to apply design techniques for cold water systems  |  | 7.1 – 7.3           |
| LO8  | Know the fault diagnosis and rectification procedures for cold water systems and components                    |  | 8.1 – 8.7           |
| LO9  | Be able to diagnose and rectify faults in cold water systems and components                                    |  | 9.1 – 9.3           |
| LO10   | Know the commissioning requirements of cold water systems and components                                       |  | 10.1 – 10.10        |
| LO11   | Be able to commission cold water systems and components  |  | 11.1 – 11.7         |

|  |  |
|--|--|
| <b>Learning Outcome 1</b>  |  |
| Know the legislation relating to the installation and maintenance of cold water supplied for domestic purposes |  |
| <b>Assessment Criteria</b>   |  |
| 1.1  | Interpret the legislation controlling the installation and use of water systems:<br>a) Supplied from a water undertaker<br>b) Supplied from a private source |
| 1.2  | Clarify the notification requirements for work on wholesome and recycled water systems:<br>a) Water undertaker<br>b) Building control or self-certification  |
| 1.3  | Differentiate between installer and user responsibilities under water legislation  |

|   |   |
|---|---|
| <b>Learning Outcome 2</b>   |   |
| Know the types of cold water system layout used in multi-storey dwellings |   |
| <b>Assessment Criteria</b>  |   |
| 2.1   | State the cold water system component layout features for multi-storey dwellings:<br>a) Supplied direct from the main<br>b) Using break cistern arrangements<br>c) Providing drinking water |

| <b>Learning Outcome 2</b>   |   |
|---|---|
| Know the types of cold water system layout used in multi-storey dwellings |   |
| <b>Assessment Criteria (continued)</b>                                    |   |
| <b>2.2</b>  | State the system layout features for large scale storage cisterns used in multi-storey cold water systems for dwellings: <ul style="list-style-type: none"> <li>a) Warning/overflow pipe</li> <li>b) Alternative filling methods using</li> <li>c) Float switches and solenoid valves</li> <li>d) Specialist inlet valves</li> <li>e) Interlinking multiple cisterns</li> <li>f) Use of sectional cisterns</li> </ul> |
| <b>2.3</b>  | State the system layout features for break cisterns used in multi-storey cold water systems for dwellings   |
| <b>2.4</b>  | Define the function of components used in boosted cold water systems in multi-storey dwellings: <ul style="list-style-type: none"> <li>a) Booster pumps</li> <li>b) Sets with integral controls</li> <li>c) Self-assembled sets</li> <li>d) Pressure/expansion vessels</li> <li>e) Pressure switch (transducer)</li> <li>f) Float switch</li> </ul>   |

| <b>Learning Outcome 3</b>   |  |
|---|--|
| Know the types of cold water system layout used with single occupancy dwellings fed by private water supplies |  |
| <b>Assessment Criteria</b>  |  |
| <b>3.1</b>  | Propose the methods of providing private water supplies to single occupancy dwellings: <ul style="list-style-type: none"> <li>a) Pumped from wells and boreholes</li> <li>b) Collected from surface water sources – streams and springs</li> <li>c) Use of externally sited break cisterns</li> </ul>  |
| <b>3.2</b>  | Propose the methods of treating water for use in single occupancy dwellings: <ul style="list-style-type: none"> <li>a) Localised water filtration units</li> <li>b) Localised water treatment units – ultraviolet</li> </ul>   |
| <b>3.3</b>  | State the system layout features for cold water systems fed from private water supplies: <ul style="list-style-type: none"> <li>a) Conventional direct or indirect systems from an incoming supply</li> <li>b) Boosted (pumped) supply from a well or borehole</li> <li>c) Boosted (pumped) supply from a low level internal or external break cistern</li> </ul>  |
| <b>3.4</b>  | Define the method of operation of the components used in a boosted (pumped) cold water supply system from private sources for single occupancy dwellings: <ul style="list-style-type: none"> <li>a) Small booster pump sets which incorporate all controls and components</li> <li>b) Boosted system with separate controls and components</li> <li>c) Use of accumulators in increasing system flow rate</li> </ul> |

| <b>Learning Outcome 4</b>   |  |
|---|--|
| Know the requirements for backflow protection in plumbing systems |  |
| <b>Assessment Criteria</b>  |  |
| <b>4.1</b>  | Interpret the five fluid risk levels as laid down in water legislation   |
| <b>4.2</b>  | Define terminology used when selecting and applying backflow prevention devices: <ul style="list-style-type: none"> <li>a) Point of use protection</li> <li>b) Whole site or zone protection</li> </ul>  |
| <b>4.3</b>  | Propose the installation situations in which non-mechanical backflow prevention devices may be used: <ul style="list-style-type: none"> <li>a) Type AA – air gap with unrestricted discharge above spill over level</li> <li>b) Type AB – air gap with weir overflow</li> <li>c) Type AD – air gap with injector</li> <li>d) Type AG – air gap with minimum size circular overflow</li> <li>e) Type AUK1 – air gap with interposed cistern</li> <li>f) Type AUK2 – air gaps for taps and combination taps</li> <li>g) Type AUK3 – air gaps for taps and combination taps</li> <li>h) Type DC pipe interrupter with permanent atmospheric vent</li> </ul> |
| <b>4.4</b>  | Propose the installation situations in which mechanical backflow prevention devices may be used: <ul style="list-style-type: none"> <li>a) Type BA – reduced pressure zone valve</li> <li>b) Type DB – pipe interrupter with permanent atmospheric vent and moving element</li> <li>c) Type EC/ED – double check valves</li> <li>d) Type HUK1 – hose union tap with double check valves</li> <li>e) Type CA – non verifiable disconnecter</li> <li>f) Type EA/EB – single check valves</li> <li>g) Type HA – hose union backflow preventer</li> <li>h) Type HC – diverter with automatic return</li> </ul>   |
| <b>4.5</b>  | Determine methods of preventing cross connection in systems that contain non-wholesome water sources   |

| <b>Learning Outcome 5</b>                                    |  |
|--|--|
| Know the uses of specialist components in cold water systems |  |
| <b>Assessment Criteria</b>                                   |  |
| <b>5.1</b>   | Analyse the working principles of cold water system components: <ul style="list-style-type: none"> <li>a) Infra-red operated taps</li> <li>b) Concussive taps</li> <li>c) Combination bath tap and shower head</li> <li>d) Flow limiting valves</li> <li>e) Spray taps</li> <li>f) Urinal – water conservation controls</li> <li>g) Shower pumps – single and twin impellor</li> <li>h) Pressure reducing valves</li> <li>i) Shock arrestors/mini expansion vessels</li> </ul> |

| <b>Learning Outcome 5</b>                                    |   |
|--|---|
| Know the uses of specialist components in cold water systems |   |
| <b>Assessment Criteria (continued)</b>                       |   |
| <b>5.2</b>   | Evaluate the use of components in cold water systems to overcome temperature and pressure effects caused by the installation of backflow prevention devices |

| <b>Learning Outcome 6</b>                         |   |
|---|---|
| Know the design techniques for cold water systems |   |
| <b>Assessment Criteria</b>                        |   |
| <b>6.1</b>  | Interpret information sources when undertaking design work on cold water systems: <ul style="list-style-type: none"> <li>a) Statutory regulations</li> <li>b) Industry standards</li> <li>c) Manufacturer technical instructions</li> <li>d) Verbal and written feedback from the customer</li> </ul> |
| <b>6.2</b>  | Clarify how to take measurements of building features in order to carry out design calculations: <ul style="list-style-type: none"> <li>a) From plans, drawings and specifications</li> <li>b) From site</li> </ul>   |
| <b>6.3</b>  | Calculate the size of cold water system components used in single occupancy dwellings: <ul style="list-style-type: none"> <li>a) Cistern</li> <li>b) Pipework</li> <li>c) Pump</li> <li>d) Pressure vessel</li> </ul>   |
| <b>6.4</b>  | Clarify how to present design calculations in an acceptable format: <ul style="list-style-type: none"> <li>a) Using basic not to scale line drawings</li> <li>b) Details for insertion into a quotation or tender for work in a small-scale dwelling</li> </ul>                                       |

| <b>Learning Outcome 7</b>                                 |  |
|---|--|
| Be able to apply design techniques for cold water systems |  |
| <b>Assessment Criteria</b>                                |  |
| <b>7.1</b>  | Use information sources when undertaking design work for cold water systems: <ul style="list-style-type: none"> <li>a) Statutory regulations</li> <li>b) Industry standards</li> <li>c) Manufacturer technical instructions</li> <li>d) Verbal and written feedback from the customer</li> </ul> |
| <b>7.2</b>  | Calculate the size of cold water system components used in single occupancy dwellings: <ul style="list-style-type: none"> <li>a) Cistern</li> <li>b) Pipework</li> <li>c) Pump</li> <li>d) Pressure vessel</li> </ul>  |
| <b>7.3</b>  | Present design calculations in an acceptable format: <ul style="list-style-type: none"> <li>a) Using basic not to scale line drawings</li> <li>b) Details for insertion into a quotation or tender for work in a small-scale dwelling</li> </ul>   |



| <b>Learning Outcome 8</b>   |  |
|---|--|
| Know the fault diagnosis and rectification procedures for cold water systems and components |  |
| <b>Assessment Criteria</b>  |  |
| <b>8.1</b>  | State the methods of obtaining details of system faults from end users   |
| <b>8.2</b>  | Interpret manufacturer instructions and industry standards to establish the diagnostic requirements of cold water system components  |
| <b>8.3</b>  | <p>Propose routine checks and diagnostics on cold water system components as part of a fault finding process:</p> <ul style="list-style-type: none"> <li>a) Checking components for correct operating pressures and flow rates</li> <li>b) Cleaning system components (including dismantling and reassembly)</li> <li>c) Checking for correct component operation</li> <li>d) Pumps</li> <li>e) Pressure switches (transducers)</li> <li>f) Float switches</li> <li>g) Expansion and pressure vessels</li> <li>h) Gauges and controls</li> <li>i) Checking for correct operation of treatment devices</li> <li>j) Water filters</li> <li>k) Water softeners</li> </ul> |
| <b>8.4</b>  | <p>Specify methods of repairing faults in cold water system components:</p> <ul style="list-style-type: none"> <li>a) Pumps</li> <li>b) Expansion/pressure vessels</li> <li>c) Pressure switches (transducers)</li> <li>d) Float switches</li> <li>e) Gauges and controls</li> </ul>   |
| <b>8.5</b>  | Specify methods of safely isolating cold water systems or components to prevent them being brought into operation before the work has been fully completed   |
| <b>8.6</b>  | <p>Define procedures for carrying out diagnostic tests to locate faults in cold water system components:</p> <ul style="list-style-type: none"> <li>a) Booster (pump) set to a system</li> <li>b) Backflow prevention devices</li> </ul>   |
| <b>8.7</b>  | <p>Specify methods for diagnosing and preventing corrosion within cold water system pipework:</p> <ul style="list-style-type: none"> <li>a) Electrolytic corrosion</li> <li>b) Blue water corrosion</li> </ul>   |

| <b>Learning Outcome 9</b>   |  |
|---|--|
| Be able to diagnose and rectify faults in cold water systems and components |  |
| <b>Assessment Criteria</b>  |  |
| <b>9.1</b>  | Use manufacturer instructions and industry standards to establish the diagnostic requirements of cold water system components  |
| <b>9.2</b>  | Isolate cold water systems or components to prevent them being brought into operation before the work has been fully completed |

| <b>Learning Outcome 9</b>   |  |
|---|--|
| Be able to diagnose and rectify faults in cold water systems and components |  |
| <b>Assessment Criteria (continued)</b>                                      |  |
| <b>9.3</b>  | Carry out diagnostic tests to locate faults in cold water system components and carry out repair work: <ul style="list-style-type: none"> <li>a) Booster (pump) set to a system</li> <li>b) Backflow prevention devices</li> </ul> |

| <b>Learning Outcome 10</b>   |   |
|--|---|
| Know the commissioning requirements of cold water systems and components |   |
| <b>Assessment Criteria</b>   |   |
| <b>10.1</b>  | Interpret information sources required to complete commissioning work on cold water systems   |
| <b>10.2</b>  | State how to fill cold water pipework with water at normal operating pressure and check for leakage   |
| <b>10.3</b>  | Identify how to conduct a soundness test on cold water systems: <ul style="list-style-type: none"> <li>a) Metallic systems</li> <li>b) Plastic pipework systems</li> </ul>  |
| <b>10.4</b>  | Specify the disinfection procedures for cold water systems and the circumstances in which disinfection should be applied  |
| <b>10.5</b>  | State the flushing procedure for cold water systems and components  |
| <b>10.6</b>  | Clarify how to take flow rate and pressure readings from new and existing cold water systems  |
| <b>10.7</b>  | Specify the actions that must be taken when commissioning reveals defects in cold water systems: <ul style="list-style-type: none"> <li>a) Dealing with systems that do not meet correct installation requirements</li> <li>b) Micro-biological contamination within a cold water systems</li> <li>c) Remedial work associated with defective components</li> </ul> |
| <b>10.8</b>  | State the procedure for notifying works carried out to the relevant authority   |
| <b>10.9</b>  | Propose the range of information that would be detailed on a commissioning record for a cold water system   |
| <b>10.10</b>   | Propose the points to be covered when handing over a completed system to the end-user   |

| <b>Learning Outcome 11</b>                              |  |
|---|--|
| Be able to commission cold water systems and components |  |
| <b>Assessment Criteria</b>                              |  |
| <b>11.1</b>   | Carry out a visual inspection of a boosted cold water system to confirm that it is ready to be filled with water |
| <b>11.2</b>   | Charge cold water pipework with water at normal operating pressure and check for leakage                         |

| <b>Learning Outcome 11</b>                              |  |
|---|--|
| Be able to commission cold water systems and components |  |
| <b>Assessment Criteria (continued)</b>                  |  |
| <b>11.3</b>   | Perform a soundness test to industry requirements on cold water systems pipework and components  |
| <b>11.4</b>   | Perform a disinfection procedure on a cold water system to industry requirements   |
| <b>11.5</b>   | Flush the system with wholesome water on completion of soundness testing   |
| <b>11.6</b>   | Use test instruments to take readings of the water supply pressure and flow rate   |
| <b>11.7</b>   | Adjust and set controls to achieve system design requirements: <ul style="list-style-type: none"> <li>a) Pressure at outlets</li> <li>b) Flow rate at outlets</li> </ul> |

## K/502/9155 - Understand and apply domestic hot water system installation, commissioning, service, and maintenance techniques

|  |  |   |
|--|--|---|
| Unit level   | 3  | <i>This combination unit provides learning in the design, installation, maintenance, and commissioning of a complex range of hot water system/component types in single occupancy dwellings. The unit also covers the requirements of statutory legislation for the installation, maintenance, and commissioning of unvented hot water storage systems.</i> |
| GLH  | 76   |   |
| Unit   |  |   |
| K/502/9155 - Understand and apply domestic hot water system installation, commissioning, service, and maintenance techniques |  |   |
| Learning Outcomes  |  | Assessment Criteria   |
| LO1  | Know the types of hot water system and their layout requirements                           | 1.1 – 1.9   |
| LO2  | Know the uses of specialist components in hot water systems                                | 2.1 – 2.2   |
| LO3  | Know the design techniques for hot water systems   | 3.1 – 3.6   |
| LO4  | Be able to apply design techniques for hot water systems                                   | 4.1 – 4.3   |
| LO5  | Know the installation requirements of hot water systems and components                     | 5.1 – 5.4   |
| LO6  | Be able to install hot water systems and components  | 6.1 – 6.2   |
| LO7  | Know the fault diagnosis and rectification procedures for hot water systems and components | 7.1 – 7.7   |
| LO8  | Be able to diagnose and rectify faults in hot water systems and components                 | 8.1 – 8.4   |
| LO9  | Know the commissioning requirements of hot water systems and components                    | 9.1 – 9.11  |
| LO10   | Be able to commission hot water systems and components                                     | 10.1 – 10.6   |

|  |   |  |
|--|---|--|
| <b>Learning Outcome 1</b>  |   |  |
| Know the types of hot water system and their layout requirements |   |  |
| <b>Assessment Criteria</b>                                       |   |  |
| <b>1.1</b>   | Compare the types of hot water supply systems used in dwellings: <ul style="list-style-type: none"> <li>a) Centralised systems</li> <li>b) Unvented hot water systems</li> <li>c) Open vented hot water systems</li> <li>d) Localised systems</li> <li>e) Unvented point of use heaters</li> <li>f) Instantaneous heaters</li> </ul>                        |  |
| <b>1.2</b>   | Identify hot water system pipework layout features for dwellings: <ul style="list-style-type: none"> <li>a) Centralized unvented hot water systems</li> <li>b) Larger systems requiring a secondary circulation system</li> </ul>   |  |
| <b>1.3</b>   | Confirm the recommended design temperatures within hot water systems: <ul style="list-style-type: none"> <li>a) Hot water storage vessel</li> <li>b) Hot water outflow</li> <li>c) Secondary return</li> <li>d) At point of use</li> <li>e) Instantaneous heaters</li> <li>f) Storage system</li> <li>g) Thermostatic mixing valve installations</li> </ul> |  |

| <b>Learning Outcome 1</b>  |  |
|--|--|
| Know the types of hot water system and their layout requirements |  |
| <b>Assessment Criteria (continued)</b>                           |  |
| <b>1.4</b>   | Evaluate the various types of unvented hot water system: <ul style="list-style-type: none"> <li>a) Indirect storage systems</li> <li>b) Direct storage systems</li> <li>c) Electrically heated</li> <li>d) Gas or oil fired</li> <li>e) Small point of use (under sink)</li> </ul>   |
| <b>1.5</b>   | Clarify the use of cold water accumulators in unvented hot water systems   |
| <b>1.6</b>   | Define the function of components in unvented hot water systems: <ul style="list-style-type: none"> <li>a) Safety devices</li> <li>b) Control thermostat</li> <li>c) Overheat thermostat (thermal cut-out)</li> <li>d) Temperature relief valve</li> <li>e) Functional devices</li> <li>f) Line strainer</li> <li>g) Pressure reducing valve</li> <li>h) Single check valve</li> <li>i) Expansion device (vessel or integral to cylinder)</li> <li>j) Expansion relief valve</li> <li>k) Tundish arrangements</li> <li>l) Application of composite valves</li> </ul> |
| <b>1.7</b>   | Specify the layout features for temperature and expansion relief pipe in unvented hot water systems  |
| <b>1.8</b>   | Specify the layout features for pipework systems incorporating secondary circulation: <ul style="list-style-type: none"> <li>a) Pump type and location</li> <li>b) Timing devices</li> <li>c) Prevention of reverse circulation</li> <li>d) Methods of balancing circuits</li> </ul>   |
| <b>1.9</b>   | State how trace heating can be used as an alternative to a secondary circulation system  |

| <b>Learning Outcome 2</b>                                   |   |
|---|---|
| Know the uses of specialist components in hot water systems |   |
| <b>Assessment Criteria</b>                                  |   |
| <b>2.1</b>  | Analyse the working principles of hot water system components: <ul style="list-style-type: none"> <li>a) Infra-red operated taps</li> <li>b) Concussive taps</li> <li>c) Combination bath tap and shower head</li> <li>d) Flow limiting valves</li> <li>e) Spray taps</li> <li>f) Shower pumps – single and twin impellor</li> <li>g) Pressure reducing valves</li> <li>h) Show arrestors/mini expansion vessels</li> </ul> |

| <b>Learning Outcome 2</b>                                   |  |
|---|--|
| Know the uses of specialist components in hot water systems |  |
| <b>Assessment Criteria (continued)</b>                      |  |
| <b>2.2</b>  | Evaluate the use of components in hot water systems to overcome temperature and pressure effects caused by the installation of backflow prevention devices |

| <b>Learning Outcome 3</b>                        |   |
|--|---|
| Know the design techniques for hot water systems |   |
| <b>Assessment Criteria</b>                       |   |
| <b>3.1</b>                                       | Define the factors which affect the selection of hot water systems for single occupancy dwellings   |
| <b>3.2</b>                                       | State the criteria used then selecting hot water system and component types: <ul style="list-style-type: none"> <li>a) Customer needs</li> <li>b) Building layout and features</li> <li>c) Suitability of system</li> <li>d) Energy efficiency</li> <li>e) Environmental impact</li> </ul>            |
| <b>3.3</b>                                       | Interpret information sources when undertaking design work on hot water systems: <ul style="list-style-type: none"> <li>a) Statutory regulations</li> <li>b) Industry standards</li> <li>c) Manufacturer technical instructions</li> <li>d) Verbal and written feedback from the customer</li> </ul>  |
| <b>3.4</b>                                       | Clarify how to take measurements of building features in order to carry out design calculations: <ul style="list-style-type: none"> <li>a) From plans, drawings and specifications</li> <li>b) From site</li> </ul>   |
| <b>3.5</b>                                       | Calculate the size of hot water system components used in single occupancy dwellings: <ul style="list-style-type: none"> <li>a) Cistern</li> <li>b) Hot water storage vessel</li> <li>c) Pipework</li> <li>d) Secondary circulation pump</li> <li>e) Booster pump (shower and full system)</li> </ul> |
| <b>3.6</b>                                       | Clarify how to present calculations in an acceptable format: <ul style="list-style-type: none"> <li>a) Using basic not to scale line drawings</li> <li>b) Details for insertion into a quotation or tender for work in a small-scale dwelling</li> </ul>  |

| <b>Learning Outcome 4</b>                                |   |
|--|---|
| Be able to apply design techniques for hot water systems |   |
| <b>Assessment Criteria</b>                               |   |
| <b>4.1</b>   | Use information sources when undertaking design work for hot water systems: <ul style="list-style-type: none"> <li>a) Statutory regulations</li> <li>b) Industry standards</li> <li>c) Manufacturer technical instructions</li> <li>d) Verbal and written feedback from the customer</li> </ul> |

| <b>Learning Outcome 4</b>                                |   |
|--|---|
| Be able to apply design techniques for hot water systems |   |
| <b>Assessment Criteria (continued)</b>                   |   |
| <b>4.2</b>   | Calculate the size of hot water system components used in single occupancy dwellings: <ul style="list-style-type: none"> <li>a) Cistern</li> <li>b) Cylinder</li> <li>c) Pipework</li> <li>d) Secondary circulation pump</li> <li>e) Booster pump (shower and full system)</li> </ul> |
| <b>4.3</b>   | Present design calculations in an acceptable format <ul style="list-style-type: none"> <li>a) Using basic not to scale line drawings</li> <li>b) Details for insertion into a quotation or tender for a work in a small scale dwelling</li> </ul>                                     |

| <b>Learning Outcome 5</b>  |  |
|--|--|
| Know the installation requirements of hot water systems and components |  |
| <b>Assessment Criteria</b>   |  |
| <b>5.1</b>   | Define the terms balanced and unbalanced supply pressures in unvented hot water storage systems  |
| <b>5.2</b>   | Specify the positioning and fixing requirements of components and unvented hot water systems: <ul style="list-style-type: none"> <li>a) Safety devices</li> <li>b) Control thermostat</li> <li>c) Overheat thermostat (thermal cut-out)</li> <li>d) Temperature relief valve</li> <li>e) Functional devices</li> <li>f) Line strainer</li> <li>g) Pressure reducing valve</li> <li>h) Single check valve</li> <li>i) Expansion relief valve (vessel or integral to cylinder)</li> <li>j) Tundish arrangements</li> <li>k) Application of composite valves</li> </ul> |
| <b>5.3</b>   | State the pipe size and positioning methods for safety relief pipework connected to unvented hot water cylinder safety valves: <ul style="list-style-type: none"> <li>a) D1 section</li> <li>b) Tundish</li> <li>c) D2 pipework</li> <li>d) Correction termination</li> </ul>  |
| <b>5.4</b>   | State the positioning and fixing requirements of components of secondary circulation systems: <ul style="list-style-type: none"> <li>a) System pipework</li> <li>b) Pump</li> <li>c) Control valves</li> <li>d) Timing devices</li> <li>e) Reverse circulation control valves</li> <li>f) Pipework insulation</li> </ul>   |

| <b>Learning Outcome 6</b>                           |   |
|---|---|
| Be able to install hot water systems and components |   |
| <b>Assessment Criteria</b>                          |   |
| <b>6.1</b>  | Connect pipework to an unvented hot water system: <ul style="list-style-type: none"> <li>a) Incoming supply pipework</li> <li>b) Line strainer</li> <li>c) Pressure reducing valve</li> <li>d) Expansion vessel</li> <li>e) Storage cylinder</li> <li>f) Check valve</li> </ul> |
| <b>6.2</b>  | Position, fix and connect new hot water safety relieve pipework: <ul style="list-style-type: none"> <li>a) D1 pipework</li> <li>b) Tundish</li> <li>c) D2 pipework</li> <li>d) Correction termination</li> </ul>  |

| <b>Learning Outcome 7</b>  |   |
|--|---|
| Know the fault diagnosis and rectification procedures for hot water systems and components |   |
| <b>Assessment Criteria</b>   |   |
| <b>7.1</b>   | Specify the periodic servicing requirements of hot water systems  |
| <b>7.2</b>   | State the methods of obtaining details of system faults from end users  |
| <b>7.3</b>   | Interpret manufacturer instructions and industry standards to establish the diagnostic requirements of hot water system components  |
| <b>7.4</b>   | Propose routine checks and diagnostics on hot water system components as part of a fault finding process: <ul style="list-style-type: none"> <li>a) Checking components for correct operating pressures, temperatures and flow rates</li> <li>b) Cleaning system components (including dismantling and reassembling)</li> <li>c) Checking for correct operation of system components</li> <li>d) Thermostats</li> <li>e) Pumps</li> <li>f) Timing devices</li> <li>g) Expansion and pressure levels</li> <li>h) Gauges and controls</li> <li>i) Checking for correct operation of system safety valves:</li> <li>j) Temperature relief</li> <li>k) Expansion</li> </ul> |
| <b>7.5</b>   | Specify methods of repairing faults in hot water system components: <ul style="list-style-type: none"> <li>a) Pumps</li> <li>b) Expansion/pressure</li> <li>c) Vessels safety valves</li> <li>d) Temperature relief</li> <li>e) Expansion relief</li> <li>f) Thermostats</li> <li>g) Gauges and controls</li> </ul>   |



| <b>Learning Outcome 7</b>  |   |
|--|---|
| Know the fault diagnosis and rectification procedures for hot water systems and components |   |
| <b>Assessment Criteria (continued)</b>   |   |
| <b>7.6</b>   | Specify methods of safety isolation hot water systems or components to prevent them being brought into operation before work has been fully completed   |
| <b>7.7</b>   | Define procedures for carrying out diagnostic tests to locate faults in hot water system components: <ul style="list-style-type: none"> <li>a) Shower booster pump unit</li> <li>b) Safety devices</li> <li>c) Expansion devices</li> <li>d) Thermostats</li> </ul> |

| <b>Learning Outcome 8</b>  |   |
|--|---|
| Be able to diagnose and rectify faults in hot water systems and components |   |
| <b>Assessment Criteria</b>   |   |
| <b>8.1</b>   | Use manufacturer instructions and industry standards to establish the diagnostic requirements of hot water system components  |
| <b>8.2</b>   | Isolate hot water systems or components to prevent them being brought into operation before the work has been fully completed   |
| <b>8.3</b>   | Carry out diagnostic tests to locate faults in hot water system components and carry out repair work <ul style="list-style-type: none"> <li>a) Shower booster pump unit</li> <li>b) Safety devices</li> <li>c) Expansion devices</li> <li>d) Thermostats</li> </ul> |
| <b>8.4</b>   | Carry out the periodic service of an unvented hot water storage system  |

| <b>Learning Outcome 9</b>   |   |
|---|---|
| Know the commissioning requirements of hot water systems and components |   |
| <b>Assessment Criteria</b>  |   |
| <b>9.1</b>  | Interpret information sources required to complete commissioning work on hot water systems  |
| <b>9.2</b>  | State the checks to be carried out during a visual inspection of an unvented hot water storage system to confirm that it is ready to be filled with water                 |
| <b>9.3</b>  | State how to fill hot water pipework with water at normal operating pressure and check for leakage  |
| <b>9.4</b>  | Identify how to conduct a soundness test on hot water systems: <ul style="list-style-type: none"> <li>a) Metallic systems</li> <li>b) Plastic pipework systems</li> </ul> |
| <b>9.5</b>  | State the flushing procedure for hot water systems and components   |
| <b>9.6</b>  | Clarify how to take flow rate and pressure readings from new and existing hot water outlets   |

| <b>Learning Outcome 9</b>   |   |
|---|---|
| Know the commissioning requirements of hot water systems and components |   |
| <b>Assessment Criteria (continued)</b>                                  |   |
| <b>9.7</b>  | State how to balance a secondary circulation system during commissioning activities   |
| <b>9.8</b>  | Specify the actions that must be taken when commissioning reveals defects in hot water systems: <ul style="list-style-type: none"> <li>a) Dealing with systems that do not meet correct installation requirements</li> <li>b) Remedial work associated with defective components</li> </ul> |
| <b>9.9</b>  | State the procedure for notifying works carried out to the relevant authority   |
| <b>9.10</b>   | Propose the range of information that would be detailed on a commissioning record for a hot water system  |
| <b>9.11</b>   | Propose the points to be covered when handing over a completed system to the end-user   |

| <b>Learning Outcome 10</b>                             |   |
|--|---|
| Be able to commission hot water systems and components |   |
| <b>Assessment Criteria</b>                             |   |
| <b>10.1</b>  | Carry out a visual inspection of an unvented hot water system to confirm that it is ready to be filled with water   |
| <b>10.2</b>  | Charge hot water pipework with water at normal operating pressure and check for leakage   |
| <b>10.3</b>  | Perform a soundness test to industry requirements on hot water systems pipework and components  |
| <b>10.4</b>  | Flush the system with wholesome water on completion of soundness testing  |
| <b>10.5</b>  | Use test instruments to take readings of the water supply pressure and flow rate  |
| <b>10.6</b>  | Adjust and set system controls to achieve system design requirements: <ul style="list-style-type: none"> <li>a) Pressure at outlets</li> <li>b) Flow rate at outlets</li> </ul> |

## M/502/9156 - Understand and apply domestic central heating system installation, commissioning, service, and maintenance techniques

|  |  |   |                     |
|--|--|---|---------------------|
| Unit level   | 3  | <i>This combination unit provides learning in the design, installation, maintenance, and commissioning of a complex range of central heating system/component types in single occupancy dwellings. The unit also covers the requirements of statutory legislation relating to the energy conservation of heating systems. The scope of the unit also covers underfloor heating systems, complex control systems and multiple boiler installations in larger dwellings using low loss headers.</i> |                     |
| GLH  | 98   |   |                     |
| Unit   |  |   |                     |
| M/502/9156 - Understand and apply domestic central heating system installation, commissioning, service, and maintenance techniques |  |   |                     |
| Learning Outcomes  |  |   | Assessment Criteria |
| LO1  | Know the types of central heating system and their layout requirements                           |   | 1.1 – 1.7           |
| LO2  | Know the design techniques for central heating systems   |   | 2.1 – 2.13          |
| LO3  | Be able to apply design techniques for central heating systems                                   |   | 3.1 – 3.3           |
| LO4  | Know the installation requirements of central heating systems and components                     |   | 4.1 – 4.3           |
| LO5  | Be able to install central heating systems and components  |   | 5.1 – 5.2           |
| LO6  | Know the fault diagnosis and rectification procedures for central heating systems and components |   | 6.1 – 6.7           |
| LO7  | Be able to diagnose and rectify faults in central heating systems and components                 |   | 7.1 – 7.3           |
| LO8  | Know the commissioning requirements of central heating systems and components                    |   | 8.1 – 8.10          |
| LO9  | Be able to commission central heating systems and components                                     |   | 9.1 – 9.5           |

|  |   |
|--|---|
| <b>Learning Outcome 1</b>  |   |
| Know the types of central heating system and their layout requirements |   |
| <b>Assessment Criteria</b>   |   |
| <b>1.1</b>   | Define the space heating zoning requirements under statutory legislation for larger single occupancy dwellings  |
| <b>1.2</b>   | Define the function of components used in central heating systems: <ul style="list-style-type: none"> <li>a) Zone control valves for multiple space heating applications with appropriate time and temperature control arrangements</li> <li>b) Controllers</li> <li>c) Weather compensation</li> <li>d) Delayed start</li> <li>e) Optimum start</li> <li>f) Home automation systems</li> </ul> |
| <b>1.3</b>   | Analyse the operating principles of environmental heat sources used in conjunction with central heating systems: <ul style="list-style-type: none"> <li>a) Heat pumps</li> <li>b) Ground source</li> <li>c) Air source</li> <li>d) Micro combined heat and power</li> </ul>   |
| <b>1.4</b>   | Identify the layout features of underfloor central heating systems  |

| <b>Learning Outcome 1</b>  |  |
|--|--|
| Know the types of central heating system and their layout requirements |  |
| <b>Assessment Criteria (continued)</b>                                 |  |
| <b>1.5</b>   | Analyse the working principles of underfloor central heating system pipework and components <ul style="list-style-type: none"> <li>a) Use of manifolds</li> <li>b) Controls system application - time and temperature to space heating zones</li> <li>c) Underfloor pipework arrangements from manifold to room</li> </ul>   |
| <b>1.6</b>   | Identify the system layout features for multiple boiler installations incorporating low loss headers   |
| <b>1.7</b>   | Analyse functional flow wiring diagrams to determine the method of control operation for central heating systems: <ul style="list-style-type: none"> <li>a) Pumped heating only systems</li> <li>b) Pumped heating systems with combination boilers</li> <li>c) Pumped heating with gravity hot water systems</li> <li>d) Fully pumped incorporating 3 port valves – mid position and diverter valves</li> <li>e) Fully pumped incorporating 2 x two port valves</li> <li>f) Fully pumped incorporating hot water and multiple space heating zones</li> <li>g) Fully pumped incorporating weather compensation, optimum start or delayed start controllers</li> <li>h) Multiple boiler controls application</li> <li>i) Application of frost thermostats and boilers with pump overrun facility</li> </ul> |

| <b>Learning Outcome 2</b>                              |  |
|--|--|
| Know the design techniques for central heating systems |  |
| <b>Assessment Criteria</b>                             |  |
| <b>2.1</b>   | Define the factors which affect the selection of central heating systems for dwellings   |
| <b>2.2</b>   | State the criteria used when selecting heating system and component types: <ul style="list-style-type: none"> <li>a) Customers' needs</li> <li>b) Building layout and features</li> <li>c) Suitability of system</li> <li>d) Energy efficiency</li> <li>e) Environmental impact</li> </ul>                 |
| <b>2.3</b>   | Interpret information sources when undertaking design work on central heating systems: <ul style="list-style-type: none"> <li>a) Statutory regulations</li> <li>b) Industry standards</li> <li>c) Manufacturer technical instructions</li> <li>d) Verbal and written feedback from the customer</li> </ul> |
| <b>2.4</b>   | Clarify how to take measurements of building features in order to carry out design calculations: <ul style="list-style-type: none"> <li>a) From plans, drawings and specifications</li> <li>b) From site</li> </ul>  |
| <b>2.5</b>   | Justify the selection of system and control types for single family dwellings  |

| <b>Learning Outcome 2</b>                              |  |
|--|--|
| Know the design techniques for central heating systems |  |
| <b>Assessment Criteria (continued)</b>                 |  |
| <b>2.6</b>   | State the principles of heat loss and gain in dwellings: <ul style="list-style-type: none"> <li>a) Through the building fabric</li> <li>b) Due to ventilation</li> </ul>   |
| <b>2.7</b>   | Evaluate the heating requirements of rooms in dwellings when designing a central heating system: <ul style="list-style-type: none"> <li>a) Room size</li> <li>b) Temperature required – indoor to outdoor</li> <li>c) Air change rate</li> </ul>                   |
| <b>2.8</b>   | Specify the methods of sizing pipework and circulators for central heating systems: <ul style="list-style-type: none"> <li>a) Pipe sizing calculations – space heating and hot water circuits</li> <li>b) Pump sizing calculations</li> </ul>                      |
| <b>2.9</b>   | Justify the selection criteria for boilers in dwellings: <ul style="list-style-type: none"> <li>a) Space heating load</li> <li>b) Hot water heating load</li> <li>c) Heat loss from pipework</li> <li>d) Factors for intermittent heating</li> </ul>               |
| <b>2.10</b>  | Clarify how to size expansion vessels for sealed central heating systems and feed and expansion cisterns for open vented systems   |
| <b>2.11</b>  | Clarify the design principles for underfloor central heating systems: <ul style="list-style-type: none"> <li>a) Combined with radiators</li> <li>b) Stand alone</li> </ul>   |
| <b>2.12</b>  | Calculate the size of central heating components used in single occupancy dwellings: <ul style="list-style-type: none"> <li>a) Heat emitter size</li> <li>b) Hot water heating load</li> <li>c) Pipe size</li> <li>d) Pump size</li> <li>e) Boiler size</li> </ul> |
| <b>2.13</b>  | Clarify how to present design calculations in an acceptable format: <ul style="list-style-type: none"> <li>a) Using basic not to scale line drawings</li> <li>b) Details for insertion into a quotation or tender for work in a small-scale dwelling</li> </ul>    |

| <b>Learning Outcome 3</b>                                      |   |
|--|---|
| Be able to apply design techniques for central heating systems |   |
| <b>Assessment Criteria</b>                                     |   |
| <b>3.1</b>   | Use information sources when undertaking design work for central heating systems: <ul style="list-style-type: none"> <li>a) Statutory regulations</li> <li>b) Industry standards</li> <li>c) Manufacturer technical instructions</li> <li>d) Verbal and written feedback from the customer</li> </ul> |

| <b>Learning Outcome 3</b>                                      |  |
|--|--|
| Be able to apply design techniques for central heating systems |  |
| <b>Assessment Criteria (continued)</b>                         |  |
| <b>3.2</b>   | Calculate the size of central heating components used in single occupancy dwellings: <ul style="list-style-type: none"> <li>a) Heat emitter size</li> <li>b) Hot water heating load</li> <li>c) Pipe size</li> <li>d) Pump size</li> <li>e) Boiler size</li> </ul> |
| <b>3.3</b>   | Present design calculations in an acceptable format: <ul style="list-style-type: none"> <li>a) Using basic not to scale line drawings</li> <li>b) Details for insertion into a quotation or tender for work in a small-scale dwelling</li> </ul>                   |

| <b>Learning Outcome 4</b>  |  |
|--|--|
| Know the installation requirements of central heating systems and components |  |
| <b>Assessment Criteria</b>   |  |
| <b>4.1</b>   | Specify the positioning and fixing requirements of components in underfloor central heating systems: <ul style="list-style-type: none"> <li>a) Manifolds</li> <li>b) Pipework arrangements (cabling)</li> <li>c) Pipework installation techniques</li> <li>d) Solid floor</li> <li>e) Suspended timber floor</li> </ul>  |
| <b>4.2</b>   | Specify the positioning, fixing and connection requirements of new central heating components for sealed central heating systems: <ul style="list-style-type: none"> <li>a) Connections to a boiler</li> <li>b) Fully pumped central heating control components – mid position or 2 x two port valve arrangement</li> <li>c) Sealed system components</li> <li>d) Connections to panel radiators or underfloor heating manifold</li> <li>e) Connections to hot water cylinder</li> </ul> |
| <b>4.3</b>   | Specify the positioning and fixing requirements of multiple boiler installations with low loss headers   |

| <b>Learning Outcome 5</b>                                 |  |
|---|--|
| Be able to install central heating systems and components |  |
| <b>Assessment Criteria</b>                                |  |
| <b>5.1</b>  | Connect pipework to an underfloor central heating system   |
| <b>5.2</b>  | Position, fix and connect new central heating components for a sealed central heating system: <ul style="list-style-type: none"> <li>a) Connections to a boiler</li> <li>b) Fully pumped central heating control components – mid position or 2 x two port valve arrangement</li> <li>c) Sealed system components</li> <li>d) Connections to panel radiators or underfloor heating manifold</li> <li>e) Connections to hot water cylinder</li> </ul> |

| <b>Learning Outcome 6</b>  |  |
|--|--|
| Know the fault diagnosis and rectification procedures for central heating systems and components |  |
| <b>Assessment Criteria</b>   |  |
| <b>6.1</b>   | Specify the periodic servicing requirements of central heating systems   |
| <b>6.2</b>   | State the methods of obtaining details of system faults from end users   |
| <b>6.3</b>   | Interpret manufacturer instructions and industry standards to establish the diagnostic requirements of central heating system components   |
| <b>6.4</b>   | Propose routine checks and diagnostics on central heating system components as part of a fault-finding process: <ul style="list-style-type: none"> <li>a) Checking components for correct operation – pressure settings, temperature and circulation</li> <li>b) Cleaning system components (including dismantling and reassembly)</li> <li>c) Checking for blockages in heat emitters and pipework</li> <li>d) Checking for correct operation of system components</li> <li>e) Circulating pumps</li> <li>f) Control components</li> <li>g) Expansion vessels</li> <li>h) Pressure relief valves</li> <li>i) Feed and expansion cisterns</li> </ul> |
| <b>6.5</b>   | Specify methods of repairing faults in central heating system components: <ul style="list-style-type: none"> <li>a) Sealed and open vented – fill and vent pipework and components</li> <li>b) Circulating pumps</li> <li>c) Central heating control components</li> <li>d) Motorised valves</li> <li>e) Timing devices</li> <li>f) Thermostats</li> <li>g) Specialist controls – weather compensation, delayed and optimum start</li> <li>h) Blockages in heat emitters and pipework by power flushing</li> </ul>   |
| <b>6.6</b>   | Specify methods of safely isolating central heating systems or components to prevent them being brought into operation before the work has been fully completed  |

| <b>Learning Outcome 6</b>  |  |
|--|--|
| Know the fault diagnosis and rectification procedures for central heating systems and components |  |
| <b>Assessment Criteria (continued)</b>   |  |
| <b>6.7</b>   | Define procedures for carrying out diagnostic tests to locate faults in central heating system components: <ul style="list-style-type: none"> <li>a) Replacement of circulating pumps</li> <li>b) Sealed heating system components</li> <li>c) Control components</li> </ul> |

| <b>Learning Outcome 7</b>  |  |
|--|--|
| Be able to diagnose and rectify faults in central heating systems and components |  |
| <b>Assessment Criteria</b>   |  |
| <b>7.1</b>   | Use manufacturer instructions and industry standards to establish the diagnostic requirements of central heating system components   |
| <b>7.2</b>   | Isolate central heating systems or components to prevent them being brought into operation before the work has been fully completed  |
| <b>7.3</b>   | Carry out diagnostic tests to locate faults in central heating system components and carry out repair work: <ul style="list-style-type: none"> <li>a) Replacement of a circulating pump</li> <li>b) Sealed heating system components</li> <li>c) Control components</li> <li>d) Clean system components using power</li> </ul> |

| <b>Learning Outcome 8</b>   |   |
|---|---|
| Know the commissioning requirements of central heating systems and components |   |
| <b>Assessment Criteria</b>  |   |
| <b>8.1</b>  | Interpret information sources required to complete commissioning work on central heating systems  |
| <b>8.2</b>  | State the checks to be carried out during a visual inspection of a central heating system to confirm that it is ready to be filled with water                                   |
| <b>8.3</b>  | State how to fill central heating pipework with water at normal operating pressure and check for leakage  |
| <b>8.4</b>  | Identify how to conduct a soundness test on central heating systems: <ul style="list-style-type: none"> <li>a) Metallic systems</li> <li>b) Plastic pipework systems</li> </ul> |



| <b>Learning Outcome 8</b>   |  |
|---|--|
| Know the commissioning requirements of central heating systems and components |  |
| <b>Assessment Criteria (continued)</b>  |  |
| <b>8.5</b>  | Specify the flushing requirements including the use of chemical treatments for new and existing central heating systems: <ul style="list-style-type: none"> <li>a) Cold and hot flushing</li> <li>b) Power flushing</li> <li>c) System additives</li> <li>d) Neutralisers</li> <li>e) Control components</li> <li>f) Cleansers</li> <li>g) Corrosion inhibitors</li> </ul>   |
| <b>8.6</b>  | Specify the method required to balance a central heating system during commissioning activities  |
| <b>8.7</b>  | Specify the actions that must be taken when commissioning reveals defects in central heating systems: <ul style="list-style-type: none"> <li>a) Dealing with systems that do not meet correct installation requirements</li> <li>b) Defects in the connection of components in systems</li> <li>c) Unbalanced systems – poor circulation</li> <li>d) Poor boiler connection into a low loss header</li> <li>e) Remedial work associated with defective components</li> </ul> |
| <b>8.8</b>  | Propose the range of information that would be detailed on a commissioning record for a central heating system   |
| <b>8.9</b>  | State the procedure for notifying works carried out to the relevant authority  |
| <b>8.10</b>   | Propose the points to be covered when handing over a completed system to the end-user  |

| <b>Learning Outcome 9</b>                                    |  |
|--|--|
| Be able to commission central heating systems and components |  |
| <b>Assessment Criteria</b>                                   |  |
| <b>9.1</b>   | Carry out a visual inspection of a central heating system to confirm that it is ready to be filled with water  |
| <b>9.2</b>   | Charge central heating components with water at normal operating pressure and check for leakage  |
| <b>9.3</b>   | Perform a soundness test to industry requirements on central heating systems pipework and components   |
| <b>9.4</b>   | Flush and treat a central heating system with appropriate additives: <ul style="list-style-type: none"> <li>a) System cleanser/neutraliser</li> <li>b) System inhibitor</li> </ul> |
| <b>9.5</b>   | Balance a central heating system to meet design requirements   |

## T/502/9157 - Understand and carry out electrical work on domestic plumbing and heating systems and components

|  |   |   |                     |
|--|---|---|---------------------|
| Unit level   | 3   | <i>This combination unit provides learning in work preparation, installation, inspection, testing and fault diagnosis/rectification of electrical components, equipment and connections to Domestic MES systems. This unit also cover the requirements for completing associated documentation required upon completion of electrical installation, inspection, testing and maintenance activities.</i> |                     |
| GLH  | 102   |   |                     |
| Unit   |   |   |                     |
| <b>T/502/9157 - Understand and carry out electrical work on domestic plumbing and heating systems and components</b> |   |   |                     |
| Learning Outcomes  |   |   | Assessment Criteria |
| LO1  | Know the electrical standards that apply to the mechanical services industry  |   | 1.1 – 1.3           |
| LO2  | Know the principles of electricity supply to dwellings  |   | 2.1 – 2.3           |
| LO3  | Know the layout features of electrical circuits in dwellings  |   | 3.1 – 3.8           |
| LO4  | Understand the electrical industry safe isolation procedure   |   | 4.1 – 4.3           |
| LO5  | Be able to carry out the electrical industry safe isolation procedure   |   | 5.1 – 5.2           |
| LO6  | Know the site preparation techniques for the electrical connection of mechanical services components in dwellings         |   | 6.1 – 6.7           |
| LO7  | Be able to apply site preparation techniques for the electrical connection of mechanical services components in dwellings |   | 7.1 – 7.2           |
| LO8  | Understand the installation and connection requirements of electrically operated mechanical services components           |   | 8.1 – 8.6           |
| LO9  | Be able to install and connect electrically operated mechanical services components                                       |   | 9.1 – 9.3           |
| LO10   | Know the inspection and testing requirements of electrically operated mechanical services components                      |   | 10.1 – 10.6         |
| LO11   | Be able to inspect and test electrically operated mechanical services components  |   | 11.1 – 11.2         |
| LO12   | Know the procedures for safely diagnosing and rectifying faults in electrically operated mechanical services components   |   | 12.1 – 12.7         |
| LO13   | Be able to safely diagnose and rectify faults in electrically operated mechanical services components                     |   | 13.1 – 13.3         |

|  |  |
|--|--|
| <b>Learning Outcome 1</b>  |  |
| Know the electrical standards that apply to the mechanical services industry |  |
| <b>Assessment Criteria</b>   |  |
| <b>1.1</b>   | State the statutory legislation and guidance information that applies to electrical supply and control of domestic mechanical services systems and their components <ul style="list-style-type: none"> <li>a) General legislation</li> <li>b) Construction specific legislation</li> <li>c) Mechanical services specific legislation               <ul style="list-style-type: none"> <li>a. Professional body guidance</li> </ul> </li> <li>d) Codes of practice</li> <li>e) Manufacturer installation &amp; service/maintenance instructions</li> <li>f) Manufacturer user instructions</li> </ul> |

| <b>Learning Outcome 1</b>  |   |
|--|---|
| Know the electrical standards that apply to the mechanical services industry |   |
| <b>Assessment Criteria (continued)</b>                                       |   |
| <b>1.2</b>   | Identify the range of information that would be detailed on a minor works certificate for an electrical system or component |
| <b>1.3</b>   | Specify the procedure for notifying works carried out to the relevant authority   |

| <b>Learning Outcome 2</b>                              |   |
|--|---|
| Know the principles of electricity supply to dwellings |   |
| <b>Assessment Criteria</b>                             |   |
| <b>2.1</b>   | Specify the methods by which electricity is generated: <ul style="list-style-type: none"> <li>a) Basic power station operation</li> <li>b) Principles of generation</li> <li>c) Types of supply</li> <li>d) Single phase</li> <li>e) Three-phase and neutral</li> </ul>   |
| <b>2.2</b>   | Specify the methods by which generated electricity is distributed to dwellings: <ul style="list-style-type: none"> <li>a) Basic operation of the national grid and local distribution systems</li> <li>b) Sub-stations</li> <li>c) Supply transformers</li> <li>d) Local distribution of three – and single-phase supplies to premises</li> </ul> |
| <b>2.3</b>   | State the purpose of electrical components at entry to the property: <ul style="list-style-type: none"> <li>a) Main fuse (single phase) and cable head connection</li> <li>b) Meter</li> <li>c) Consumer unit</li> <li>d) Main earth terminal</li> </ul>  |

| <b>Learning Outcome 3</b>                                    |   |
|--|---|
| Know the layout features of electrical circuits in dwellings |   |
| <b>Assessment Criteria</b>                                   |   |
| <b>3.1</b>   | Define the system layout features for electrical circuits in dwellings: <ul style="list-style-type: none"> <li>a) Ring main circuit</li> <li>b) Radial circuit</li> <li>c) Fixed appliance supplies</li> <li>d) Cooker</li> <li>e) Immersion heater</li> <li>f) Instantaneous shower</li> <li>g) Lighting</li> <li>h) Macerator WC</li> <li>i) Central heating controls</li> <li>j) Shower pump/Jacuzzi</li> <li>k) Heat producing or cooling appliances</li> </ul> |
| <b>3.2</b>   | Specify the types of cables and cords used for the installation of electrical equipment in domestic mechanical services systems   |

| <b>Learning Outcome 3</b>   |   |
|---|---|
| <b>Know the layout features of electrical circuits in dwellings</b> |   |
| <b>Assessment Criteria (continued)</b>                              |   |
| <b>3.3</b>  | State the applications and limitations of the types of cable and conductors used for the installation of electrical equipment in mechanical services systems  |
| <b>3.4</b>  | Clarify the difference between class 1 and class 2 electrical equipment   |
| <b>3.5</b>  | <p>Define the function of electrically operated components used in domestic mechanical services systems:</p> <ul style="list-style-type: none"> <li>a) Flame rectification devices</li> <li>b) Flame suppression devices</li> <li>c) Solenoid valves</li> <li>d) Thermistors</li> <li>e) Thermocouples</li> <li>f) Micro switches</li> <li>g) Relays</li> <li>h) Printed circuit boards</li> <li>i) Pressure switches</li> <li>j) Pumps</li> <li>k) Fans</li> <li>l) Control components</li> <li>m) Thermostats</li> <li>n) Programmers/timers</li> <li>o) Electrically operated control valves</li> <li>p) Wiring centres</li> <li>q) Switches</li> <li>r) Rocker plate (with/without cpc) – single and double pole</li> <li>s) Pull cord</li> </ul> |
| <b>3.6</b>  | <p>Define the operating principles of electrical circuit protection devices:</p> <ul style="list-style-type: none"> <li>a) Miniature circuit breakers</li> <li>b) Residual current devices including RCBOs</li> <li>c) Fuses</li> <li>d) Re-wireable</li> <li>e) Cartridge</li> <li>f) High breaking capacity</li> </ul>  |
| <b>3.7</b>  | <p>Clarify the need for, and requirements of earthing systems:</p> <ul style="list-style-type: none"> <li>a) Main earthing systems <ul style="list-style-type: none"> <li>1) TT system</li> <li>2) TN - S system</li> <li>3) TN-C-S system</li> </ul> </li> <li>b) Protective equipotential bonding</li> <li>c) High risk rooms (zones) in dwellings</li> <li>d) Supplementary earthing (bonding)</li> <li>e) Temporary continuity bonding</li> </ul>   |
| <b>3.8</b>  | Identify the warning notices to be applied to consumer units  |

| <b>Learning Outcome 4</b>                                   |   |
|---|---|
| Understand the electrical industry safe isolation procedure |   |
| <b>Assessment Criteria</b>                                  |   |
| <b>4.1</b>  | Identify the test equipment required to prove that circuits to be worked on are dead: <ul style="list-style-type: none"> <li>a) Approved voltage indicating device</li> <li>b) Proving unit</li> </ul>  |
| <b>4.2</b>  | Specify the electrical industry agreed procedure for safe isolation of electrical circuits: <ul style="list-style-type: none"> <li>a) Select the approved voltage indicating device and test on a known supply</li> <li>b) Locate and identify the isolation point for the equipment to be worked on</li> <li>c) Isolate the supply and prevent re-energisation</li> <li>d) Verify that the equipment is dead</li> <li>e) Fit warning labels</li> <li>f) Re-check the approved voltage indicating on a known supply for correct function</li> </ul> |
| <b>4.3</b>  | Clarify the methods of ensuring that circuits cannot be re-activated while work is taking place on them: <ul style="list-style-type: none"> <li>a) Use of locking devices</li> <li>b) Device retention (fuse removal)</li> </ul>  |

| <b>Learning Outcome 5</b>   |  |
|---|--|
| Be able to carry out the electrical industry safe isolation procedure |  |
| <b>Assessment Criteria</b>  |  |
| <b>5.1</b>  | Check to ensure that test equipment is safe to be used       |
| <b>5.2</b>  | Carry out the safe isolation procedure to industry standards |

| <b>Learning Outcome 6</b>   |   |
|---|---|
| Know the site preparation techniques for the electrical connection of mechanical services components in dwellings |   |
| <b>Assessment Criteria</b>  |   |
| <b>6.1</b>  | Identify the required sources of information when carrying out work on electrical systems: <ul style="list-style-type: none"> <li>a) Statutory regulations</li> <li>b) Industry standards</li> <li>c) Manufacturer technical instructions</li> </ul>  |
| <b>6.2</b>  | Identify the preparatory work required to be carried out to the building fabric in order to install, commission, decommission or maintain electrical systems or components  |
| <b>6.3</b>  | State the types of pre-existing damage to the existing building fabric or customer property that may be encountered before commencing work on electrical systems and components: <ul style="list-style-type: none"> <li>a) Building wall/floor surfaces</li> <li>b) Existing electrical system components</li> <li>c) Building décor and carpets</li> </ul> |
| <b>6.4</b>  | State how to carry out simple electrical calculations: <ul style="list-style-type: none"> <li>a) Ohm's law</li> <li>b) Power consumption of electrical circuits</li> <li>c) Basic over-current protection device size</li> <li>d) Voltage, current and resistance in series and parallel circuits</li> </ul>  |

| <b>Learning Outcome 6</b>   |   |
|---|---|
| Know the site preparation techniques for the electrical connection of mechanical services components in dwellings |   |
| <b>Assessment Criteria (continued)</b>  |   |
| <b>6.5</b>  | Identify the protection measures to be applied to the building fabric or customer property, during and on completion of work on electrical systems and components: <ul style="list-style-type: none"> <li>a) Building wall/floor surfaces</li> <li>b) Existing and new electrical systems and kitchen furniture</li> <li>c) Building décor and carpets</li> </ul> |
| <b>6.6</b>  | Identify the cable, materials and fittings required to complete work on electrical systems  |
| <b>6.7</b>  | Identify the hand and power tools required to complete work on electrical systems   |

| <b>Learning Outcome 7</b>   |   |
|---|---|
| Be able to apply site preparation techniques for the electrical connection of mechanical services components in dwellings |   |
| <b>Assessment Criteria</b>  |   |
| <b>7.1</b>  | Check the safety of the work location in order for the work to safely proceed: <ul style="list-style-type: none"> <li>a) Safe access and exit</li> <li>b) Immediate work location e.g. tripping hazards</li> <li>c) Appropriate risk assessments/ method statements are followed</li> </ul> |
| <b>7.2</b>  | Wear Personal Protective Equipment relevant to the installation, decommissioning or maintenance tasks being carried out   |

| <b>Learning Outcome 8</b>   |  |
|---|--|
| Understand the installation and connection requirements of electrically operated mechanical services components |  |
| <b>Assessment Criteria</b>  |  |
| <b>8.1</b>  | Define the method used to identify that existing electrical supplies and circuits are suitable for the proposed installation of electrical equipment used in domestic mechanical services systems  |
| <b>8.2</b>  | <ul style="list-style-type: none"> <li>a) State the procedure for sizing electrical materials and components:</li> <li>b) Basic cable sizing procedure domestic type cables and cords</li> <li>c) Basic circuit protection device sizing procedure –domestic circuit types</li> </ul>        |
| <b>8.3</b>  | Specify the method used to select suitable cables and cords for components and circuits: <ul style="list-style-type: none"> <li>a) Selection of appropriate multi-core cable</li> <li>b) Selection of appropriate multi-core cords</li> <li>c) Selection of pvc single conductors</li> </ul> |

| <b>Learning Outcome 8</b>   |   |
|---|---|
| Understand the installation and connection requirements of electrically operated mechanical services components |   |
| <b>Assessment Criteria (continued)</b>  |   |
| <b>8.4</b>  | <p>Specify the requirements for protecting cables installed in the building fabric and terminating in enclosures:</p> <ul style="list-style-type: none"> <li>a) Protection methods in wall and floor surfaces</li> <li>b) Embedded (sheathing) – depth of cover, application of RCD protection</li> <li>c) Exposed (mini trunking)</li> <li>d) Within ducting</li> <li>e) Within timber stud partitions</li> <li>f) Within timber floor structures</li> <li>g) Junction boxes</li> <li>h) Switch/socket boxes</li> <li>i) Countersunk</li> <li>j) Pattresses</li> <li>k) Surface mounted</li> <li>l) Wiring centres</li> </ul>  |
| <b>8.5</b>  | <p>Define the types of cable termination methods approved for use in dwellings</p> <ul style="list-style-type: none"> <li>a) Screw terminals</li> <li>b) Pillar terminals</li> <li>c) Claw and washer terminals</li> <li>d) Crimping</li> <li>e) Strip connectors</li> </ul>  |
| <b>8.6</b>  | <p>Specify the method of installation and wiring termination for fixed electrical appliances</p> <p><b><u>From consumer unit</u></b></p> <ul style="list-style-type: none"> <li>a) Macerator WC</li> <li>b) Central heating control system</li> <li>c) Instantaneous shower</li> <li>d) Immersion heater</li> <li>e) Shower pump/Jacuzzi</li> </ul> <p><b><u>From fused-spur connection unit</u></b></p> <ul style="list-style-type: none"> <li>a) Central heating control system</li> <li>b) Shower pump/Jacuzzi</li> </ul> <p><b><u>From existing appliance supply point</u></b></p> <ul style="list-style-type: none"> <li>a) Macerator WC</li> <li>b) Central heating control system</li> <li>c) Shower pump/Jacuzzi</li> <li>d) Immersion heater</li> <li>e) Shower</li> </ul> |

| <b>Learning Outcome 9</b>   |  |
|---|--|
| Be able to install and connect electrically operated mechanical services components |  |
| <b>Assessment Criteria</b>  |  |
| <b>9.1</b>  | Carry out the electrical wiring of a central heating control system from an existing fused spur connection unit: <ul style="list-style-type: none"> <li>a) Fully pumped system incorporating all necessary control components</li> <li>b) Positioning and fixing of all necessary enclosures, switches and circuit protection devices</li> <li>c) Correct routing, installation and termination of appropriate cables and cords to control system components</li> <li>d) Correct earthing provision for all components and exposed metallic parts of the system</li> </ul> |
| <b>9.2</b>  | Carry out the replacement of electrical cords from an existing isolation point to the fixed appliance: <ul style="list-style-type: none"> <li>a) Immersion heater</li> <li>b) WC macerator unit</li> <li>c) Shower pump</li> </ul>   |
| <b>9.3</b>  | Apply temporary continuity bonding to metallic pipework prior to making pipework connections   |

| <b>Learning Outcome 10</b>   |   |
|--|---|
| Know the inspection and testing requirements of electrically operated mechanical services components |   |
| <b>Assessment Criteria</b>   |   |
| <b>10.1</b>  | Specify the requirements of a visual inspection of completed electrical installation work for domestic mechanical services systems prior to electrical inspection and testing   |
| <b>10.2</b>  | Define the equipment used for electrical testing of mechanical services components and its calibration requirements   |
| <b>10.3</b>  | Identify the importance of carrying out tests on dead circuits wherever possible  |
| <b>10.4</b>  | State the purpose of the electrical testing procedures for new and existing circuits: <ul style="list-style-type: none"> <li>a) Polarity</li> <li>b) Earth continuity</li> <li>c) Insulation resistance</li> <li>d) Earth fault loop impedance</li> <li>e) Residual current device</li> </ul> |
| <b>10.5</b>  | Clarify the requirements for carrying out functional testing of electrical components   |
| <b>10.6</b>  | Clarify the procedure for final handover of electrical circuits that supply electrically operated domestic mechanical services components: <ul style="list-style-type: none"> <li>a) Installation completion of certification</li> <li>b) Demonstration to the user</li> </ul>                |



| <b>Learning Outcome 11</b>   |  |
|--|--|
| Be able to inspect and test electrically operated mechanical services components |  |
| <b>Assessment Criteria</b>   |  |
| <b>11.1</b>  | Carry out the inspection and testing of a completed central heating controls system: <ul style="list-style-type: none"> <li>a) Visual inspection</li> <li>b) Selection and use of appropriate test equipment</li> <li>c) Appropriate circuit testing</li> <li>d) Polarity</li> <li>e) Earth continuity</li> <li>f) Insulation resistance</li> <li>g) Functional testing</li> <li>h) Completion of a minor works certificate</li> </ul> |
| <b>11.2</b>  | Carry out the inspection and testing of existing electrical circuits following replacement of electrical cords: <ul style="list-style-type: none"> <li>a) Immersion heater</li> <li>b) WC macerator unit</li> <li>c) Shower pump</li> </ul>  |

| <b>Learning Outcome 12</b>  |  |
|---|--|
| Know the procedures for safely diagnosing and rectifying faults in electrically operated mechanical services components |  |
| <b>Assessment Criteria</b>  |  |
| <b>12.1</b>   | State the methods of obtaining details of system faults from end users   |
| <b>12.2</b>   | Identify and use manufacturer instructions and industry standards to establish the diagnostic requirements of electrical system components |
| <b>12.3</b>   | Identify the electrical test equipment used to undertake fault diagnostics   |
| <b>12.4</b>   | Identify the situations in which dead testing of components can be carried out   |
| <b>12.5</b>   | Identify the situations in which live testing of components may be necessary and the safety precautions required                           |

| <b>Learning Outcome 12</b>  |   |
|---|---|
| Know the procedures for safely diagnosing and rectifying faults in electrically operated mechanical services components |   |
| <b>Assessment Criteria</b>  |   |
| <b>12.6</b>   | <p>Define how to perform a range of routine checks and diagnostics on electrical system components as part of a fault-finding process. Checking for correct operation of:</p> <ul style="list-style-type: none"> <li>a) Appliance components</li> <li>b) Flame rectification devices</li> <li>c) Flame suppression devices</li> <li>d) Solenoid valves</li> <li>e) Thermistors</li> <li>f) Thermocouples</li> <li>g) Micro switches</li> <li>h) Relays</li> <li>i) Pressure switches</li> <li>j) Printed circuit boards</li> <li>k) Pumps</li> <li>l) Fans</li> <li>m) Control components</li> <li>n) Thermostats</li> <li>o) Programmers/timers</li> <li>p) Electrically operated control valves</li> <li>q) Wiring centres</li> <li>r) Switches</li> <li>s) Rocker plate (with/without cpc) - single and double pole</li> <li>t) Pull cord</li> </ul> |
| <b>12.7</b>   | <p>State the methods of correcting deficiencies in electrical components:</p> <ul style="list-style-type: none"> <li>a) Inadequate earthing provision</li> <li>b) Defective cable positioning (aged cables/ proximity to other services)</li> <li>c) Failed electrical components</li> <li>d) Incorrect polarity</li> <li>e) Provision of inadequate circuit protection devices</li> </ul>  |

| <b>Learning Outcome 13</b>  |   |
|---|---|
| Be able to safely diagnose and rectify faults in electrically operated mechanical services components |   |
| <b>Assessment Criteria</b>  |   |
| <b>13.1</b>   | Safely isolate electrical systems or components to prevent them being brought into operation before the work has been fully completed   |
| <b>13.2</b>   | <p>Carry out diagnostic checks to electrical circuits:</p> <ul style="list-style-type: none"> <li>a) Inadequate earthing provision</li> <li>b) Defective cable routing</li> <li>c) Defective termination</li> <li>d) Incorrect polarity</li> <li>e) Provision of inadequate circuit protection devices</li> </ul> |

| <b>Learning Outcome 13</b>  |  |
|---|--|
| Be able to safely diagnose and rectify faults in electrically operated mechanical services components |  |
| <b>Assessment Criteria (continued)</b>  |  |
| <b>13.3</b>   | <p>State the methods of correcting deficiencies in electrical components:</p> <ul style="list-style-type: none"> <li>a) Replacement of a motorised valve head gear</li> <li>b) Boiler components replacement</li> <li>c) Thermistor</li> <li>d) Thermocouples</li> <li>e) Pressure switches</li> <li>f) Control components</li> <li>g) Thermostats</li> <li>h) Programmers/timers</li> <li>i) Shower control components</li> </ul> |

## D/502/9296 - Understand and apply domestic sanitation system installation, commissioning, service, and maintenance techniques

|  |  |  |                     |
|--|--|--|---------------------|
| Unit level   | 3  | <i>This combination unit provides learning in the design, installation, maintenance, and commissioning of a complex range of sanitation system/component types in single occupancy dwellings and multiple storey dwellings up to 3 storeys. The unit also covers the requirements of work on WC macerator units and sink waste disposal units.</i> |                     |
| GLH  | 72   |  |                     |
| Unit   |  |  |                     |
| D/502/9296 - Understand and apply domestic sanitation system installation, commissioning, service and maintenance techniques |  |  |                     |
| Learning Outcomes  |  |  | Assessment Criteria |
| LO1  | Know the types of sanitation system and their layout requirements                                  |  | 1.1 – 1.5           |
| LO2  | Know the design techniques for sanitation and rainwater systems                                    |  | 2.1 – 2.10          |
| LO3  | Be able to apply design techniques for sanitation and rainwater systems                            |  | 3.1 – 3.4           |
| LO4  | Understand the installation requirements of sanitation system components                           |  | 4.1 – 4.5           |
| LO5  | Know the fault diagnosis and rectification procedures for sanitary pipework systems and components |  | 5.1 – 5.6           |
| LO6  | Be able to diagnose and rectify faults in sanitary pipework systems and components                 |  | 6.1 – 6.3           |
| LO7  | Know the commissioning requirements of sanitary pipework systems and components                    |  | 7.1 – 7.9           |
| LO8  | Be able to commission sanitary pipework systems and components                                     |  | 8.1 – 8.4           |

|   |   |
|---|---|
| <b>Learning Outcome 1</b>   |   |
| Know the types of sanitation system and their layout requirements |   |
| <b>Assessment Criteria</b>  |   |
| <b>1.1</b>  | State the use of air admittance valves in above ground sanitary pipework systems:<br>a) Types of air admittance valves<br>b) Their suitability of use in the various types of pipework system<br>c) Application on multi-dwelling housing estates |
| <b>1.2</b>  | Clarify the statutory requirements for the provision of sanitary facilities and equipment in dwellings for the disabled:<br>a) Spacing requirements of the human body<br>b) Appliance space requirements for the disabled                         |
| <b>1.3</b>  | Analyse the working principles and layout features for foul tanks in sanitation systems:<br>a) Cesspits<br>b) Septic tanks  |
| <b>1.4</b>  | State the periodic maintenance and cleaning requirements of foul tanks:<br>a) Cesspits<br>b) Septic tanks   |
| <b>1.5</b>  | Analyse the working principles and system layout features of specialist sanitary components:<br>a) WC macerators<br>b) Waste water lifters<br>c) Sink waste disposals   |

| <b>Learning Outcome 2</b>                                       |   |
|---|---|
| Know the design techniques for sanitation and rainwater systems |   |
| <b>Assessment Criteria</b>                                      |   |
| <b>2.1</b>  | Define the factors which affect the selection of sanitation systems for dwellings   |
| <b>2.2</b>  | State the criteria used when selecting sanitation systems and appliances: <ul style="list-style-type: none"> <li>a) Customers' needs</li> <li>b) Building layout and features</li> <li>c) Suitability of system</li> <li>d) Energy efficiency</li> <li>e) Environmental impact</li> </ul>                       |
| <b>2.2</b>  | Interpret information sources required when undertaking design work for sanitation systems: <ul style="list-style-type: none"> <li>a) Statutory regulations</li> <li>b) Industry standards</li> <li>c) Manufacturer technical instructions</li> <li>d) Verbal and written feedback from the customer</li> </ul> |
| <b>2.3</b>  | Specify the fire stopping arrangements required under statutory legislation as they apply to sanitary pipework passing between fire compartments in a dwelling  |
| <b>2.4</b>  | Calculate the sanitary provision requirements for dwellings   |
| <b>2.5</b>  | Clarify the method of sizing and selecting the correct gradient for branch pipework used in sanitary pipework systems   |
| <b>2.6</b>  | Clarify the methods used when designing a sanitary pipework system: <ul style="list-style-type: none"> <li>a) Main stack size</li> <li>b) Branch pipework sizes</li> <li>c) Ventilation requirements</li> <li>d) Air admittance valves</li> <li>e) Ventilating pipes</li> </ul>                                 |
| <b>2.7</b>  | Clarify the methods used when designing a rainwater system: <ul style="list-style-type: none"> <li>a) Roof area calculations</li> <li>b) Gutter type selection</li> <li>c) Outlet positioning</li> </ul>  |
| <b>2.8</b>  | Calculate the size of sanitary pipework used in single occupancy dwellings: <ul style="list-style-type: none"> <li>a) Main stack size</li> <li>b) Branch pipework size</li> <li>c) Stack vent size</li> </ul>   |
| <b>2.9</b>  | Calculate the size of rainwater system components used with single occupancy and multiple terraced properties: <ul style="list-style-type: none"> <li>a) Outlet requirements</li> <li>b) Gutter requirements</li> <li>c) Rainwater pipe requirements</li> </ul>   |
| <b>2.10</b>   | Clarify how to present design calculations in an acceptable format: <ul style="list-style-type: none"> <li>a) Using basic not to scale line drawings</li> <li>b) Details for insertion into a quotation or tender for work in a small-scale dwelling</li> </ul>   |

| <b>Learning Outcome 3</b>   |  |
|---|--|
| Be able to apply design techniques for sanitation and rainwater systems |  |
| <b>Assessment Criteria</b>  |  |
| <b>3.1</b>  | Use information sources when undertaking design work for sanitation systems: <ul style="list-style-type: none"> <li>a) Statutory regulations</li> <li>b) Industry standards</li> <li>c) Manufacturer technical instructions</li> <li>d) Verbal and written feedback from the customer</li> </ul> |
| <b>3.2</b>  | Calculate the size of sanitary pipework used in single occupancy dwellings. Simple calculations of: <ul style="list-style-type: none"> <li>a) Main stack size</li> <li>b) Branch pipework size</li> <li>c) Stack vent size</li> </ul>  |
| <b>3.3</b>  | Calculate the size of rainwater system components used with single occupancy and multiple terraced properties: <ul style="list-style-type: none"> <li>a) Outlet requirements</li> <li>b) Gutter requirements</li> <li>c) Rainwater pipe requirements</li> </ul>                                  |
| <b>3.4</b>  | Present design calculations in an acceptable format: <ul style="list-style-type: none"> <li>a) Using basic not to scale line drawings</li> <li>b) Details for insertion into a quotation or tender for work in a small-scale dwelling</li> </ul>   |

| <b>Learning Outcome 4</b>  |  |
|--|--|
| Understand the installation requirements of sanitation system components |  |
| <b>Assessment Criteria</b>   |  |
| <b>4.1</b>   | State the layout features for walk in wet rooms in dwellings   |
| <b>4.2</b>   | Specify the installation and fixing methods for components of walk in wet rooms used in dwellings <ul style="list-style-type: none"> <li>a) Glass sanitary appliances</li> <li>b) Antique style sanitary appliances</li> <li>c) Sanitary appliances with floor mounted taps</li> </ul>                           |
| <b>4.3</b>   | State how to assemble and prepare for the installation of sanitation system components: <ul style="list-style-type: none"> <li>a) WC macerator</li> <li>b) Waste water lifter</li> <li>c) Sink waste disposal unit</li> </ul>  |
| <b>4.4</b>   | Specify the methods for positioning and fixing WC macerators and waste water lifters: <ul style="list-style-type: none"> <li>a) Reference to manufacturer's instructions</li> <li>b) Vertical lift position</li> <li>c) Use of long radius bends</li> <li>d) Pipework material selection and assembly</li> </ul> |
| <b>4.5</b>   | Specify the methods for positioning and fixing sink waste disposal units: <ul style="list-style-type: none"> <li>a) Reference to manufacturer's instructions</li> <li>b) Trapping and branch discharge pipework requirements</li> </ul>  |

| <b>Learning Outcome 5</b>  |  |
|--|--|
| Know the fault diagnosis and rectification procedures for sanitary pipework systems and components |  |
| <b>Assessment Criteria</b>   |  |
| <b>5.1</b>   | State the methods of obtaining details of system faults from end users   |
| <b>5.2</b>   | Interpret manufacturer instructions and industry standards to establish the diagnostic requirements of sanitation system components  |
| <b>5.3</b>   | Propose routine checks and diagnostics on sanitation system components as part of a fault finding process:<br>Checking for correct operation of system components<br>WC macerators<br>Waste water lifters<br>Sink waste disposal units |
| <b>5.4</b>   | Specify methods of repairing faults in sanitation components:<br>a) WC macerators<br>b) Waste water lifters<br>c) Sink waste disposal units<br>d) Air admittance valves  |
| <b>5.5</b>   | Specify methods of safely isolating sanitation system components to prevent them being brought into operation before the work has been fully completed   |
| <b>5.6</b>   | Define procedures for diagnosing faults in macerator units   |

| <b>Learning Outcome 6</b>  |   |
|--|---|
| Be able to diagnose and rectify faults in sanitary pipework systems and components |   |
| <b>Assessment Criteria</b>   |   |
| <b>6.1</b>   | Use manufacturer instructions and industry standards to establish the diagnostic requirements of sanitation system components |
| <b>6.2</b>   | Isolate sanitation system components to prevent them being brought into operation before the work has been fully completed    |
| <b>6.3</b>   | Carry out diagnostic tests to locate faults in macerator units  |

| <b>Learning Outcome 7</b>   |   |
|---|---|
| Know the commissioning requirements of sanitary pipework systems and components |   |
| <b>Assessment Criteria</b>  |   |
| <b>7.1</b>  | Interpret information sources required to complete commissioning work on sanitation systems                                     |
| <b>7.2</b>  | State the checks to be carried out during a visual inspection of a sanitation system to confirm that it is ready to be operated |
| <b>7.3</b>  | Identify how to carry out an air test on a sanitary pipework system to industry requirements                                    |
| <b>7.4</b>  | State how to performance test sanitation systems to test for trap seal retention  |
| <b>7.5</b>  | Specify the commissioning procedures for macerator type WCs   |
| <b>7.6</b>  | Specify the actions that must be taken when commissioning reveals defects in sanitation systems                                 |

| <b>Learning Outcome 7</b>   |   |
|---|---|
| Know the commissioning requirements of sanitary pipework systems and components |   |
| <b>Assessment Criteria (continued)</b>  |   |
| <b>7.7</b>  | Propose the range of information that would be detailed on a commissioning record for a sanitation system |
| <b>7.8</b>  | State the procedure for notifying works carried out to the relevant authority                             |
| <b>7.9</b>  | Propose the points to be covered when handing over a completed system to the end-user                     |

| <b>Learning Outcome 8</b>                                      |  |
|--|--|
| Be able to commission sanitary pipework systems and components |  |
| <b>Assessment Criteria</b>                                     |  |
| <b>8.1</b>   | Carry out a visual inspection of a sanitation system to confirm that it is ready to be operated  |
| <b>8.2</b>   | Perform an air test on a sanitary pipework system to industry requirements   |
| <b>8.3</b>   | Carry out a performance test on a sanitary pipework system to check for effective trap seal retention: <ul style="list-style-type: none"> <li>a) Branch discharge pipework</li> <li>b) Test for self-siphonage</li> <li>c) Test for induced siphonage</li> <li>d) Main discharge stack</li> <li>e) Test for induced siphonage and compression</li> </ul> |
| <b>8.4</b>   | Commission a WC with macerator pump installation   |



## 7. Assessment Requirements for Individual Units

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### 7.1. L3 Generic Units

#### **Unit Ref: R/602/2498 – Understand how to organise resources within BSE**

To achieve the completion of this knowledge unit, you must satisfactorily complete the applicable knowledge assessment for the knowledge learning outcomes and assessment criteria within the unit (detail contained with BPEC assessment specification).

#### **Unit Ref: K/502/8930 – Understand and apply domestic cold water system installation, commissioning, service, and maintenance techniques**

To achieve the completion of this combination unit, you must satisfactorily complete the applicable knowledge assessment for the knowledge learning outcomes within the unit (detail contained with BPEC assessment specification). You must also complete the appropriate practical performance activities in simulated conditions as per the requirements of BPEC Practical Assessment no.1 as detailed in the BPEC L3 Plumbing and Heating practical assessment manual.

#### **Unit Ref: K/502/9155 – Understand and apply domestic hot water system installation, commissioning, service and maintenance techniques**

To achieve the completion of this combination unit, you must satisfactorily complete the applicable knowledge assessment for the knowledge learning outcomes within the unit (detail contained with BPEC assessment specification). You must also complete the appropriate practical performance activities in simulated conditions as per the requirements of BPEC Practical Assessment no.2 as detailed in the BPEC L3 Plumbing and Heating practical assessment manual.

#### **Unit Ref: M/502/9156 – Understand and apply domestic central heating system installation, commissioning, service, and maintenance techniques**

To achieve the completion of this combination unit, you must satisfactorily complete the applicable knowledge assessment for the knowledge learning outcomes within the unit (detail contained with BPEC assessment specification). You must also complete the appropriate practical performance activities in simulated conditions as per the requirements of BPEC Practical Assessment no.3 as detailed in the BPEC L3 Plumbing and Heating practical assessment manual.

#### **Unit Ref: T/502/9157 – Understand and carry out electrical work on domestic plumbing and heating systems and components**

To achieve the completion of this combination unit, you must satisfactorily complete the applicable knowledge assessment for the knowledge learning outcomes within the unit (detail contained with BPEC assessment specification). You must also complete the appropriate practical performance activities in simulated conditions as per the requirements of BPEC Practical Assessment no.4 as detailed in the BPEC L3 Plumbing and Heating practical assessment manual.

#### **Unit Ref: D/502/9296 – Understand and apply domestic sanitation system installation, commissioning, service and maintenance techniques**

To achieve the completion of this combination unit, you must satisfactorily complete the applicable knowledge assessment for the knowledge learning outcomes within the unit (detail contained with BPEC assessment specification). You must also complete the appropriate practical performance activities in simulated conditions as per the requirements of BPEC Practical Assessment no.5 as detailed in the BPEC L3 Plumbing and Heating practical assessment manual.

## 8. Marking Strategies

### 8.1. On-line Multiple-Choice Tests

There are 6 Multiple Choice Tests:

| Unit       |   | No. of Questions | Open or closed book |
|------------|---|------------------|---------------------|
| R/602/2498 | Understand how to organise resources within BSE   | 20               | Closed book         |
| K/502/8930 | Understand and apply domestic cold water system installation, commissioning, service, and maintenance techniques      | 45               | Open book           |
| K/502/9155 | Understand and apply domestic hot water system installation, commissioning, service, and maintenance techniques       | 45               | Open book           |
| M/502/9156 | Understand and apply domestic central heating system installation, commissioning, service, and maintenance techniques | 30               | Open book           |
| T/502/9157 | Understand and carry out electrical work on domestic plumbing and heating systems and components                      | 49               | Open book           |
| D/502/9296 | Understand and apply domestic sanitation system installation, commissioning, service, and maintenance techniques      | 25               | Open book           |

The pass rate for all on-line exams is **60%**.

If the pass rate of 60% is not achieved a full re-sit will be required. The centre should use the exams summary report to identify any areas that would need further training before offering any re-sits.

The centre should not enter any Learner into any exams without first confirming they are ready.

### 8.2. Performance Assessments

The pass mark for the practical assessments is pass/fail.

First Attempt – Learners are given a first attempt in all areas of the performance assessment. Second Attempt – performance areas not satisfactorily completed will be re-attempted. At the assessor's discretion, the Learner is re-assessed by oral questioning and/or observing the performance in an attempt to establish competence in all remaining areas. Learners who have not achieved the 100% pass mark at this stage will be deemed to have failed the performance assessment. Learners wishing to retake the assessment will be required to re-attempt the full performance assessment in its entirety.

### 8.3. Written Design Assignment

The pass mark for written assignments is 100%

### 8.4. Learner Result Submission Form

Learner Result Submission Forms have been produced for the L3 Plumbing qualification. This document shall be used to record that the learner has completed the whole qualification in a satisfactory manner. The document shall be completed and signed by the centre assessor and the internal verifier.

The completed Learner Result Submission Forms shall be sent to BPEC Certification Ltd. for certification.

Copies of the Learner Result Form shall also be retained in the Learner Portfolio and the Centre Portfolio.

## 9. Further Information

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Requests for further information regarding centre/scheme approval or any aspect of assessment of the BPEC qualifications please contact:

BPEC Certification Ltd. 2 Mallard Way, Pride Park, Derby, DE24 8GX

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