Qualification Guide

BPEC 601/2514/7 - Level 1 Diploma in Plumbing Foundation
BPEC 600/9432/1 - Level 2 Diploma in Plumbing Foundation
BPEC 600/5270/3 - Level 2 NVQ Diploma in Plumbing and Heating
BPEC 600/5271/5 - Level 2 NVQ Diploma in Domestic Heating
BPEC 600/9353/5 - Level 3 Diploma in Plumbing Foundation
BPEC 600/6284/8 - Level 3 NVQ Diploma in Domestic Plumbing and Heating (Gas Water Heating and Wet Central Heating Appliances)
BPEC 600/6286/1 - Level 3 NVQ Diploma in Domestic Heating (Gas Water Heating and Wet Central Heating Appliances)
BPEC 600/6863/2 - Level 3 NVQ Diploma in Domestic Plumbing and Heating (Environmental Technology)
BPEC 600/6871/1 - Level 3 NVQ Diploma in Domestic Heating (Environmental Technology)
THE L1, L2 AND L3 PLUMBING FOUNDATION, L2 AND L3 NVQ DIPLOMA IN PLUMBING AND HEATING AND THE L2 AND L3 NVQ DIPLOMA IN DOMESTIC HEATING QUALIFICATIONS

Introduction

This Guide has been produced based on the ‘National Occupational Standards’ and Units of Assessment for the Domestic Plumbing and Heating/Domestic Heating qualifications. This guide also covers the Units of Assessment for the Plumbing Foundation qualification. It details the requirements for centres delivering and learners undertaking the qualifications - and aims to provide:

- An overview of the structure of the L1, L2 and L3 Plumbing Foundation, L2 and L3 NVQ Domestic Plumbing and Heating and L2 and L3 NVQ Domestic Heating qualifications
- An overview of the assessment strategy for the L1, L2 and L3 Plumbing Foundation, L2 and L3 NVQ Domestic Plumbing and Heating and L2 and L3 NVQ Domestic Heating qualifications
- Guidance notes for assessors and other centre staff for the L1, L2 and L3 Plumbing Foundation, L2 and L3 NVQ Domestic Plumbing and Heating and L2 and L3 NVQ Domestic Heating qualifications

The L1 and L2 Plumbing Foundation qualifications require the completion of centre based knowledge and practical assessments designed to provide individuals with the basic skills and understanding to allow a progression route to completion of the L2 NVQ Diploma in Plumbing and Heating, Domestic Heating or L3 Plumbing Foundation qualification.

The L3 Plumbing Foundation requires the completion of centre based knowledge and practical assessments designed to provide individuals with the basic skills and understanding to allow a progression route to completion of the L3 NVQ Diploma in Domestic Plumbing and Heating or Domestic Heating qualification.

The L2 and L3 NVQ Plumbing and Heating qualification requires the completion of centre based knowledge and practical assessments and workplace-based performance assessments and is designed for individuals carrying out the installation, commissioning, de-commissioning, servicing and maintenance of domestic plumbing and heating systems.

The L2 and L3 NVQ Diploma in Domestic Heating qualification requires the completion of centre based knowledge and practical assessments and workplace-based performance assessments and is designed for individuals carrying out the installation, commissioning, de-commissioning, servicing and maintenance of domestic heating systems.

Note:
The Plumbing Foundation is centre based only. It is NOT a full plumbing qualification.

The Level 2 NVQ Diploma in Plumbing and Heating is a pre-requisite qualification to the Level 3 NVQ Diploma in Domestic Plumbing and Heating (Gas Water Heaters and Wet Central Heating Appliances)

The Level 2 NVQ Diploma in Domestic Heating or Plumbing and Heating is a pre-requisite qualification to the Level 3 NVQ Diploma in Domestic Heating

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Rules of Combination

Level 1 Plumbing Foundation

This is a Level 1 qualification of 40 credits and 356 guided learning hours consisting of 9 mandatory units. ALL units must be achieved to achieve the overall qualification.

Successful completion of this qualification provides learners with the basic knowledge and skills required for progression to the Level 2 Diploma in Plumbing Foundation. The qualification and unit details are shown below:

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Level 1 Diploma In Plumbing Foundation (QCF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPEC Qualification Number</td>
<td>601/2514/7</td>
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<tr>
<td>Last Registration Date</td>
<td>01/12/2014</td>
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<td>Last Certification Date</td>
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<th>Unit Title</th>
<th>Level</th>
<th>Credit Value</th>
<th>Notional Learning Time</th>
<th>Guided Learning Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>J/602/2479</td>
<td>Understand and carry out safe working practices in Building Services Engineering</td>
<td>2</td>
<td>10</td>
<td>95</td>
<td>88</td>
</tr>
<tr>
<td>J/602/2482</td>
<td>Understand how to communicate with others within Building Services Engineering</td>
<td>2</td>
<td>3</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>D/602/2486</td>
<td>Understand how to apply environmental protection measures within BSE</td>
<td>2</td>
<td>4</td>
<td>38</td>
<td>38</td>
</tr>
<tr>
<td>Y/502/8180</td>
<td>Understand fundamental scientific principles within building services engineering</td>
<td>1</td>
<td>3</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>K/505/9403</td>
<td>Understand and carry out copper pipe fabrication work for domestic plumbing systems</td>
<td>1</td>
<td>5</td>
<td>42</td>
<td>42</td>
</tr>
<tr>
<td>K/505/9417</td>
<td>Understand and carry out low carbon steel pipe fabrication work for domestic plumbing systems</td>
<td>1</td>
<td>5</td>
<td>42</td>
<td>42</td>
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<tr>
<td>M/505/9418</td>
<td>Understand and carry out plastic pipe fabrication work for domestic plumbing systems</td>
<td>1</td>
<td>4</td>
<td>32</td>
<td>32</td>
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<tr>
<td>K/505/9420</td>
<td>Understand the key features of domestic plumbing systems</td>
<td>1</td>
<td>4</td>
<td>38</td>
<td>38</td>
</tr>
<tr>
<td>T/505/9419</td>
<td>Understand and demonstrate techniques for installing and securing plumbing pipework</td>
<td>1</td>
<td>2</td>
<td>20</td>
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</tr>
</tbody>
</table>

Totals | 40 | 363 | 356 |
Level 2 Plumbing Foundation

This is a Level 2 qualification of 70 credits and 588 guided learning hours consisting of 10 mandatory units. **ALL** units must be achieved to achieve the overall qualification.

Successful completion of this qualification provides learners with the basic knowledge and skills required for progression to complete either the Level 2 NVQ Diploma in Plumbing and Heating or the Level 2 NVQ Diploma in Heating. The qualification and unit details are shown below:

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Level 2 Diploma In Plumbing Foundation (QCF)</th>
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<tbody>
<tr>
<td>BPEC Qualification Number</td>
<td>600/9432/1</td>
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<tr>
<td>Last Registration Date</td>
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<tr>
<td>Last Certification Date</td>
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<thead>
<tr>
<th>QCF Unit Ref</th>
<th>Unit Title</th>
<th>Level</th>
<th>Credit Value</th>
<th>Notional Learning Time</th>
<th>Guided Learning Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>J/602/2479</td>
<td>Understand and carry out safe working practices in Building Services Engineering</td>
<td>2</td>
<td>10</td>
<td>95</td>
<td>88</td>
</tr>
<tr>
<td>J/602/2482</td>
<td>Understand how to communicate with others within Building Services Engineering</td>
<td>2</td>
<td>3</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>D/602/2486</td>
<td>Understand how to apply environmental protection measures within BSE</td>
<td>2</td>
<td>4</td>
<td>38</td>
<td>38</td>
</tr>
<tr>
<td>J/602/2496</td>
<td>Understand how to apply scientific principles within MES</td>
<td>2</td>
<td>7</td>
<td>66</td>
<td>66</td>
</tr>
<tr>
<td>D/602/2682</td>
<td>Understand and carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems</td>
<td>2</td>
<td>10</td>
<td>92</td>
<td>88</td>
</tr>
<tr>
<td>H/602/2697</td>
<td>Understand and apply domestic cold water system installation and maintenance techniques</td>
<td>2</td>
<td>8</td>
<td>66</td>
<td>62</td>
</tr>
<tr>
<td>F/602/2884</td>
<td>Understand and apply domestic hot water system installation and maintenance techniques</td>
<td>2</td>
<td>8</td>
<td>66</td>
<td>62</td>
</tr>
<tr>
<td>Y/602/2888</td>
<td>Understand and apply domestic central heating system installation and maintenance techniques</td>
<td>2</td>
<td>10</td>
<td>88</td>
<td>82</td>
</tr>
<tr>
<td>F/602/2917</td>
<td>Understand and apply domestic rainwater system installation and maintenance techniques</td>
<td>2</td>
<td>4</td>
<td>32</td>
<td>30</td>
</tr>
<tr>
<td>J/602/2921</td>
<td>Understand and apply domestic above ground drainage system installation and maintenance techniques</td>
<td>2</td>
<td>6</td>
<td>48</td>
<td>44</td>
</tr>
</tbody>
</table>

**Totals** | 70 | 619 | 588 |
Rules of Combination

Level 2 NVQ Diploma in Plumbing and Heating

This is a Level 2 qualification of 76 credits and 596 guided learning hours consisting of 12 mandatory units. ALL units must be achieved to achieve the overall qualification.

Successful completion of this qualification proves that learners are competent to install, commission, decommission, service and maintain domestic plumbing and heating systems, components and appliances. The qualification and unit details are shown below:

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Level 2 NVQ Diploma in Plumbing and Heating</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPEC Qualification Number</td>
<td>600/5270/3</td>
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<tr>
<td>Last Registration Date</td>
<td>30/06/2015</td>
</tr>
<tr>
<td>Last Certification Date</td>
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<table>
<thead>
<tr>
<th>QCF Unit Ref</th>
<th>Unit Title</th>
<th>Level</th>
<th>Credit Value</th>
<th>Notional Learning Time</th>
<th>Guided Learning Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>J/602/2479</td>
<td>Understand and carry out safe working practices in Building Services Engineering</td>
<td>2</td>
<td>10</td>
<td>95</td>
<td>88</td>
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<tr>
<td>J/602/2482</td>
<td>Understand how to communicate with others within Building Services Engineering</td>
<td>2</td>
<td>3</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>D/602/2486</td>
<td>Understand how to apply environmental protection measures within BSE</td>
<td>2</td>
<td>4</td>
<td>38</td>
<td>38</td>
</tr>
<tr>
<td>J/602/2496</td>
<td>Understand how to apply scientific principles within MES</td>
<td>2</td>
<td>7</td>
<td>66</td>
<td>66</td>
</tr>
<tr>
<td>D/602/2682</td>
<td>Understand and carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems</td>
<td>2</td>
<td>10</td>
<td>92</td>
<td>88</td>
</tr>
<tr>
<td>H/602/2697</td>
<td>Understand and apply domestic cold water system installation and maintenance techniques</td>
<td>2</td>
<td>8</td>
<td>66</td>
<td>62</td>
</tr>
<tr>
<td>F/602/2884</td>
<td>Understand and apply domestic hot water system installation and maintenance techniques</td>
<td>2</td>
<td>8</td>
<td>66</td>
<td>62</td>
</tr>
<tr>
<td>Y/602/2888</td>
<td>Understand and apply domestic central heating system installation and maintenance techniques</td>
<td>2</td>
<td>10</td>
<td>88</td>
<td>82</td>
</tr>
<tr>
<td>F/602/2917</td>
<td>Understand and apply domestic rainwater system installation and maintenance techniques</td>
<td>2</td>
<td>4</td>
<td>32</td>
<td>30</td>
</tr>
<tr>
<td>J/602/2921</td>
<td>Understand and apply domestic above ground drainage system installation and maintenance techniques</td>
<td>2</td>
<td>6</td>
<td>48</td>
<td>44</td>
</tr>
<tr>
<td>T/602/2493</td>
<td>Apply safe working practices in building services engineering working environment</td>
<td>2</td>
<td>2</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>D/602/2939</td>
<td>Install and Maintain domestic plumbing and heating systems</td>
<td>2</td>
<td>4</td>
<td>20</td>
<td>4</td>
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<tr>
<td><strong>Totals</strong></td>
<td><strong>76</strong></td>
<td><strong>649</strong></td>
<td><strong>596</strong></td>
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</table>
## Rules of Combination

### Level 2 NVQ Diploma in Domestic Heating

This is a Level 2 qualification of 66 credits and 522 guided learning hours consisting of 10 mandatory units. ALL units must be achieved to achieve the overall qualification.

Successful completion of this qualification proves that learners are competent to install, commission, de-commission, service and maintain domestic heating systems, components and appliances. The qualification and unit details are shown below:

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Level 2 NVQ Diploma in Domestic Heating</th>
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<tbody>
<tr>
<td>BPEC Qualification Number</td>
<td>600/5271/5</td>
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<tr>
<td>Last Registration Date</td>
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<tr>
<td>Last Certification Date</td>
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<table>
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<tr>
<th>QCF Unit Ref</th>
<th>Unit Title</th>
<th>Level</th>
<th>Credit Value</th>
<th>Notional Learning Time</th>
<th>Guided Learning Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>J/602/2479</td>
<td>Understand and carry out safe working practices in Building Services Engineering</td>
<td>2</td>
<td>10</td>
<td>95</td>
<td>88</td>
</tr>
<tr>
<td>J/602/2482</td>
<td>Understand how to communicate with others within Building Services Engineering</td>
<td>2</td>
<td>3</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>D/602/2486</td>
<td>Understand how to apply environmental protection measures within BSE</td>
<td>2</td>
<td>4</td>
<td>38</td>
<td>38</td>
</tr>
<tr>
<td>J/602/2496</td>
<td>Understand how to apply scientific principles within MES</td>
<td>2</td>
<td>7</td>
<td>66</td>
<td>66</td>
</tr>
<tr>
<td>D/602/2682</td>
<td>Understand and carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems</td>
<td>2</td>
<td>10</td>
<td>92</td>
<td>88</td>
</tr>
<tr>
<td>H/602/2697</td>
<td>Understand and apply domestic cold water system installation and maintenance techniques</td>
<td>2</td>
<td>8</td>
<td>66</td>
<td>62</td>
</tr>
<tr>
<td>F/602/2884</td>
<td>Understand and apply domestic hot water system installation and maintenance techniques</td>
<td>2</td>
<td>8</td>
<td>66</td>
<td>62</td>
</tr>
<tr>
<td>Y/602/2888</td>
<td>Understand and apply domestic central heating system installation and maintenance techniques</td>
<td>2</td>
<td>10</td>
<td>88</td>
<td>82</td>
</tr>
<tr>
<td>T/602/2493</td>
<td>Apply safe working practices in building services engineering working environment</td>
<td>2</td>
<td>2</td>
<td>10</td>
<td>4</td>
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<td>R/602/2971</td>
<td>Install and Maintain domestic heating systems</td>
<td>2</td>
<td>4</td>
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<td>4</td>
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</tbody>
</table>

**Totals**: 66 credits, 569 Notional Learning Hours, 522 Guided Learning Hours
Rules of Combination

Level 3 Plumbing Foundation

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.

Successful completion of this qualification provides learners with the basic knowledge and skills required for progression to complete either the Level 3 NVQ Diploma in Domestic Plumbing and Heating or the Level 3 NVQ Diploma in Domestic Heating. The qualification and unit details are shown below:

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Level 3 Diploma In Plumbing Foundation (QCF)</th>
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<tr>
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<td><strong>Number</strong></td>
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<tr>
<td>BPEC Qualification Number</td>
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<td>Last Certification Date</td>
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<th>Credit Value</th>
<th>Notional Learning Time</th>
<th>Guided Learning Hours</th>
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</thead>
<tbody>
<tr>
<td>R/602/2498</td>
<td>Understand how to organise resources within BSE</td>
<td>3</td>
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<td>26</td>
<td>26</td>
</tr>
<tr>
<td>K/502/8930</td>
<td>Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques</td>
<td>3</td>
<td>9</td>
<td>80</td>
<td>76</td>
</tr>
<tr>
<td>K/502/9155</td>
<td>Understand and apply domestic hot water system installation, commissioning, service and maintenance techniques</td>
<td>3</td>
<td>9</td>
<td>80</td>
<td>76</td>
</tr>
<tr>
<td>M/502/9156</td>
<td>Understand and apply domestic central heating system installation, commissioning, service and maintenance techniques</td>
<td>3</td>
<td>12</td>
<td>105</td>
<td>98</td>
</tr>
<tr>
<td>T/502/9157</td>
<td>Understand and carry out electrical work on domestic plumbing and heating systems and components</td>
<td>3</td>
<td>12</td>
<td>107</td>
<td>102</td>
</tr>
<tr>
<td>D/502/9296</td>
<td>Understand and apply domestic sanitation system installation, commissioning, service and maintenance techniques</td>
<td>3</td>
<td>8</td>
<td>80</td>
<td>72</td>
</tr>
</tbody>
</table>

**Totals** | 53 | 478 | 450 |
Rules of Combination

Level 3 NVQ Diploma in Domestic Plumbing and Heating (Gas Water Heating and Wet Central Heating Appliances).

This is a Level 3 qualification of 146 credits and 1034 guided learning hours consisting of 13 mandatory units. ALL units must be successfully completed to achieve the overall qualification.

Successful completion of this qualification proves that learners are competent to install, commission, decommission service and maintain domestic plumbing and heating systems, components and appliances. The qualification and unit details are shown below:

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Level 3 NVQ Diploma in Plumbing and Heating (Gas Water Heating and Wet Central Heating Appliances)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPEC Qualification Number</td>
<td>600/6284/8</td>
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<td>Last Registration Date</td>
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<th>Credit Value</th>
<th>Notional Learning Time</th>
<th>Guided Learning Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>R/602/2498</td>
<td>Understand how to organise resources within BSE</td>
<td>3</td>
<td>3</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>K/502/8930</td>
<td>Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques</td>
<td>3</td>
<td>9</td>
<td>80</td>
<td>76</td>
</tr>
<tr>
<td>K/502/9155</td>
<td>Understand and apply domestic hot water system installation, commissioning, service and maintenance techniques</td>
<td>3</td>
<td>9</td>
<td>80</td>
<td>76</td>
</tr>
<tr>
<td>M/502/9156</td>
<td>Understand and apply domestic central heating system installation, commissioning, service and maintenance techniques</td>
<td>3</td>
<td>12</td>
<td>105</td>
<td>98</td>
</tr>
<tr>
<td>T/502/9157</td>
<td>Understand and carry out electrical work on domestic plumbing and heating systems and components</td>
<td>3</td>
<td>12</td>
<td>107</td>
<td>102</td>
</tr>
<tr>
<td>D/502/9296</td>
<td>Understand and apply domestic sanitation system installation, commissioning, service and maintenance techniques</td>
<td>3</td>
<td>8</td>
<td>80</td>
<td>72</td>
</tr>
<tr>
<td>K/502/9298</td>
<td>Install, commission, service and maintain domestic plumbing and heating systems</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>J/502/9390</td>
<td>Understand core gas safety principles for natural gas within domestic building services engineering</td>
<td>3</td>
<td>13</td>
<td>150</td>
<td>120</td>
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<tr>
<td>H/502/8487</td>
<td>Specific Core Installation and Maintenance</td>
<td>3</td>
<td>21</td>
<td>150</td>
<td>120</td>
</tr>
<tr>
<td>T/502/8381</td>
<td>Install, commission and de-commission gas pipework up to 35mm 1¼ diameter in domestic and small commercial premises</td>
<td>3</td>
<td>19</td>
<td>144</td>
<td>115</td>
</tr>
<tr>
<td>D/503/8628</td>
<td>Tightness test, purge, commission and de-commission gas pipework up to 35mm 1¼ diameter in small natural gas installations.</td>
<td>2</td>
<td>3</td>
<td>20</td>
<td>16</td>
</tr>
<tr>
<td>Y/502/8454</td>
<td>Install domestic gas water heaters and wet central heating appliances</td>
<td>3</td>
<td>18</td>
<td>168</td>
<td>134</td>
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<tr>
<td>T/502/8459</td>
<td>Maintain gas water heating and wet central heating appliances</td>
<td>3</td>
<td>16</td>
<td>94</td>
<td>75</td>
</tr>
</tbody>
</table>

Completion of this Qualification Combination will enable Gas Safe Registration in the following categories:
CCN 1, CENWAT, CPA 1, MET1/2, CoNGLP1 PD
Rules of Combination

**Level 3 NVQ Diploma in Domestic Heating (Gas Water Heating and Wet Central Heating Appliances).**

This is a Level 3 qualification of 138 credits and 962 guided learning hours consisting of 12 mandatory units. ALL units must be successfully completed to achieve the overall qualification.

Successful completion of this qualification proves that learners are competent to install, commission, decommission service and maintain domestic heating systems, components and appliances. The qualification and unit details are shown below:

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Level 3 NVQ Diploma in Domestic Heating (Gas Water Heating and Wet Central Heating Appliances)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPEC Qualification Number</td>
<td>600/6286/1</td>
</tr>
<tr>
<td>Last Registration Date</td>
<td>30/11/2014</td>
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<tr>
<td>Last Certification Date</td>
<td>30/11/2017</td>
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<tr>
<th>QCF Unit Ref Core Plumbing</th>
<th>Unit Title</th>
<th>Level</th>
<th>Credit Value</th>
<th>Notional Learning Time</th>
<th>Guided Learning Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>R/602/2498</td>
<td>Understand how to organise resources within BSE</td>
<td>3</td>
<td>3</td>
<td>32</td>
<td>26</td>
</tr>
<tr>
<td>K/502/8930</td>
<td>Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques</td>
<td>3</td>
<td>9</td>
<td>95</td>
<td>76</td>
</tr>
<tr>
<td>K/502/9155</td>
<td>Understand and apply domestic hot water system installation, commissioning, service and maintenance techniques</td>
<td>3</td>
<td>9</td>
<td>95</td>
<td>76</td>
</tr>
<tr>
<td>M/502/9156</td>
<td>Understand and apply domestic central heating system installation, commissioning, service and maintenance techniques</td>
<td>3</td>
<td>12</td>
<td>122</td>
<td>98</td>
</tr>
<tr>
<td>T/502/9157</td>
<td>Understand and carry out electrical work on domestic plumbing and heating systems and components</td>
<td>3</td>
<td>12</td>
<td>128</td>
<td>102</td>
</tr>
<tr>
<td>A/502/8933</td>
<td>Install, commission, service and maintain heating systems</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>J/502/9390</td>
<td>Understand core gas safety principles for natural gas within domestic building services engineering</td>
<td>3</td>
<td>13</td>
<td>150</td>
<td>120</td>
</tr>
<tr>
<td>H/502/8487</td>
<td>Specific Core Installation and Maintenance</td>
<td>3</td>
<td>21</td>
<td>150</td>
<td>120</td>
</tr>
<tr>
<td>T/502/8381</td>
<td>Install, commission and de-commission gas pipework up to 35mm 1/4 diameter in domestic and small commercial premises</td>
<td>3</td>
<td>19</td>
<td>144</td>
<td>115</td>
</tr>
<tr>
<td>D/503/8628</td>
<td>Tightness test, purge, commission and decommission gas pipework up to 35mm 1/4 diameter in small natural gas installations</td>
<td>2</td>
<td>3</td>
<td>20</td>
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<tr>
<td>Y/502/8454</td>
<td>Install domestic gas water heaters and wet central heating appliances</td>
<td>3</td>
<td>18</td>
<td>168</td>
<td>134</td>
</tr>
<tr>
<td>T/502/8459</td>
<td>Maintain gas water heating and wet central heating appliances</td>
<td>3</td>
<td>16</td>
<td>94</td>
<td>75</td>
</tr>
</tbody>
</table>

**Totals** 66 1203 962

Completion of this Qualification Combination will enable Gas Safe Registration in the following categories:
**CCN 1, CENWAT, CPA 1, MET1/2, CoNGLP1 PD**
Rules of Combination

Level 3 NVQ Diploma in Domestic Plumbing and Heating (Environmental Technology)

This is a Level 3 qualification of 68 credits and 534 guided learning hours consisting of 8 mandatory units with an additional 4 units from EN1, EN2 or EN3. ALL units must be achieved to achieve the overall qualification.

Successful completion of this qualification proves that learners are competent to install, commission, decommission, service and solar thermal hot water systems, heat pump systems or water harvesting systems. The qualification and unit details are shown below:

<table>
<thead>
<tr>
<th>Qualification Title</th>
<th>Level 3 NVQ Diploma in Domestic Plumbing and Heating (Environmental Technology)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPEC Qualification Number</td>
<td>600/6863/2</td>
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<td>Last Registration Date</td>
<td>31/08/2014</td>
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<td>Last Certification Date</td>
<td>31/08/2017</td>
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<tr>
<th>QCF Unit Ref</th>
<th>Unit Title</th>
<th>Level</th>
<th>Credit Value</th>
<th>Notional Learning Time</th>
<th>Guided Learning Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandatory Units</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R/602/2498</td>
<td>Understand how to organise resources within BSE</td>
<td>3</td>
<td>3</td>
<td>32</td>
<td>26</td>
</tr>
<tr>
<td>D/502/9296</td>
<td>Understand and apply domestic sanitation system installation, commissioning, service and maintenance techniques</td>
<td>3</td>
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<td>90</td>
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</tr>
<tr>
<td>K/502/8930</td>
<td>Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques</td>
<td>3</td>
<td>9</td>
<td>95</td>
<td>76</td>
</tr>
<tr>
<td>K/502/9155</td>
<td>Understand and apply domestic hot water system installation, commissioning, service and maintenance techniques</td>
<td>3</td>
<td>9</td>
<td>95</td>
<td>76</td>
</tr>
<tr>
<td>M/502/9156</td>
<td>Understand and apply domestic central heating system installation, commissioning, service and maintenance techniques</td>
<td>3</td>
<td>12</td>
<td>122</td>
<td>98</td>
</tr>
<tr>
<td>T/502/9157</td>
<td>Understand and carry out electrical work on domestic plumbing and heating systems and components</td>
<td>3</td>
<td>12</td>
<td>128</td>
<td>102</td>
</tr>
<tr>
<td>K/502/9298</td>
<td>Install, commission, service and maintain domestic plumbing and heating systems</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>K/602/3138</td>
<td>Understand the Fundamental Principles and Requirements of Environmental Technology Systems</td>
<td>3</td>
<td>2</td>
<td>15</td>
<td>15</td>
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<tr>
<td>Optional Solar Thermal Units EN1</td>
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</tr>
<tr>
<td>F/602/3100</td>
<td>Know the requirements to install, commission and handover solar thermal hot water systems</td>
<td>3</td>
<td>4</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>L/602/3102</td>
<td>Install, commission and handover ‘active’ solar thermal hot water systems</td>
<td>3</td>
<td>2</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Y/602/3104</td>
<td>Know the requirements to inspect, service and maintain ‘active’ solar thermal hot water systems</td>
<td>3</td>
<td>2</td>
<td>15</td>
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</tr>
<tr>
<td>K/602/3107</td>
<td>Inspect, service and maintain ‘active’ solar thermal hot water systems</td>
<td>3</td>
<td>2</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Totals</td>
<td>68</td>
<td>647</td>
<td>534</td>
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<tr>
<td>Optional Heat Pumps Units EN2</td>
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</tr>
<tr>
<td>Y/602/3054</td>
<td>Know the requirements to install, commission and handover heat pump systems non-refrigerant circuits</td>
<td>3</td>
<td>4</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>D/602/3072</td>
<td>Install, commission and handover heat pumps non-refrigerant circuits</td>
<td>3</td>
<td>2</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>F/602/3078</td>
<td>Know the requirements to inspect, service and maintain heat pump system installations non-refrigerant circuits</td>
<td>3</td>
<td>2</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>L/602/3083</td>
<td>Inspect, service and maintain heat pump installations non-refrigerant circuits</td>
<td>3</td>
<td>2</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>68</td>
<td>647</td>
<td>534</td>
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<table>
<thead>
<tr>
<th>Optional Water Recycling Units EN3</th>
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</thead>
<tbody>
<tr>
<td>T/602/3109</td>
<td>Know the requirements to install, commission and handover rainwater harvesting and greywater reuse systems</td>
<td>3</td>
<td>4</td>
<td>35</td>
</tr>
<tr>
<td>K/602/3110</td>
<td>Install, commission and handover rainwater harvesting and greywater reuse systems</td>
<td>3</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>M/602/3111</td>
<td>Know the requirements to inspect, service and maintain rainwater harvesting and greywater reuse systems</td>
<td>3</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>A/602/3130</td>
<td>Inspect, service and maintain rainwater harvesting and greywater reuse systems</td>
<td>3</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>68</td>
<td>647</td>
<td>534</td>
<td></td>
</tr>
</tbody>
</table>
Rules of Combination

Level 3 NVQ Diploma in Domestic Heating (Environmental Technology)

This is a Level 3 qualification of 68 credits and 534 guided learning hours consisting of 8 mandatory units with an additional 4 units from EN1, EN2 or EN3. ALL units must be achieved to achieve the overall qualification.

Successful completion of this qualification proves that learners are competent to install, commission, decommission, service and solar thermal hot water systems, heat pump systems or water harvesting systems. The qualification and unit details are shown below:

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<thead>
<tr>
<th>Qualification Title</th>
<th>Level 3 NVQ Diploma in Domestic Heating (Environmental Technology)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPEC Qualification Number</td>
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<td>31/08/2014</td>
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<td>Last Certification Date</td>
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</tbody>
</table>

<table>
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<tr>
<th>QCF Unit Ref</th>
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<th>Level</th>
<th>Credit Value</th>
<th>Notional Learning Time</th>
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</thead>
<tbody>
<tr>
<td>Mandatory Units</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R/602/2498</td>
<td>Understand how to organise resources within BSE</td>
<td>3</td>
<td>3</td>
<td>32</td>
<td>26</td>
</tr>
<tr>
<td>K/502/8930</td>
<td>Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques</td>
<td>3</td>
<td>9</td>
<td>95</td>
<td>76</td>
</tr>
<tr>
<td>K/502/9155</td>
<td>Understand and apply domestic hot water system installation, commissioning, service and maintenance techniques</td>
<td>3</td>
<td>9</td>
<td>95</td>
<td>76</td>
</tr>
<tr>
<td>M/502/9156</td>
<td>Understand and apply domestic central heating system installation, commissioning, service and maintenance techniques</td>
<td>3</td>
<td>12</td>
<td>122</td>
<td>98</td>
</tr>
<tr>
<td>T/502/9157</td>
<td>Understand and carry out electrical work on domestic plumbing and heating systems and components</td>
<td>3</td>
<td>12</td>
<td>128</td>
<td>102</td>
</tr>
<tr>
<td>A/502/8933</td>
<td>Install, commission, service and maintain heating systems</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>K/602/3138</td>
<td>Understand the Fundamental Principles and Requirements of Environmental Technology Systems</td>
<td>3</td>
<td>2</td>
<td>15</td>
<td>15</td>
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</tbody>
</table>

| Optional Solar Thermal Units EN1 | | |
|----------------------------------|---|---|---|
| F/602/3100 | Know the requirements to install, commission and handover solar thermal hot water systems | 3 | 4 | 35 | 35 |
| L/602/3102 | Install, commission and handover ‘active’ solar thermal hot water systems | 3 | 2 | 15 | 15 |
| Y/602/3104 | Know the requirements to inspect, service and maintain ‘active’ solar thermal hot water systems | 3 | 2 | 15 | 15 |
| K/602/3107 | Inspect, service and maintain ‘active’ solar thermal hot water systems | 3 | 2 | 15 | 15 |

| Totals | 60 | 540 | 477 |
### Optional Heat Pumps Units EN2

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>NLT</th>
<th>GLH</th>
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<tbody>
<tr>
<td>Y/602/3054</td>
<td>Know the requirements to install, commission and handover heat pump systems non-refrigerant circuits</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>D/602/3072</td>
<td>Install, commission and handover heat pumps non-refrigerant circuits</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>F/602/3078</td>
<td>Know the requirements to inspect, service and maintain heat pump system installations non-refrigerant circuits</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>L/602/3083</td>
<td>Inspect, service and maintain heat pump installations non-refrigerant circuits</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td>68</td>
<td>540</td>
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### Optional Water Recycling Units EN3

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>NLT</th>
<th>GLH</th>
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</thead>
<tbody>
<tr>
<td>T/602/3109</td>
<td>Know the requirements to install, commission and handover rainwater harvesting and greywater reuse systems</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>K/602/3110</td>
<td>Install, commission and handover rainwater harvesting and greywater reuse systems</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>M/602/3111</td>
<td>Know the requirements to inspect, service and maintain rainwater harvesting and greywater reuse systems</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>A/602/3130</td>
<td>Inspect, service and maintain rainwater harvesting and greywater reuse systems</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td>68</td>
<td>540</td>
</tr>
</tbody>
</table>

**Note**

Notional Learning Time (NLT) is the average time for a learner to achieve the learning outcomes and assessment criteria. An initial assessment of a learner’s ability to achieve the qualification should be carried out to estimate the learning time. It can be assumed that a learner with no previous experience in the work activity will require between 20 – 25% additional learning time to complete the qualification, whereas an experienced learner may require some 20 – 25% less learning time.

Guided Learning Hours (GLH) is the estimated number of hours of teacher supervised or directed study time required to teach the qualification and each unit.
**Unit Details**

The next pages detail the requirements of the individual Plumbing and Heating Units:

<table>
<thead>
<tr>
<th>QCF Unit Ref</th>
<th>Level 1 Unit Title</th>
<th>Page</th>
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</thead>
<tbody>
<tr>
<td>Y/502/8180</td>
<td>Understand fundamental scientific principles within building services engineering</td>
<td>18</td>
</tr>
<tr>
<td>K/505/9403</td>
<td>Understand and carry out copper pipe fabrication work for domestic plumbing systems</td>
<td>21</td>
</tr>
<tr>
<td>K/505/9417</td>
<td>Understand and carry out low carbon steel pipe fabrication work for domestic plumbing systems</td>
<td>24</td>
</tr>
<tr>
<td>M/505/9418</td>
<td>Understand and carry out plastic pipe fabrication work for domestic plumbing systems</td>
<td>26</td>
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<tr>
<td>K/505/9420</td>
<td>Understand the key features of domestic plumbing systems</td>
<td>27</td>
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<tr>
<td>T/505/9419</td>
<td>Understand and demonstrate techniques for installing and securing plumbing pipework</td>
<td>30</td>
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<tr>
<td>QCF Unit Ref</td>
<td>Level 2 Unit Title</td>
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<tr>
<td>J/602/2479</td>
<td>Understand and carry out safe working practices in building services engineering</td>
<td>33</td>
</tr>
<tr>
<td>J/602/2482</td>
<td>Understand how to communicate with others within Building Services Engineering</td>
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<tr>
<td>D/602/2486</td>
<td>Understand how to apply environmental protection measures within BSE</td>
<td>44</td>
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<tr>
<td>J/602/2496</td>
<td>Understand how to apply scientific principles within MES</td>
<td>48</td>
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<tr>
<td>D/602/2682</td>
<td>Understand and carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems</td>
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<tr>
<td>H/602/2697</td>
<td>Understand and apply domestic cold water system installation and maintenance techniques</td>
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<td>F/602/2884</td>
<td>Understand and apply domestic hot water system installation and maintenance techniques</td>
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<tr>
<td>Y/602/2888</td>
<td>Understand and apply domestic central heating system installation and maintenance techniques</td>
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<td>F/602/2917</td>
<td>Understand and apply domestic rainwater system installation and maintenance techniques</td>
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<td>J/602/2921</td>
<td>Understand and apply domestic above ground drainage system installation and maintenance techniques</td>
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<tr>
<td>T/602/2493</td>
<td>Apply safe working practices in building services engineering working environment</td>
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<tr>
<td>D/602/2939</td>
<td>Install and Maintain domestic plumbing and heating systems</td>
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<tr>
<td>R/602/2971</td>
<td>Install and Maintain domestic heating systems</td>
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<td>QCF Unit Ref</td>
<td>Level 3 Unit Title</td>
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<tr>
<td>R/602/2498</td>
<td>Understand how to organise resources within BSE</td>
<td>102</td>
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<tr>
<td>K/502/8930</td>
<td>Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques</td>
<td>105</td>
</tr>
<tr>
<td>K/502/9155</td>
<td>Understand and apply domestic hot water system installation, commissioning, service and maintenance techniques</td>
<td>111</td>
</tr>
<tr>
<td>M/502/9156</td>
<td>Understand and apply domestic central heating system installation, commissioning, service and maintenance techniques</td>
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<tr>
<td>T/502/9157</td>
<td>Understand and carry out electrical work on domestic plumbing and heating systems and components</td>
<td>124</td>
</tr>
<tr>
<td>D/502/9296</td>
<td>Understand and apply domestic sanitation system installation, commissioning, service and maintenance techniques</td>
<td>134</td>
</tr>
<tr>
<td>K/502/9298</td>
<td>Install, commission, service and maintain domestic plumbing and heating systems</td>
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</tr>
<tr>
<td>A/502/8933</td>
<td>Install, commission, service and maintain heating systems</td>
<td>143</td>
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<tr>
<td>J/502/9390</td>
<td>Understand core gas safety principles for natural gas within domestic building services engineering</td>
<td>146</td>
</tr>
<tr>
<td>H/502/8487</td>
<td>Specific Core Installation and Maintenance</td>
<td>160</td>
</tr>
<tr>
<td>T/502/8381</td>
<td>Install, commission and de-commission gas pipework up to 35mm 1¼ diameter in domestic and small commercial premises</td>
<td>167</td>
</tr>
<tr>
<td>D/503/8628</td>
<td>Tightness test, purge, commission and de-commission gas pipework up to 35mm 1¼ diameter in small natural gas installations</td>
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<td>Install, commission and handover heat pumps non-refrigerant circuits</td>
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<td>Inspect, service and maintain rainwater harvesting and greywater reuse systems</td>
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</table>
Y/502/8180 - Understand fundamental scientific principles within building services engineering

The knowledge unit provides learning in the basic essential scientific principles that apply to building services engineering work activities.

Upon completion of the unit the learners will:

- Know the standard units of measurement used in the building services engineering industry
- Know the properties of materials used in the building services engineering industries
- Know the basic principles for energy, heat and power in the building services engineering industry
- Know the principles of force and pressure and their application in the building services engineering industries
- Know simple mechanical principles and their application in the building services engineering industries
- Know the principles of electricity as they relate to the building services engineering industries

### Learning Outcome 1

Know the standard units of measurement used in the building services engineering industry

#### Assessment Criteria

1.1 Define internationally recognised (SI) units of measurement for:
   - a. Metre (length)
   - b. Kilogram (mass)
   - c. Second (time)
   - d. Kelvin (temperature)

1.2 Define SI derived units for:
   - a. Area (m²)
   - b. Volume (m³)
   - c. Litres (L)
   - d. Density (kg/m³)
   - e. Velocity (m/s)

### Learning Outcome 2

Know the properties of materials used in the building services engineering industries

#### Assessment Criteria

2.1 Identify the types of solid materials used in the building services industry
   - a. Metals
   - b. Plastics
   - c. Fireclays/ceramics

2.2 Give examples of the properties of solid materials
   - a. Strength – tensile and compressive
   - b. Hardness
   - c. Ductility
   - d. Malleability
   - e. Conductivity – heat and electricity
### Learning Outcome 3

**Know the basic principles for energy, heat and power in the building services engineering industry**

**Assessment Criteria**

3.1 Indicate the relationship between the Celsius and Kelvin temperature scales  
   a. Units of temperature measurement  
   b. Temperature measurement devices used  
3.2 Identify the terminology associated with a change of state  
   a. Solid, liquid & gas  
3.3 Give examples of heat transfer  
   a. Conduction in solids  
   b. Convection in liquids and gases  
   c. Radiation between two bodies  
3.4 Indicate how units of energy and heat are related  
   a. Energy – Joules (J)  
   b. Specific heat capacity (kJ/kg/°C)  
   c. Power – Watts (W)

### Learning Outcome 4

**Know the principles of force and pressure and their application in the building services engineering industries**

**Assessment Criteria**

4.1 Give examples of the relationship between velocity, pressure and flow rate in systems  
   a. Effects of increasing/reducing pipe size on  
   b. Velocity and flow rate at constant pressure  
4.2 Identify the reasons why pipework restricts the flow of liquids and gases  
   a. Changes of direction, bends and tees  
   b. Pipe size  
   c. Friction

### Learning Outcome 5

**Know simple mechanical principles and their application in the building services engineering industries**

**Assessment Criteria**

5.1 State the principles behind simple machines  
   a. Mechanical advantage  
5.2 Indicate the principles of basic mechanics  
   a. Theory of moments  
   b. Action & reaction  
   c. Centre of gravity  
   d. Equilibrium
## Learning Outcome 6

Know the principles of electricity as they relate to the building services engineering industries

### Assessment Criteria

6.1 Outline the basic principles of electron flow theory
   a. Measurements of electrical flow
   b. Material conductivity and resistance
   c. Direct and alternating current

6.2 Use simple units of electrical measurement
   a. Current (Amps)
   b. Voltage (Volts)
   c. Resistance (Ohms)
   d. Power (Watts)

6.3 State how to carry out simple electrical calculations
   a. Ohm’s law
   b. Voltage, current and resistance in series circuits
Understand and carry out copper pipe fabrication work for domestic plumbing systems

The combination unit provides learning in the essential job knowledge and basic skills required to safely fabricate copper pipe for use in domestic plumbing systems. The unit is designed to cover work that is applicable to new-build domestic construction sites and refurbishment work in occupied and unoccupied domestic properties. Upon completion of the unit the learners will:

- Be able to apply Health and Safety procedures during completion of work activities
- Know the hand tools that are used for copper pipe fabrication work
- Be able to safely use hand tools to carry out copper pipe fabrication work
- Know the materials and components used for copper pipe fabrications
- Know the procedures for completing basic copper pipe fabrication processes
- Be able to carry out basic copper pipe fabrication processes

**Learning Outcome 1**
Be able to apply Health and Safety procedures during completion of work activities

**Assessment Criteria**

1.1 Identify and correctly use appropriate items of Personal Protective Equipment for copper pipe fabrication activities
1.2 Check work area for potential hazards before beginning work
1.3 Report any potential hazards noticed before or during completion of work activities

**Learning Outcome 2**
Know the hand tools that are used for copper pipe fabrication work

**Assessment Criteria**

2.1 List the hand tools that are used for the following copper pipe fabrication work activities:
   a. Measuring and marking out
   b. Cutting and de-burring
   c. Bending
   d. Jointing by mechanical means
   e. Jointing by use of heating equipment
2.2 State how to safely use and look after hand tools that are required for copper pipe fabrication work
### Learning Outcome 3

**Be able to safely use hand tools to carry out copper pipe fabrication work**

**Assessment Criteria**

3.1 Demonstrate how to safely use the following hand tools and equipment for copper pipe fabrication work:

- a. Tape measure and pencil/marker
- b. Pipe slice/pipe cutter
- c. Junior hacksaw
- d. De-burring tool
- e. Bending machine
- f. Set square
- g. Folding metallic ruler
- h. Grips/pump pliers/joint pliers
- i. Adjustable spanners
- j. Small blowlamp
- k. Wire wool/cleaner
- l. Soldering mat

### Learning Outcome 4

**Know the materials and components used for copper pipe fabrications**

**Assessment Criteria**

4.1 State the sizes of copper pipe that are typically used in domestic plumbing systems

4.2 State the types of fittings that are used for copper pipework fabrications in domestic plumbing systems

4.3 Identify materials and equipment that are used for:

- a. Cleaning and preparing copper pipe for mechanical jointing
- b. Cleaning and preparing copper pipe for jointing by use of heating equipment
- c. Fixing and securing copper pipework to building fabric

### Learning Outcome 5

**Know the procedures for completing basic copper pipe fabrication processes**

**Assessment Criteria**

5.1 State the types of drawings and specifications used to detail copper pipe fabrications

5.2 Identify basic information (component/fitting type, pipe sizes etc) from drawings

5.3 State the correct procedures for fabricating copper pipe:

- a. Measuring and marking out
- b. Cutting and de-burring
- c. Producing 90° bends and off-sets

5.4 State the correct procedures for jointing copper pipe using the following methods:

- a. Mechanical (compression + plastic push fit)
- b. Capillary (solder ring + end feed)

5.5 State the correct procedures for fixing and securing copper pipe to building fabric

5.6 List the basic steps for pressure testing copper pipe assemblies
<table>
<thead>
<tr>
<th>Learning Outcome 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be able to carry out basic copper pipe fabrication processes</td>
</tr>
<tr>
<td><strong>Assessment Criteria</strong></td>
</tr>
<tr>
<td>6.1 Correctly read basic drawings and specifications to identify fabrication requirements</td>
</tr>
<tr>
<td>6.2 Accurately measure copper pipe and safely cut to required size</td>
</tr>
<tr>
<td>6.3 Safely use bending equipment to fabricate copper pipe to include completion of:</td>
</tr>
<tr>
<td>a. 90° bends</td>
</tr>
<tr>
<td>b. Off-sets</td>
</tr>
<tr>
<td>6.4 Fabricate a copper pipe frame using mechanical and soldered jointing techniques</td>
</tr>
<tr>
<td>6.5 Demonstrate the basic procedure for leak testing a copper pipe assembly</td>
</tr>
<tr>
<td>6.6 Demonstrate the correct procedures for tidying the work area upon completion of work activities, including:</td>
</tr>
<tr>
<td>a. Returning tools and equipment</td>
</tr>
<tr>
<td>b. Returning excess materials to stores</td>
</tr>
<tr>
<td>c. Safe disposal of waste</td>
</tr>
</tbody>
</table>
K/505/9417 - Understand and carry out low carbon steel pipe fabrication work for domestic plumbing systems

The combination unit provides learning in the essential job knowledge and basic skills required to safely fabricate low carbon steel pipe. Upon completion of the unit the learners will:
- Be able to apply Health and Safety procedures during completion of work activities
- Know the hand tools that are used for low carbon steel pipe fabrication work
- Be able to safely use hand tools to carry out low carbon steel pipe fabrication work
- Know the materials and components used for low carbon steel pipe fabrications
- Know the procedures for completing basic low carbon steel pipe fabrication processes
- Be able to carry out basic low carbon steel pipe fabrication processes

<table>
<thead>
<tr>
<th>Learning Outcome 1</th>
<th>Be able to apply Health and Safety procedures during completion of work activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment Criteria</strong></td>
<td></td>
</tr>
<tr>
<td>1.1 Identify and correctly use appropriate items of Personal Protective Equipment for low carbon steel pipe fabrication activities</td>
<td></td>
</tr>
<tr>
<td>1.2 Check work area for potential hazards before beginning work</td>
<td></td>
</tr>
<tr>
<td>1.3 Report any potential hazards noticed before or during completion of work activities</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Outcome 2</th>
<th>Know the hand tools that are used for low carbon steel pipe fabrication work</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment Criteria</strong></td>
<td></td>
</tr>
<tr>
<td>2.1 List the hand tools that are used for the following low carbon steel pipe fabrication work activities:</td>
<td></td>
</tr>
<tr>
<td>a. Measuring and marking out</td>
<td></td>
</tr>
<tr>
<td>b. Cutting and de-burring</td>
<td></td>
</tr>
<tr>
<td>c. Hydraulic bending</td>
<td></td>
</tr>
<tr>
<td>d. Jointing by mechanical means</td>
<td></td>
</tr>
<tr>
<td>2.2 State how to safely use and look after hand tools that are required for low carbon steel pipe fabrication work</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Outcome 3</th>
<th>Be able to safely use hand tools to carry out low carbon steel pipe fabrication work</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment Criteria</strong></td>
<td></td>
</tr>
<tr>
<td>3.1 Demonstrate how to safely use the following hand tools and equipment for low carbon steel pipe fabrication work:</td>
<td></td>
</tr>
<tr>
<td>a. Tape measure and pencil/marker</td>
<td></td>
</tr>
<tr>
<td>b. Pipe/tube cutter</td>
<td></td>
</tr>
<tr>
<td>c. Large frame hacksaw</td>
<td></td>
</tr>
<tr>
<td>d. File</td>
<td></td>
</tr>
<tr>
<td>e. Hydraulic bending machine</td>
<td></td>
</tr>
<tr>
<td>f. Set square</td>
<td></td>
</tr>
<tr>
<td>g. Manual pipe threading equipment</td>
<td></td>
</tr>
<tr>
<td>h. Wire brush</td>
<td></td>
</tr>
<tr>
<td>i. Stilsons/pipe wrench</td>
<td></td>
</tr>
<tr>
<td>j. Spanners/adjustable spanners</td>
<td></td>
</tr>
<tr>
<td>k. Pipe vice</td>
<td></td>
</tr>
</tbody>
</table>
### Learning Outcome 4
Know the materials and components used for low carbon steel pipe fabrications

**Assessment Criteria**

<table>
<thead>
<tr>
<th>4.1</th>
<th>State the sizes of low carbon steel pipe that are commonly used</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2</td>
<td>State the types of fittings that are used for low carbon steel pipe fabrications</td>
</tr>
<tr>
<td>4.3</td>
<td>Identify materials and equipment that are used for:</td>
</tr>
<tr>
<td></td>
<td>a. Cleaning and preparing low carbon steel pipe for mechanical jointing</td>
</tr>
<tr>
<td></td>
<td>b. Fixing and securing low carbon steel pipework to building fabric</td>
</tr>
</tbody>
</table>

### Learning Outcome 5
Know the procedures for completing basic low carbon steel pipe fabrication processes

**Assessment Criteria**

<table>
<thead>
<tr>
<th>5.1</th>
<th>State the types of drawings and specifications used to detail low carbon steel pipe fabrications</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.2</td>
<td>Identify basic information (component/fitting type, pipe sizes etc) from drawings</td>
</tr>
<tr>
<td>5.3</td>
<td>State the correct procedures for fabricating low carbon steel pipe:</td>
</tr>
<tr>
<td></td>
<td>a. Measuring and marking out</td>
</tr>
<tr>
<td></td>
<td>b. Cutting and reaming</td>
</tr>
<tr>
<td></td>
<td>c. Cutting threads</td>
</tr>
<tr>
<td></td>
<td>d. Producing 90° bends using hydraulic bending machine</td>
</tr>
<tr>
<td>5.4</td>
<td>State the correct procedures for joining low carbon steel pipe using threaded and screwed joints</td>
</tr>
<tr>
<td>5.5</td>
<td>State the correct procedures for fixing and securing low carbon steel pipe to building fabric</td>
</tr>
<tr>
<td>5.6</td>
<td>List the basic steps for pressure testing low carbon steel pipe assemblies</td>
</tr>
</tbody>
</table>

### Learning Outcome 6
Be able to carry out basic low carbon steel pipe fabrication processes

**Assessment Criteria**

<table>
<thead>
<tr>
<th>6.1</th>
<th>Correctly read basic drawings and specifications to identify fabrication requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.2</td>
<td>Accurately measure low carbon steel pipe and safely cut to required size</td>
</tr>
<tr>
<td>6.3</td>
<td>Safely use hydraulic bending equipment to fabricate 90° bends in low carbon steel pipe</td>
</tr>
<tr>
<td>6.4</td>
<td>Fabricate a low carbon steel pipe frame using screwed joints</td>
</tr>
<tr>
<td>6.5</td>
<td>Demonstrate the basic procedure for leak testing a low carbon steel pipe assembly</td>
</tr>
<tr>
<td>6.6</td>
<td>Demonstrate the correct procedures for tidying the work area upon completion of work activities, including:</td>
</tr>
<tr>
<td></td>
<td>a. Returning tools and equipment</td>
</tr>
<tr>
<td></td>
<td>b. Returning excess materials to stores</td>
</tr>
<tr>
<td></td>
<td>c. Safe disposal of waste</td>
</tr>
</tbody>
</table>
M/505/9418 - Understand and carry out plastic pipe fabrication work for domestic plumbing systems

The combination unit provides learning in the essential job knowledge and basic skills required to safely fabricate plastic pipe for use in domestic plumbing systems. The unit is designed to cover work that is applicable to new-build domestic construction sites and refurbishment work in occupied and unoccupied domestic properties. Upon completion of the unit the learners will:

- Be able to apply Health and Safety procedures during completion of work activities
- Know the hand tools that are used for plastic pipe fabrication work
- Be able to safely use hand tools to carry out plastic pipe fabrication work
- Know the materials and components used for plastic pipe fabrications
- Know the procedures for completing basic plastic pipe fabrication processes
- Be able to carry out basic plastic pipe fabrication processes

### Learning Outcome 1

Be able to apply Health and Safety procedures during completion of work activities

#### Assessment Criteria

1.1 Identify and correctly use appropriate items of Personal Protective Equipment for plastic pipe fabrication activities
1.2 Check work area for potential hazards before beginning work
1.3 Report any potential hazards noticed before or during completion of work activities

### Learning Outcome 2

Know the hand tools that are used for plastic pipe fabrication work

#### Assessment Criteria

2.1 List the hand tools that are used for the following plastic pipe fabrication work activities:
   a. Measuring and marking out
   b. Cutting and preparing
   c. Jointing by mechanical means
2.2 State how to safely use and look after hand tools that are required for plastic pipe fabrication work

### Learning Outcome 3

Be able to safely use hand tools to carry out plastic pipe fabrication work

#### Assessment Criteria

3.1 Demonstrate how to safely use the following hand tools and equipment for plastic pipe fabrication work:
   a. Tape measure and pencil/marker
   b. Plastic pipe cutters/ratchet
   c. De-mounting tool
   d. Adjustable spanner
   e. Screwdrivers
### Learning Outcome 4
Know the materials and components used for plastic pipe fabrications

**Assessment Criteria**

4.1 State the sizes of plastic pipe that is commonly used in domestic water and heating supply systems
4.2 State the sizes of plastic pipe that is commonly used in domestic waste systems
4.3 State the types of fittings that are commonly used for plastic pipe fabrications
4.4 Identify materials and equipment that are used for:
   - Cleaning and preparing plastic pipe for mechanical jointing and jointing using solvent cement
   - Fixing and securing plastic pipe to building fabric

### Learning Outcome 5
Know the procedures for completing basic plastic pipe fabrication processes

**Assessment Criteria**

5.1 State the types of drawings and specifications used to detail plastic pipe fabrications
5.2 Identify basic information (component/fitting type, pipe sizes etc) from drawings
5.3 State the correct procedures for fabricating plastic pipe:
   - Measuring and marking out
   - Cutting and preparing pipe for installation
5.4 State the correct procedures for jointing plastic pipe using the following methods:
   - Compression
   - Push fit
   - Solvent cement
5.5 State the correct procedures for fixing and securing plastic pipe to building fabric
5.6 List the basic steps for pressure testing plastic pipe assemblies

### Learning Outcome 6
Be able to carry out basic plastic pipe fabrication processes

**Assessment Criteria**

6.1 Correctly read basic drawings and specifications to identify fabrication requirements
6.2 Accurately measure plastic pipe and safely cut to required size
6.3 Fabricate a plastic waste pipe frame using push fit and compression jointing techniques
6.4 Fabricate a plastic water or heating supply pipe frame using push fit jointing techniques
6.5 Demonstrate the basic procedure for leak testing a plastic pipe assembly
6.6 Demonstrate the correct procedures for tidying the work area upon completion of work activities, including:
   - Returning tools and equipment
   - Returning excess materials to stores
   - Safe disposal of waste
K/505/9420 - Understand the key features of domestic plumbing systems

This knowledge unit provides learning in the essential job knowledge relating to the characteristics of key domestic plumbing systems. Upon completion of the unit the learners will:

- Know the key regulations that apply to domestic plumbing installations
- Know the key features of domestic plumbing systems
- Know the key components in basic domestic plumbing systems
- Know the basic requirements for testing domestic plumbing systems
- Know the basic procedures for decommissioning plumbing systems

**Learning Outcome 1**
Know the key regulations that apply to domestic plumbing installations

**Assessment Criteria**

1.1 List the key regulations that apply to the installation of:
   - a. Cold water systems
   - b. Hot water systems
   - c. Domestic heating systems (wet)
   - d. Above ground discharge systems

**Learning Outcome 2**
Know the key features of domestic plumbing systems

**Assessment Criteria**

2.1 State the key features of the following domestic cold water systems:
   - a. Direct
   - b. Indirect
2.2 State the key features of the following domestic hot water systems
   - a. Direct
   - b. Indirect
   - c. Vented
   - d. Unvented
2.3 State the key features of domestic heating and hot water systems which utilise:
   - a. Combination boilers
   - b. System boilers with separate hot water storage vessels
2.4 State the key features of the primary ventilated stack syst

**Learning Outcome 3**
Know the key components in basic domestic plumbing systems

**Assessment Criteria**

3.1 Identify the location and purpose of the following cold water system components:
   - a. Supply pipe
   - b. Stop valve
   - c. Drain valve
   - d. Cold Water Storage Cistern
   - e. Service valve
3.2 Identify the location and purpose of the following hot water system components:
   - a. Hot water storage cylinder
   - b. Coil type heat exchanger
   - c. Feed and expansion cistern
   - d. Service valve
### Learning Outcome 3  Continued

**Assessment Criteria**

3.3 Identify the location and purpose of the following hot water heating system components:
   a. Flow and return pipework
   b. Motorised valves
   c. Room thermostats
   d. Cylinder thermostats
   e. Radiators
   f. Pump

3.4 Identify the location and purpose of the following above ground discharge system components:
   a. Traps
   b. Long radius bend
   c. Flushing cisterns and devices

### Learning Outcome 4

**Assessment Criteria**

4.1 List the test equipment that is required for:
   a. Cold and hot water systems
   b. Above ground discharge systems

4.2 State the basic procedure for carrying out soundness tests on:
   a. Cold and hot water systems
   b. Above ground discharge systems

4.3 State what is meant by commissioning

### Learning Outcome 5

**Assessment Criteria**

5.1 State what is meant by decommissioning

5.2 List the steps that must be undertaken when decommissioning plumbing systems
T/505/9419 - Understand and demonstrate techniques for installing and securing plumbing pipework

This knowledge unit provides learning in the essential job knowledge and skills relating to the methods and techniques for fixing and securing domestic plumbing pipework. Upon completion of the unit the learners will:

- Know the hand and power tools that are used for installing and securing plumbing pipework
- Know the safety requirements for using power tools in the installation of plumbing pipework
- Know the safety requirements for using hand tools in the installation of plumbing pipework
- Be able to safely use hand and power tools to drill and fix pipe supports and brackets
- Know the requirements for selecting, positioning and fixing pipe supports and brackets for different types of plumbing pipework
- Be able to correctly position and fix pipe supports and brackets for different types of plumbing pipework

### Learning Outcome 1

**Know the hand and power tools that are used for installing and securing plumbing pipework**

**Assessment Criteria**

1.1 List the hand tools that are used for drilling and fixing pipe supports and brackets
1.2 List the power tools that are used for drilling and fixing pipe supports and brackets

### Learning Outcome 2

**Know the safety requirements for using power tools in the installation of plumbing pipework**

**Assessment Criteria**

2.1 Identify the appropriate Personal Protective Equipment (PPE) to be used when drilling through different types of building fabric:
   - Brick work/block work
   - Plaster/ plasterboard
   - Timber
2.2 State the safety requirements for using the following power tools:
   - Power drills
   - Cordless drills
2.3 List the basic pre-use and maintenance checks that should be performed before and after power tool use

### Learning Outcome 3

**Know the safety requirements for using hand tools in the installation of plumbing pipework**

**Assessment Criteria**

3.1 Identify the appropriate Personal Protective Equipment (PPE) that should be worn when using hand tools to install plumbing pipework
3.2 State the safety requirements for using the following hand tools:
   - Hammers
   - Screwdrivers
   - Wood chisels
3.3 List the basic pre-use and maintenance checks that should be performed before and after hand tool use
Learning Outcome 4

Be able to safely use hand and power tools to drill and fix pipe supports and brackets

Assessment Criteria

4.1 Select appropriate PPE for the required work operation
4.2 Demonstrate the correct use of Personal Protective Equipment when drilling and fixing pipe supports and brackets
4.3 Demonstrate methods for safely using the following power tools when drilling and fixing pipe supports and brackets:
   a. Power drills
   b. Cordless drills
4.4 Demonstrate methods for safely using the following hand tools during the installation of pipe supports and brackets:
   a. Tape measure
   b. Hammer
   c. Screwdrivers
   d. Spirit level
   e. Plumb line

Learning Outcome 5

Know the requirements for selecting, positioning and fixing pipe supports and brackets for different types of plumbing pipework

Assessment Criteria

5.1 Identify appropriate pipe brackets for the fixing of:
   a. Copper pipe
   b. Low carbon steel pipe
   c. Plastic pipe (soil and waste systems)
   d. Plastic pipe (water supply or heating systems)
5.2 State the recommended pipe support/bracket spacings for:
   a. Copper pipe in vertical and horizontal positions
   b. Low carbon steel pipe in vertical and horizontal positions
   c. Plastic waste pipe in vertical and horizontal positions
5.3 List the different methods that may be used for fixing pipework supports and brackets to the building fabric
5.4 Identify the different types of wall plug that can be used to help secure pipe brackets and supports
5.5 Identify the following types of drill bits and when they should be used:
   a. Wood bits
   b. Hole saws
   c. Diamond tipped bits
   d. Masonry drill bits
5.6 List the precautions that should be taken before drilling into building fabric
### Learning Outcome 6

Be able to correctly position and fix pipe supports and brackets for different types of plumbing pipework

### Assessment Criteria

6.1 Select appropriate pipe supports and brackets for a given task
6.2 Check the correct spacing requirements for the pipe supports/brackets
6.3 Demonstrate the techniques for measuring, marking out, drilling and fixing pipe supports/brackets to different types of building fabric, including:
   - a. Blockwork/brickwork
   - b. Timber
6.4 Demonstrate the correct procedures for tidying the work area upon completion of work activities, including:
   - a. Returning tools and equipment
   - b. Returning excess materials to stores
   - c. Safe disposal of waste
**J/602/2479 - Understand and carry out safe working practices in building services engineering**

The combination unit provides learning in the essential health & safety job knowledge required to work safely in the Building Services Engineering Industries. The essential job knowledge covered relates to work on new-build construction sites (dwellings and industrial/commercial buildings) and refurbishment work in occupied and unoccupied properties (dwellings and industrial/commercial buildings). Upon completion of the unit the learners will:

- Know the health and safety legislation that applies to the building services industry
- Know how to recognise and respond to hazardous situations while working in the building services industry
- Know the safe personal protection measures while working in the building services industry
- Be able to apply manual handling techniques
- Know how to respond to accidents that occur while working in the building services industry
- Know the procedures for electrical safety when working in the building services industry
- Be able to apply basic electrical safety measures in the building services industry
- Know the methods of working safely with heat producing equipment in the building services industry
- Be able to safely work with gas heating equipment in the building services industry
- Know the methods of safely using access equipment in the building services industry
- Be able to safely use access equipment in the building services industry
- Know the methods of working safely in excavations and confined spaces in the building services industry

### Learning Outcome 1

**Know the Health and Safety legislation that applies to the building services industry**

#### Assessment Criteria

1.1 State the aims of Health and Safety legislation in protecting the workforce and members of the public.
   - a. General legislation
   - b. Construction specific legislation
   - c. Building services specific legislation

1.2 Identify the responsibilities of members of the construction team under health & safety legislation.
   - a. Employers (including employer representatives)
   - b. Designers
   - c. Main contractors
   - d. Sub-contractors
   - e. Employees
   - f. Self-employed (labour only)
   - g. Clients (customers)

1.3 State the legal status of health and safety guidance materials.
   - b. Regulations
   - c. Approved Codes of Practice
   - d. HSE Guidance Notes
### Learning Outcome 1  Continued

**Know the Health and Safety legislation that applies to the building services industry**

**Assessment Criteria**

1.4 State the role of enforcing authorities under health & safety legislation.
   - a. Health & Safety Executive
   - b. Local Authority

1.5 Identify the powers of inspectors under health & safety legislation.
   - a. Improvement notice
   - b. Prohibition notice
   - c. Powers of prosecution
   - d. Role in providing advice and guidance

### Learning Outcome 2

**Know how to recognise and respond to hazardous situations while working in the building services industry**

**Assessment Criteria**

2.1 Identify the types of general site hazards that may be encountered while at work.
   - Site/work area cleanliness:
     - a. Tripping hazards
     - b. Slipping hazards
   - Using equipment:
     - a. Inadequate or lack of personal protective equipment
     - b. Defective (unsafe) equipment
   - Personal conduct:
     - a. Manual handling
     - b. Working at heights

2.2 State the potential dangers to the workforce and members of the public when work is carried out.
   - a. On construction sites (all property types)
   - b. In industrial commercial premises (occupied and unoccupied refurbishment)
   - c. In dwellings (occupied and unoccupied refurbishment)

2.3 Identify the methods that can be used to prevent accidents or dangerous situations occurring during work activities.
   - Working practices (use and understanding of):
     - a. Method statements
     - b. Permit to work systems
     - c. Risk assessments
   - Safety notices (use and understanding of):
     - a. Mandatory signs
     - b. Prohibition signs
     - c. Hazard signs
     - d. Fire fighting signs
     - e. Safe condition signs
     - f. Combination signs
## Learning Outcome 2 Continued

Know how to recognise and respond to hazardous situations while working in the building services industry

### Assessment Criteria

2.4 Identify how hazardous substance legislation classifies substances and the direct precautions to be taken while working with those substances.

- a. Toxic
- b. Harmful
- c. Corrosive
- d. Irritant
- e. Oxidising
- f. Extremely flammable

2.5 Identify the general precautions necessary for working with commonly encountered substances.

- a. Lead - solid and fume
- b. Solvents and lubricants
- c. Fluxes
- d. Jointing compounds
- e. Sealants
- f. Gases – LPG, oxy-acetylene and carbon dioxide
- g. Cleaning agents

2.6 State the range of common building materials and services components that may contain asbestos

2.7 Identify the types of asbestos that may be encountered in the workplace:

- a. White asbestos (Chrysotile)
- b. Brown or grey asbestos (Amosite)
- c. Blue asbestos (Crocidolite)
- d. Asbestos cement materials

2.8 State the procedures that must be used to safely work with asbestos cement based materials.

- a. Flue, soil, rainwater pipes and gutters
- b. Tanks and cisterns
- c. Artex
- d. Small gaskets and seals

2.9 Identify the actions to be taken when asbestos is encountered while undertaking work activities.

- a. Protection of the workforce and members of the public.
- b. Licensing requirements for asbestos removal organisations
- c. Safe disposal requirements
### Learning Outcome 3

**Know the safe personal protection measures while working in the building services industry**

**Assessment Criteria**

3.1 State the purpose of, and application of protective equipment.
   a. Clothing protection including high visibility
   b. Eye protection
   c. Hand protection
   d. Head protection
   e. Foot protection
   f. Hearing protection
   g. Respiratory protection

3.2 Identify the procedures for manually handling heavy and bulky items.
   a. Assessment of a safe load that a person can lift
   b. Application of safe kinetic lifting technique
   c. Use of simple mechanical lifting aids – sack trolley
   d. Application and use of mechanical lifting aids on large construction sites

### Learning Outcome 4

**Be able to apply manual handling techniques**

**Assessment Criteria**

4.1 Perform manual handling of heavy and bulky items
   a. Plan the lift
   b. Safely move the load
   c. Assist in a two-person lift

4.2 Manually handle loads using mechanical lifting aids

### Learning Outcome 5

**Know how to respond to accidents that occur while working in the building services industry**

**Assessment Criteria**

5.1 Identify the requirements for first aid provision while working:
   a. In small occupied properties
   b. On construction sites (new-build and refurbishment)

5.2 Identify the actions that should be taken when an accident or emergency is discovered.
   a. Raising the alarm
   b. The role of the emergency services and contact methods
   c. Typical emergency evacuation procedures

5.3 State the procedures for dealing with minor injuries that can occur while working.
   a. Cuts
   b. Minor burns
   c. Objects in the eye
   d. Exposure to fumes

5.4 State the procedures for dealing with major injuries that can occur while working.
   a. Statutory requirements for the reporting of accidents/serious occurrences
   b. The use of company accident books
   c. The details to be recorded on a simple accident/incident report form
**Learning Outcome 6**

**Know the procedures for electrical safety when working in the building services industry**

**Assessment Criteria**

6.1 Identify the common electrical dangers encountered on construction sites and in private dwellings
   a. Faulty electrical equipment
   b. Signs of damaged or worn electrical cables – power tools and property hard wiring system
   c. Trailing cables
   d. Proximity of cables to services pipework
   e. Buried/hidden cables
   f. Inadequate over-current protection devices

6.2 Identify the methods of safely using electrical tools and equipment on site.
   a. Battery powered supplies
   b. 110 volt supplies
   c. 230 volt supplies

6.3 Identify how to conduct a visual inspection of a power tool for safe condition before use.
   a. Checking for a valid PAT test
   b. Inspection for general condition

6.4 State the procedure that should be applied for tools and equipment that fail safety checks.

6.5 State the electrical industry safe isolation procedure that should be applied to building services equipment before carrying out work on them.

6.6 State the use of temporary continuity bonding when working on pipework components.

---

**Learning Outcome 7**

**Be able to apply basic electrical safety measures in the building services industry**

**Assessment Criteria**

7.1 Demonstrate the electrical industry safe isolation procedure to safely isolate an item of fixed mechanical or electrical plant or equipment.

7.2 Carry out a visual safety inspection of power tools before use and report on their condition.

7.3 Demonstrate the application of temporary continuity bonding when cutting into a fixed metallic pipework system.

---

**Learning Outcome 8**

**Know the methods of working safely with heat producing equipment in the building services industry**

**Assessment Criteria**

8.1 Identify the various types of gases used in pipe and sheet jointing processes
   a. Bottle colours
   b. Properties of the gases used
   c. Uses within the industry

8.2 Identify how bottled gases and equipment should be safely transported and stored.
### Learning Outcome 8  Continued

Know the methods of working safely with heat producing equipment in the building services industry

#### Assessment Criteria

8.3 Identify the various types of heat producing equipment and how to check them for safety.
   - a. Hoses
     - Colours used
     - Thread directions
     - Flashback arrestors
   - b. Control valves
   c. Gauges
   d. Blowpipes
   e. Direct connecting combined units (aeration in the nozzle)

8.4 Identify how gas heating equipment is safely assembled and used
   - a. Bottle location and position
   - b. Equipment assembly sequence
   - c. Leak detection procedures
   - d. Safe purging procedure
   - e. Safe lighting and extinguishing procedure
   - f. Actions in the event of leakage

8.5 Identify the three elements of the fire triangle and how combustion takes place.

8.6 State the dangers of working with heat producing equipment and how to prevent fires occurring.
   - State the method for fighting small localised fires that can occur in the workplace.
     - a. When to avoid tackling fires
     - b. Types of extinguisher
     - c. Selection of extinguisher by fire type
     - d. Method of use

### Learning Outcome 9

Be able to safely work with gas heating equipment in the building services industry.

#### Assessment Criteria

9.1 Perform a safety check of gas heating equipment
   - a. Transportation of gas bottles to the work area
   - b. Assess components and equipment for safety

9.2 Perform the safe assembly of gas heating equipment for use
   - a. Hose and blowpipe or combined unit attachment
   - b. Leak detection procedures
   - c. Purging procedures
   - d. Lighting and extinguishing procedures

9.3 Demonstrate the use of a fire extinguisher in extinguishing a small solid fuel fire.
## Learning Outcome 10

Know the methods of safely using access equipment in the building services industry

### Assessment Criteria

10.1 Identify the situations where it may be necessary to work at height.

10.2 Identify the types of equipment used to permit work at heights in the building services industry.
   - a. Step ladders
   - b. Ladders
   - c. Mobile mini towers/scaffolds
   - d. Roof ladders and crawling boards
   - e. Mobile tower scaffolds
   - f. Fixed scaffolds and edge protection
   - g. Mobile elevated work platforms including scissor lifts and cherry pickers

10.3 Identify how to select suitable equipment for carrying out work at heights based on the work being carried out.

10.4 State the range of safety checks to be carried out on access equipment before it is used.
   - a. Step ladders
   - b. Ladders
   - c. Mobile mini towers/scaffolds
   - d. Roof ladders and crawling boards
   - e. Mobile tower scaffolds
   - f. Fixed scaffolds and edge protection

10.5 State the method of assembly and use of access equipment.
   - a. Step ladders
   - b. Ladders
   - c. Mobile mini towers/scaffolds
   - d. Roof ladders and crawling boards
   - e. Mobile tower scaffolds
   - f. Fixed scaffolds and edge protection

## Learning Outcome 11

Be able to safely use access equipment in the building services industry.

### Assessment Criteria

11.1 Demonstrate the safe method of assembly and use of:
   - a. Step Ladders
   - b. Ladders

11.2 Demonstrate the safe method of assembly and use of mobile tower scaffolds.

## Learning Outcome 12

Know the methods of working safely in excavations and confined spaces in the building services industry.

### Assessment Criteria

12.1 Identify the situations in which it may be necessary to work in excavations.

12.2 State how excavations should be prepared for safe working.
   - a. Safe access into the excavation
   - b. Trench support systems
# Learning Outcome 12  Continued

Know the methods of working safely in excavations and confined spaces in the building services industry.

## Assessment Criteria

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
</table>
| **12.3** | State the measures that need to be applied to prevent persons or equipment falling into excavations.  
  a. Use of warning signs  
  b. Use of barriers for pedestrians  
  c. Vehicle proximity to excavation edges  |
| **12.4** | Identify where work in confined spaces may be required.  
  a. Drainage systems  
  b. Plant rooms  
  c. Main service duct-rooms  
  d. In tanks, cylinders, boilers or cisterns  
  e. Under suspended timber floors  
  f. In roof spaces |
J/602/2482 - Understand how to communicate with others within Building Services Engineering

This knowledge unit provides learning in the development and continued maintenance of effective working relationships in the building services industry associated with work in dwellings, industrial and commercial premises and for private and contract type clients. Upon completion of the unit the learner will:

- Know the members of the construction team and their role within the building services industry
- Know how to apply information sources in the building services industry
- Know how to communicate with others in the building services industry

<table>
<thead>
<tr>
<th>Learning Outcome 1</th>
<th>Assessment Criteria</th>
</tr>
</thead>
</table>
| Know the members of the construction team and their role within the building services industry | 1.1 Identify the key roles of the site management team.  
   a. Architect  
   b. Project manager/Clerk of Works  
   c. Structural engineer  
   d. Surveyor  
   e. Building services engineer  
   f. Quantity surveyor  
   g. Buyer  
   h. Estimator  
   i. Contracts manager  
   j. Construction manager  
1.2 Identify the key roles of the individuals that report to the site management team:  
   a. Sub-contractors  
   b. Site supervisor  
   c. Trade supervisor  
   d. Trades  
     - Bricklayer  
     - Joiner  
     - Plasterer  
     - Tiler  
     - Electrician  
     - H&V fitter  
     - Gas fitter  
     - Decorator  
     - Ground workers  
1.3 Identify the key roles of site visitors  
   a. Building control inspector  
   b. Water inspector  
   c. HSE inspector  
   d. Electrical services inspector |
## Learning Outcome 2

**Know how to apply information sources in the building services industry**

### Assessment Criteria

#### 2.1 Identify the types of statutory legislation and guidance information that applies to working in the industry:
   - **a. Legislation**
     - Data protection
     - Equal opportunities
     - Health & safety
     - Employment
   - **b. Regulations**
   - **c. British standards**
   - **d. Codes of practice**
   - **e. Manufacturer guidance**
     - Installation instructions
     - Service & maintenance instructions
     - User instructions

#### 2.2 Identify the purpose of information that is used in the workplace:
   - **a. Job specifications**
   - **b. Plans/drawings**
   - **c. Work programmes**
   - **d. Delivery notes**
   - **e. Time sheets**
   - **f. Policy documentation – health & safety, environmental, customer service**

#### 2.3 Identify the purpose of information given to customers:
   - **a. Quotations**
   - **b. Estimates**
   - **c. Invoices/statements**
   - **d. Statutory cancelation rights**
   - **e. Handover information**

#### 2.4 State the importance of company policies and procedures that affect working relationships:
   - **a. Company working policies/procedures**
     - Behaviour
     - Timekeeping
     - Dress code
     - Contract of employment
   - **b. Limits to personal authority**
     - Apprentices
     - Level 2 qualified staff
     - Level 3 qualified staff
   - **c. Supervisor and management responsibilities**

©BPEC Certification Ltd. Qualification Guide – L1, L2 and L3 NVQ Diploma in Plumbing and Heating Page 42 of 266
Learning Outcome 3

Know how to communicate with others in the building services industry.

Assessment Criteria

3.1 Identify suitable communication methods for use in work situations:
   a. Oral communication
   b. Written communication
      - Email
      - Fax
      - Letter

3.2 Define methods of effective communication for people with:
   a. Physical disabilities
   b. Learning difficulties
   c. Language differences
      - Dialects
      - Accents
      - Foreign and second language issues

3.3 State the actions to take to deal with conflicts between:
   a. Customers and operatives
   b. Co-workers
   c. Supervisors and operatives

3.4 State the effects that poor communication may have on an organisation:
   a. Between operatives
   b. Between operatives and management
   c. Company to customer
D/602/2486- Understand how to apply environmental protection measures within BSE

The knowledge unit provides learning in a range of basic measures associated with protection of the environment. Areas covered include the effective use of material resources, minimising wastage. The legislation surrounding the effective use of energy and water resources including an introduction to the use of environmental emerging technologies is also covered in the unit. Upon completion of the unit the learner will:

- Know the energy conservation legislation that applies to the building services industry
- Know the applications of energy sources used in the building services industry
- Know the importance of energy conservation when commissioning building services systems
- Know the methods of reducing waste and conserving energy while working in the building services industry
- Know how to safely dispose of materials used in the building services industry
- Know the methods of conserving and reducing wastage of water within the building services industry

<table>
<thead>
<tr>
<th>Learning Outcome 1</th>
<th>Know the energy conservation legislation that applies to the building services industry.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment Criteria</strong></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>State the aims of energy conservation legislation:</td>
</tr>
<tr>
<td></td>
<td>a. General legislation</td>
</tr>
<tr>
<td></td>
<td>b. Construction specific legislation</td>
</tr>
<tr>
<td></td>
<td>c. Building services specific legislation</td>
</tr>
<tr>
<td>1.2</td>
<td>Identify the responsibilities of members of the construction team under energy conservation legislation:</td>
</tr>
<tr>
<td></td>
<td>a. Clients (customers)</td>
</tr>
<tr>
<td></td>
<td>b. Designers</td>
</tr>
<tr>
<td></td>
<td>c. Employers</td>
</tr>
<tr>
<td></td>
<td>d. Employees</td>
</tr>
</tbody>
</table>
## Learning Outcome 2

Know the applications of energy sources used in the building services industry.

### Assessment Criteria

#### 2.1 Identify the types of energy used in properties:

- **High carbon**
  - Natural Gas / LPG
  - Fuel oils
  - Solid fuels (coal and peat)
  - Electricity (from non-renewable sources)
  - Hydrogen fuel cells
  - Heat pumps
  - Combined heat & power (CHP)
  - Combined cooling, heat & power (CCHP)

- **Low carbon**
  - Solar thermal
  - Solid fuel (biomass)

- **Zero Carbon**
  - Electricity – wind
  - Electricity – tidal
  - Hydroelectric
  - Solar photovoltaic

#### 2.2 Identify the basic operating principles of installations containing environmental energy sources.

- **a. Solar thermal**
- **b. Solid fuel (biomass)**
- **c. Heat pumps (water, air and ground source)**
- **d. Combined heat & power (CHP)**
- **e. Combined cooling, heat & power (CCHP)**
- **f. Wind turbine**
- **g. Solar photovoltaic**

#### 2.3 Identify organisations which give guidance and advice on energy saving and conservation techniques.

#### 2.4 Identify how to use energy rating tables and their effect on component selection.

#### 2.5 State where to find information on alternative energy sources.

## Learning Outcome 3

Know the importance of energy conservation when commissioning building services systems.

### Assessment Criteria

#### 3.1 State the role of the commissioning process in conserving energy usage.

#### 3.2 State the actions to be covered during the system handover procedure to the customer that will contribute to conserving energy usage.
## Learning Outcome 4

Know the methods of reducing waste and conserving energy while working in the building services industry.

### Assessment Criteria

<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Identify the working practices that can be employed to conserve energy and protect the environment.</td>
</tr>
</tbody>
</table>
| 4.2 | State the methods used for reducing material wastage:  
|     | a. Planning work activities  
|     | b. Accurate measurement and cutting |
| 4.3 | Identify the methods of conserving material usage:  
|     | a. Reducing material over ordering  
|     | b. Minimising damage to stored materials  
|     | c. Prevention of loss/theft |

## Learning Outcome 5

Know how to safely dispose of materials used in the building services industry.

### Assessment Criteria

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>5.1</td>
<td>Identify the statutory legislation for waste management on construction sites</td>
</tr>
</tbody>
</table>
| 5.2 | State the methods of safely disposing of waste materials:  
|     | a. Licensed waste disposal  
|     | b. Waste carriers license  
|     | c. Recycling  
|     | d. Specialist disposal – asbestos and other forms of hazardous waste |
| 5.3 | Specify the approved processes for recycling materials:  
|     | a. Metals  
|     | b. Plastics  
|     | c. Wood/cardboard |
| 5.4 | Identify the disposal requirements of potentially hazardous materials:  
|     | a. Asbestos  
|     | b. Electrical and electronic equipment  
|     | c. Refrigerants (fluorinated gases) |
| 5.5 | Identify what action to take if work activities endanger the environment. |

## Learning Outcome 6

Know the methods of conserving and reducing wastage of water within the building services industry.

### Assessment Criteria

<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>6.1</td>
<td>Identify the statutory legislation for water wastage and misuse</td>
</tr>
</tbody>
</table>
| 6.2 | State the methods used for reducing material wastage:  
|     | a. Planning work activities  
|     | b. Accurate measurement and cutting |
| 6.3 | Identify the methods of conserving material usage:  
|     | a. Reducing material over ordering  
|     | b. Minimising damage to stored materials  
|     | c. Prevention of loss/theft |
## Learning Outcome 6  Continued

Know the methods of conserving and reducing wastage of water within the building services industry.

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.4 Identify the methods available for capturing surface water and recycling used water.</td>
</tr>
</tbody>
</table>
| 6.5 Identify the uses of captured and recycled water in properties.  
  State the basic working principles of captured and recycled water systems: |
| a. Rain water harvesting  
  b. Grey water systems |
J/602/2496 - Understand how to apply scientific principles within MES

This knowledge unit provides learning in the essential scientific principles that underpin the installation, commissioning and maintenance requirements of systems and components in the Mechanical Engineering Services Industries. The unit also provides learning in a range of basic calculation methodologies underpinning system and component design. Upon completion of the unit the learner will:

- Know the standard units of measurement used in the mechanical services industry
- Know the properties of materials used in the mechanical services industry
- Know the relationship between energy, heat and power in the mechanical services industry
- Know the principles of force and pressure and their application in the mechanical services industry
- Know simple mechanical principles and their application in the mechanical services industry
- Know the principles of electricity as they relate to the mechanical services industry

**Learning Outcome 1**
Know the standard units of measurement used in the mechanical services industry.

**Assessment Criteria**

1.1 State the application and use of internationally recognised (SI) units of measurement.
   a. Metre (length) m
   b. Kilogram (mass) kg
   c. Second (time) s
   d. Kelvin (temperature) °K

1.2 State the application and use of SI derived units
   a. Area (m²)
   b. Volume (m³)
      - Litres (L)
   c. Density (kg/m³)
   d. Velocity (m/s)

**Learning Outcome 2**
Know the properties of materials used in the mechanical services industry.

**Assessment Criteria**

2.1 Calculate the relative densities of common materials.
   a. Relative density to air
   b. Relative density to water

2.2 State the principle applications of solid materials used in the mechanical services industry.
   a. Metals
      - Pure metals
      - Ferrous metals
      - Alloys including solders
   b. Plastics
      - Thermo plastics
      - Thermo-setting plastics
   c. Fireclays/ceramics
Learning Outcome 2  Continued

Know the properties of materials used in the mechanical services industry

Assessment Criteria

2.3 Identify the detailed properties of solid materials.
   a. Strength – tensile and compressive
   b. Hardness
   c. Ductility
   d. Malleability
   e. Conductivity – heat and electricity

2.4 State the reasons why solid materials breakdown.
   a. Atmospheric corrosion
      - Oxidation of metals
   b. UV damage to plastics
   c. Heat damage to plastics
   d. Electrolytic corrosion
      - Electromotive series
      - Dissimilar metals in the presence of an electrolyte (water)
   e. Erosion corrosion
   f. Methods of preventing corrosion

2.5 State the principle applications and basic properties of liquids used in the mechanical services industry.
   a. Water
   b. Refrigerant
   c. Anti-freeze/glycol mixes
   d. Fuel oils
   e. Lubricants/greases

2.6 Identify the detailed properties of water:
   a. Boiling/freezing point
   b. Change of state and molecular changes
      - Volume and pressure increases
      - Density at differing temperatures
      - To steam/super-heated steam
   c. Capillarity
   d. Acidity/alkalinity (pH value)
   e. Water hardness
      - Soft
      - Temporary hard
      - Permanently hard

2.7 State the principle applications of gases used in the mechanical services industry.
   a. Air & steam
   b. LPG
   c. Natural gas
   d. Carbon dioxide
   e. Refrigerant gases
## Learning Outcome 2  Continued

**Know the properties of materials used in the mechanical services industry**

### Assessment Criteria

2.8 Identify the detailed properties of gases.
   - Pressure exerted by a gas
   - Volume occupied by a gas
   - Temperature of gases found within the industry
   - Gas Laws
     - Charles’s law
     - Boyle’s law
     - Heat pump/refrigeration cycle

## Learning Outcome 3

**Know the relationship between energy, heat and power in the mechanical services industry.**

### Assessment Criteria

3.1 Identify the relationship between the Celsius and Kelvin temperature scales.
   - Units of temperature measurement
   - Temperature measurement devices used

3.2 Identify the terminology associated with a change of state.
   - Melting
   - Freezing
   - Boiling
   - Evaporating
   - Condensing

3.3 Identify the terms latent and sensible heat as they apply to liquids and gases.

3.4 Identify the methods of heat transfer
   - Conduction in solids
   - Convection in liquids and gases
   - Radiation between two bodies

3.5 State how units of energy and heat are related and derived.
   - Energy – Joules (J)
   - Specific heat capacity (kJ/kg/^\circ C)
   - Power – Watts (W)

3.6 State how to carry out simple heat, energy and power calculations.
   - Simple temperature calculations
   - Quantity of heat energy required to raise the temperature of a substance
   - The amount of power required to heat a substance
### Learning Outcome 4

**Know the principles of force and pressure and their application in the mechanical services industry.**

#### Assessment Criteria

<table>
<thead>
<tr>
<th>4.1</th>
<th>State how units of force and pressure are derived from SI units.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Acceleration (m/s²)</td>
</tr>
<tr>
<td></td>
<td>- Force due to gravity</td>
</tr>
<tr>
<td>b.</td>
<td>Force - Newton (N)</td>
</tr>
<tr>
<td>c.</td>
<td>Pressure (N/m²)</td>
</tr>
<tr>
<td></td>
<td>- Atmospheric pressure</td>
</tr>
<tr>
<td></td>
<td>- Principles of the siphon</td>
</tr>
<tr>
<td>d.</td>
<td>Flow rate (m³/s)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4.2</th>
<th>State the application and use of units of measurement of pressure and flow rate.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Pressure</td>
</tr>
<tr>
<td></td>
<td>- Bar / millibar</td>
</tr>
<tr>
<td></td>
<td>- kPa</td>
</tr>
<tr>
<td></td>
<td>- Psi</td>
</tr>
<tr>
<td></td>
<td>- Metre head</td>
</tr>
<tr>
<td>b.</td>
<td>Flow rate</td>
</tr>
<tr>
<td></td>
<td>- m³/s</td>
</tr>
<tr>
<td></td>
<td>- l/s</td>
</tr>
<tr>
<td></td>
<td>- kg/s</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4.3</th>
<th>State how to carry out simple force and pressure calculations.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Simple force calculations</td>
</tr>
<tr>
<td>b.</td>
<td>Pressure head</td>
</tr>
<tr>
<td>c.</td>
<td>Simple pressure calculations</td>
</tr>
<tr>
<td></td>
<td>- Static pressure</td>
</tr>
<tr>
<td></td>
<td>- Dynamic pressure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4.4</th>
<th>Identify the relationship between velocity, pressure and flow rate in systems.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Effects of increasing/reducing pressure on velocity and flow rate</td>
</tr>
<tr>
<td>b.</td>
<td>Effects of increasing/reducing pipe size on velocity and flow rate at constant pressure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4.5</th>
<th>Identify the reasons why pipework restricts the flow of liquids and gases.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Changes of direction, bends and tees</td>
</tr>
<tr>
<td>b.</td>
<td>Pipe size</td>
</tr>
<tr>
<td>c.</td>
<td>Pipe reductions</td>
</tr>
<tr>
<td>d.</td>
<td>Roughness of material surface</td>
</tr>
<tr>
<td>e.</td>
<td>Constrictions such as valves</td>
</tr>
</tbody>
</table>
## Learning Outcome 5
Know simple mechanical principles and their application in the mechanical services industry.

### Assessment Criteria

5.1 State the principles behind simple machines.
   a. Mechanical advantage
   b. Velocity ratio
      - Levers
      - Wheel and axle
      - Pulleys
      - Screws

5.2 Identify the principles of basic mechanics.
   a. Theory of moments
   b. Action & reaction
   c. Centre of gravity
   d. Equilibrium

## Learning Outcome 6
Know the principles of electricity as they relate to the mechanical services industry.

### Assessment Criteria

6.1 State the basic principles of electron flow theory.
   a. Measurements of electrical flow
   b. Material conductivity and resistance
   c. Direct and alternating current

6.2 State the purpose and application of simple units of electrical measurement for use in the mechanical services industry.
   a. Current (Amps)
   b. Voltage (Volts)
   c. Resistance (Ohms)
   d. Power (Watts)

6.3 State how to carry out simple electrical calculations.
   a. Ohm’s law
   b. Power consumption of electrical circuits
   c. Basic over-current protection device size
   d. Voltage, current and resistance in series and parallel circuits

6.4 Identify the requirements for earthing of electrical circuits.
D/602/2682 - Understand and carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems

This combination unit provides learning in a range of basic pipework competences that underpin work on plumbing and heating systems. The unit also provides an introduction to the range of work activities carried out in plumbing and heating as well as methods of checking that pipework and plumbing and heating components are leak free. On completion of the unit the learner will:

- Know the types of hand and power tools used for domestic plumbing and heating work
- Know the types of domestic plumbing and heating pipe work and their jointing principles
- Know the general site preparation techniques for plumbing and heating work
- Be able to apply general site preparation techniques for domestic plumbing and heating work
- Know how to use clips and brackets to support domestic plumbing and heating pipe work and components
- Be able to apply fixings and brackets to domestic plumbing and heating pipe work and components
- Know the installation requirements of domestic plumbing and heating pipe work
- Know the inspection and soundness testing requirements of domestic plumbing and heating pipe work
- Be able to inspect and soundness test domestic plumbing and heating pipe work

### Learning Outcome 1

Know the types of hand and power tools used for domestic plumbing and heating work.

### Assessment Criteria

1.1 State the purpose of hand and power tools used to carry out work on plumbing and heating systems.

1.2 Identify the different types of hand and power tools used to carry out work on plumbing and heating systems.

1.3 State how to safely use and maintain hand and power tools to carry out work on plumbing and heating systems.
   - a. Screwdrivers
   - b. Hammers
   - c. Chisels
   - d. Grips
   - e. Wrenches
   - f. Spanners
   - g. Spirit Levels
   - h. Manual pipe threaders
   - i. Pipe cutters
   - j. Hand saws
   - k. Pliers
   - l. Bending tools
   - m. Power drills
   - n. Drill bits
   - o. Circular saws
   - p. Jig saws
   - q. Portable pipe threading machines
   - r. Hydraulic machine benders
   - s. Portable pipe freezing kits
Learning Outcome 1  
Know the types of hand and power tools used for domestic plumbing and heating work.

Assessment Criteria

1.4 Identify pipe work materials used in domestic plumbing and heating work.
   a. Copper
      - R220 soft coils
      - R250 half hard lengths
      - R290 hard lengths
   b. Low Carbon steel (LCS)
      - Medium grade
   c. Plastic pipework (hot, cold and heating)
      - Polyethylene (MDPE)
      - Polybutylene
   d. Plastic pipework (sanitary)
      - PVC-u
      - Polypropylene
      - MUPVC
      - ABS

Learning Outcome 2

Know the types of domestic plumbing and heating pipe work and their jointing principles

Assessment Criteria

2.1 State the range of typical pipe material sizes available for use in dwellings.
   a. Copper
   b. Low carbon steel
   c. MDPE
   d. Polybutylene
   e. PVC-u
   f. Polypropylene
   g. MUPVC
   h. ABS

2.2 State the acceptable methods of jointing new hot and cold water pipe to existing lead pipe work.

2.3 Identify the general fitting types used in dwellings.
   a. Couplers
   b. Elbows and bends
   c. Equal tees
   d. Reducing tees
   e. Reducers
   f. Tap connectors
   g. Flexible connectors
   h. Manifolds
   i. Specialist fittings such as tank connectors
Learning Outcome 2  Continued

Know the types of domestic plumbing and heating pipe work and their jointing principles

Assessment Criteria

2.4 State the methods of jointing pipe work used in dwellings.
   a. Copper pipe
      - Solder ring
      - End feed
      - Compression (type A and B)
      - Push-fit
      - Press-fit
   b. Low Carbon steel (LCS) pipe
      - Threaded
      - Compression e.g. Viking
   c. Plastic pipe (hot, cold and heating)
      - Push-fit
      - Compression
      - Proprietary (between lead and MDPE)
   d. Plastic pipe (sanitary)
      - Ring seal
      - Solvent weld
      - Compression

2.5 State the methods of bending pipe work used in dwellings.
   a. Copper spring bending
      - 90° bends
      - Sets and offsets bends
   b. Copper machine bending
      - 90° bends
      - Sets and offset bends
      - Passover bends
   c. LCS hydraulic machine bending
      - 90° bends
      - Sets and offset bends
      - Passover bends
   d. Plastic (hot, cold and heating)
      - Cabling technique
## Learning Outcome 3

Know the general site preparation techniques for plumbing and heating work.

### Assessment Criteria

3.1 Define the typical range of activities to be carried out when working on plumbing and heating systems.
   - a. Preparing work sites
   - b. Designing and selecting materials and equipment
   - c. Installing systems and components
   - d. Maintaining and dealing with faults on systems and components
   - e. Decommissioning systems and components – temporary and permanent
   - f. Soundness testing systems and components
   - g. Commissioning systems and components

3.2 State what information should be passed on to the customer when carrying out work on domestic pipe work systems

3.3 Identify how to check for pre-existing damage to the building fabric or customer property before the work commences.

3.4 Identify how to protect the building fabric or customer property before the work commences.
   - a. Use of dust sheets
   - b. Protection from flame damage
   - c. Use of walking boards – lawns/flower beds
   - d. Application of packaging to protect components during partially completed works
   - e. Circumstances in which furniture, breakable items and carpets need to be removed from the work area
   - f. Circumstances in which damage to vehicles may occur

3.5 Identify the method of storing tools, equipment and materials when working in new buildings and existing dwellings.
   - a. Prevention of theft
   - b. Avoiding loss and wastage
   - c. Minimising damage

3.6 Identify the range of hand and power tools required to complete work on domestic pipework systems.

3.7 State the checks to be carried out on tools and equipment to ensure that they work correctly and are correctly calibrated.

3.8 State the work methods for preparing building construction features for installation work.
   - a. Holes in masonry surfaces – hammer and chisel, large power drill
   - b. Making good to masonry surfaces
   - c. Lifting and replacing timber flooring materials
   - d. Notching timber floor joists
   - e. Drilling holes – timber floor joists
   - f. Cutting chases – wall and floor surfaces
### Learning Outcome 4

Be able to apply general site preparation techniques for domestic plumbing and heating work.

**Assessment Criteria**

<table>
<thead>
<tr>
<th>Number</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Check the safety of the work location in order for the work to safely proceed.</td>
</tr>
<tr>
<td></td>
<td>a. Safe access and exit</td>
</tr>
<tr>
<td></td>
<td>b. Immediate work location e.g. tripping hazards</td>
</tr>
<tr>
<td></td>
<td>c. Appropriate risk assessments/ method statements are available and worked to</td>
</tr>
<tr>
<td>4.2</td>
<td>Wear Personal Protective Equipment relevant to the installation, decommissioning or maintenance task being carried out.</td>
</tr>
<tr>
<td>4.3</td>
<td>Select the hand and power tools required to complete work on domestic pipe work systems.</td>
</tr>
<tr>
<td>4.4</td>
<td>Check that tools and equipment selected for work on the installation of domestic pipe work systems are safe to use and are correctly calibrated.</td>
</tr>
</tbody>
</table>

### Learning Outcome 5

Know how to use clips and brackets to support domestic plumbing and heating pipework and components.

**Assessment Criteria**

<table>
<thead>
<tr>
<th>Number</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>State how to measure and mark out for fixings to pipe work and plumbing and heating components.</td>
</tr>
<tr>
<td>5.2</td>
<td>Identify the range of general fixing devices.</td>
</tr>
<tr>
<td></td>
<td>a. Nails</td>
</tr>
<tr>
<td></td>
<td>- For timber</td>
</tr>
<tr>
<td></td>
<td>- For masonry</td>
</tr>
<tr>
<td></td>
<td>b. Screws</td>
</tr>
<tr>
<td></td>
<td>- Slotted head</td>
</tr>
<tr>
<td></td>
<td>- Phillips head</td>
</tr>
<tr>
<td></td>
<td>- Pozidrive</td>
</tr>
<tr>
<td></td>
<td>- Plastic plugs</td>
</tr>
<tr>
<td></td>
<td>c. Heavy duty fixings</td>
</tr>
<tr>
<td></td>
<td>- Coach bolts</td>
</tr>
<tr>
<td></td>
<td>- Rawlbolts</td>
</tr>
<tr>
<td>5.3</td>
<td>Identify the range of specialist fixing devices.</td>
</tr>
<tr>
<td></td>
<td>a. Cavity fixings</td>
</tr>
<tr>
<td></td>
<td>b. Drive in fixings</td>
</tr>
<tr>
<td>5.4</td>
<td>Identify clip and bracket types for domestic plumbing and heating work.</td>
</tr>
<tr>
<td></td>
<td>a. Copper pipe work – hot, cold and central heating</td>
</tr>
<tr>
<td></td>
<td>b. LCS pipe work – central heating</td>
</tr>
<tr>
<td></td>
<td>c. Plastic pipe work – hot, cold, central heating and sanitation pipe work</td>
</tr>
</tbody>
</table>
### Learning Outcome 6
Be able to apply fixings and brackets to domestic plumbing and heating pipe work and components.

#### Assessment Criteria

6.1 Measure and mark out for fixings to pipe work and plumbing and heating components.
6.2 Fix pipe work clips and brackets at recommended spacing intervals.
   - a. Copper pipe work
   - b. LCS pipe work
   - c. Plastic pipe work

### Learning Outcome 7
Know the installation requirements of domestic plumbing and heating pipe work.

#### Assessment Criteria

7.1 Identify the methods of installing domestic plumbing and heating pipe work.
   - a. Prefabrication of pipe work
   - b. Installing pipe work in-situ
   - c. Use of sleeves
   - d. Fire stopping to pipe work
7.2 Identify how to select pipe work materials and fittings from instructions including plans and drawings.
   - a. Copper pipe work – hot, cold and central heating
   - b. LCS pipe work – central heating
   - c. Plastic pipe work – hot, cold, central heating and sanitation

### Learning Outcome 8
Be able to install domestic plumbing and heating pipe work.

#### Assessment Criteria

8.1 Accurately measure, mark and cut pipe work materials for bending and jointing.
   - a. Copper pipework – hot, cold and central heating
   - b. LCS pipework – central heating
   - c. Plastic pipework – hot, cold, central heating and sanitation pipework
8.2 Bend domestic pipework to clear obstacles.
   - a. Copper machine bending
     - 90° bends
     - Sets and offset bends
     - Passover bends
   - b. LCS Hydraulic machine bending
     - 90° bends
     - Sets and offset bends
     - Passover bends
   - c. Plastic (hot, cold and heating)
     - Cabling technique
8.3 Position and fix domestic pipework to specifications.
   - a. Copper pipework – hot, cold and central heating
   - b. LCS pipework – central heating
   - c. Plastic pipework – hot, cold, central heating and sanitation pipework
### Learning Outcome 9

Know the inspection and soundness testing requirements of domestic plumbing and heating pipework.

**Assessment Criteria**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>9.1</td>
<td>Identify the requirements of, and carry out a visual inspection of pipework to confirm that it is ready to be filled with water.</td>
</tr>
<tr>
<td>9.2</td>
<td>State how to carry out a soundness test on domestic plumbing and heating pipework.</td>
</tr>
<tr>
<td></td>
<td>a. Metallic pipework</td>
</tr>
<tr>
<td></td>
<td>b. Plastic pipework</td>
</tr>
</tbody>
</table>

### Learning Outcome 10

Be able to inspect and soundness test domestic plumbing and heating pipework.

**Assessment Criteria**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10.1</td>
<td>Fill pipework with water at normal operating pressure and check for leakage</td>
</tr>
<tr>
<td>10.2</td>
<td>Perform a soundness test on domestic plumbing and heating pipework.</td>
</tr>
<tr>
<td></td>
<td>a. Metallic pipework</td>
</tr>
<tr>
<td></td>
<td>b. Plastic pipework</td>
</tr>
</tbody>
</table>
H/602/2697 - Understand and apply domestic cold water system installation and maintenance techniques

This combination unit provides learning in the installation, maintenance, decommissioning and soundness testing of a basic range of cold water system/component types in dwellings and industrial/commercial properties (of similar size and scope to domestic dwellings). The unit covers systems in buildings up to 3 storeys in height with pipework up to 28mm diameter. The scope of the system is from the boundary stop valve into the property feeding the water outlets. Upon completion of the unit the learner will:

- Know the cold water supply route to dwellings
- Know the types of cold water system and their layout requirements
- Know the site preparation techniques for cold water systems and components
- Be able to apply site preparation techniques for cold water systems and components
- Know the installation requirements of cold water systems and components
- Be able to install cold water systems and components
- Know the service and maintenance requirements of cold water systems and components
- Be able to service and maintain cold water systems and components
- Know the decommissioning requirements of cold water systems and components
- Be able to decommission cold water systems and components
- Know the inspection and soundness testing requirements of cold water systems and components
- Be able to inspect and soundness test cold water systems and components

Learning Outcome 1

Know the cold water supply route to dwellings

Assessment Criteria

1.1 State the key stages in the rainwater cycle.
1.2 Identify the various water supply sources and the typical properties of water from those sources:
   a. Surface sources – lakes, reservoirs, rivers and streams
   b. Underground sources – deep and shallow wells, artesian wells, bore-holes, springs
1.3 State the two main types of water supply to dwellings:
   a. Supply from a water undertaker’s main
   b. Supply from a private source
1.4 Identify the mains water treatment process and typical mains water distribution system from treatment works to property.
1.5 Identify the uses of cold water supplied to dwellings.
   a. Wholesome water for domestic purposes - drinking, washing, food production
   b. Recycled water – WC flushing, water for outdoor use, clothes washing
**Learning Outcome 2**

Know the types of cold water system and their layout requirements.

**Assessment Criteria**

<table>
<thead>
<tr>
<th>Learning Objective</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>State the cold water system pipe work features between the water undertaker’s main and the main internal stop valve in dwellings:</td>
</tr>
<tr>
<td></td>
<td>a. Connection methods to the main</td>
</tr>
<tr>
<td></td>
<td>b. Communication pipe</td>
</tr>
<tr>
<td></td>
<td>c. Service pipe</td>
</tr>
<tr>
<td></td>
<td>d. Main external stop valve and meter housing including surface mounted meter boxes (Groundbreaker)</td>
</tr>
<tr>
<td></td>
<td>e. Depth of external service pipe work below ground level</td>
</tr>
<tr>
<td></td>
<td>f. Correct methods of entry of the service pipe work to a property</td>
</tr>
<tr>
<td>2.2</td>
<td>Identify the type of cold water system from layout diagrams.</td>
</tr>
<tr>
<td>2.3</td>
<td>State the factors which affect the selection of cold water systems for dwellings.</td>
</tr>
<tr>
<td></td>
<td>a. Direct cold water system</td>
</tr>
<tr>
<td></td>
<td>- Supplying a storage cistern</td>
</tr>
<tr>
<td></td>
<td>- Supplying a combination boiler</td>
</tr>
<tr>
<td></td>
<td>b. Indirect cold water system</td>
</tr>
<tr>
<td>2.4</td>
<td>State the typical pipe sizes used in cold water systems in dwellings</td>
</tr>
<tr>
<td></td>
<td>a. Supply pipe</td>
</tr>
<tr>
<td></td>
<td>b. Distributing pipe</td>
</tr>
<tr>
<td></td>
<td>c. Service pipe</td>
</tr>
<tr>
<td>2.5</td>
<td>State the factors that can lead to backflow from cold water outlets and equipment in dwellings.</td>
</tr>
<tr>
<td>2.6</td>
<td>Identify the standard backflow prevention devices that are used in cold water systems in dwellings supplying water to appliances:</td>
</tr>
<tr>
<td></td>
<td>a. Baths</td>
</tr>
<tr>
<td></td>
<td>b. WC's</td>
</tr>
<tr>
<td></td>
<td>c. Over the rim bidets</td>
</tr>
<tr>
<td></td>
<td>d. Wash hand basins</td>
</tr>
<tr>
<td></td>
<td>e. Sinks</td>
</tr>
<tr>
<td></td>
<td>f. Mixer taps</td>
</tr>
<tr>
<td></td>
<td>g. Outside taps</td>
</tr>
<tr>
<td></td>
<td>h. Shower mixer valves/ instantaneous showers</td>
</tr>
<tr>
<td></td>
<td>i. Refrigerators, washing machines and dishwashers</td>
</tr>
</tbody>
</table>
## Learning Outcome 2

Know the types of cold water system and their layout requirements.

### Assessment Criteria

2.7 Identify the working principles of cold water system components.
   - a. Stop valves
   - b. Servicing valves
   - c. Drain valves
   - d. Float operated valves
   - e. Terminal fittings
      - Pillar taps
      - Bib taps
      - Mixer taps
      - Ceramic disc taps
   - f. Shower mixer valves
      - Gravity
      - Mains fed
   - g. Water softeners
   - h. Water filters
   - i. Water conditioners
   - j. Water meters
   - k. Backflow prevention devices
      - Simple air gap arrangements
      - Double and single check valves
   - l. Cold water storage cisterns
   - m. Combined feed and expansion cisterns
   - n. WC/urinal flushing cisterns

2.8 State the system layout features for protected plastic storage cisterns.
   - a. Typical cistern sizes for small dwellings
   - b. Warning pipe (overflow) arrangements
   - c. Inlet/outlet position
   - d. Position of float operated valve
   - e. Position of cistern vent
   - f. Position of open vent pipe connection
   - g. Requirement for a rigid close fitting lid
   - h. Service valve requirements
   - i. Cistern base support requirements

2.9 State the methods of linking cold water storage cisterns for use in dwellings.

## Learning Outcome 3

Know the site preparation techniques for cold water systems and components.

### Assessment Criteria

3.1 Identify the sources of information required when undertaking work on cold water systems.
   - a. Statutory regulations
   - b. Industry standards
   - c. Manufacturer technical instructions

3.2 Identify the preparatory work required to be undertaken to the building fabric in order to install, decommission or maintain cold water systems and components.
Learning Outcome 3  Continued

Know the site preparation techniques for cold water systems and components

Assessment Criteria

3.3 Identify the protection measures required to the building fabric or customer property, during and on completion of work on cold water systems and components.
3.4 Identify the pipe work materials and fittings required to complete work on cold water systems
   a. External water service pipe work
   b. Internal water supply pipe work
3.5 State the range of hand and power tools required to complete work on cold water systems and components.

Learning Outcome 4

Be able to apply site preparation techniques for cold water systems and components.

Assessment Criteria

4.1 Check the safety of the work location in order for the work to safely proceed
   a. Safe access and exit
   b. Immediate work location e.g. tripping hazards
   c. Appropriate risk assessments/ method statements are available
4.2 Wear Personal Protective Equipment appropriate to the installation, decommissioning or maintenance task being carried out.
4.3 Apply protection measures to the building fabric or customer property, during and on completion of work on cold water systems and components.
4.4 Select the pipe work materials and fittings required to complete work on cold water systems ensuring that they are not damaged.
4.5 Select the hand and power tools required to complete work on cold water systems and components.
4.6 Carry out preparatory work in order to install cold water systems and components.

Learning Outcome 5

Know the installation requirements of cold water systems and components

Assessment Criteria

5.1 State how to take readings of the incoming water supply pressure and flow rate.
5.2 Identify suitable methods of connecting cold water system supply pipe work to incoming service pipe work:
   a. Medium density polyethylene (MDPE)
   b. Copper
   c. Lead
5.3 State the positioning requirements of components in cold water systems
   a. Supply stop valves
   b. Drain valves
   c. Water meters
   d. Water conditioning devices
   e. Service valves
   f. Backflow prevention devices
5.4 Identify how to measure, mark out and drill plastic storage cisterns to receive pipe work connections.
5.5 Identify how to make pipe work connections to storage cisterns.
### Learning Outcome 5  Continued

Know the installation requirements of cold water systems and components

#### Assessment Criteria

5.6 State the positioning and fixing requirements for cold water system pipe work and components
- a. In suspended timber floors
- b. In solid floors
- c. Embedded in walls
- d. In areas of the building subject to frost
- e. That may be exposed to warming

5.7 State how to select clips and brackets appropriate to the cold water system pipe work and the industry recommended spacing’s.
- a. Horizontally mounted pipe work
- b. Vertically mounted pipe work

5.8 Identify how to position, fix and connect new cold water pipe work to outlets.
- a. Bath tap or shower mixer valve
- b. Wash hand basin tap
- c. Sink tap
- d. Combination boiler
- e. WC flushing cistern
- f. Cold water storage cistern

5.9 Identify suitable methods of making new pipe work connections into existing cold water system pipe work.
- a. Copper
- b. Plastic
- c. Lead
- d. Galvanised steel

5.10 Identify the insulation requirements of cold water system components.
- a. Pipe work sections
- b. Storage cisterns

### Learning Outcome 6

Be able to install cold water systems and components.

#### Assessment Criteria

6.1 Use test instruments to take readings of the incoming water supply pressure and flow rate

6.2 Connect cold water supply pipe work to incoming service pipe work.
- a. MDPE to copper coupler
- b. Supply stop and drain valve

6.3 Joint cold water pipework components in copper with capillary soldered and compression fittings.

6.4 Measure, mark out and drill plastic storage cisterns to receive pipework connections.

6.5 Make pipework connections to storage cisterns.

6.6 Make pipework fixings to copper pipework.
### Learning Outcome 6  Continued

**Be able to install cold water systems and components.**

**Assessment Criteria**

6.7 Position, fix and connect new cold water pipework to outlets.
   - a. Bath tap or shower mixer valve
   - b. Wash hand basin tap
   - c. Sink tap
   - d. Combination boiler
   - e. WC flushing cistern
   - f. Cold water storage cistern

6.8 Apply insulation to cold water system components
   - a. Pipework sections
   - b. Storage cisterns

6.9 Demonstrate that cold water systems or components cannot be brought into operation by the end user before the work has been fully completed.

### Learning Outcome 7

**Know the service and maintenance requirements of cold water systems and components**

**Assessment Criteria**

7.1 Identify how to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of cold water system components.

7.2 Identify how to carry out routine checks on cold water system components as part of a periodic maintenance programme.
   - a. Visual inspection of pipework for leakage and adequate support
   - b. Effective operation of terminal fittings
   - c. Effective operation of float operated valves
   - d. Effective operation of stop and service valves
   - e. Condition of protected cold water storage cistern

7.3 State the procedures for dealing with defects in cold water components and pipework.
   - a. Cistern failure
   - b. Incorrect support to cold water system pipework and storage cisterns
   - c. Excessive noise in pipework systems
   - d. Leakage of internal cold water system pipework and fittings
   - e. Leakage or ineffective operation of:
     - Terminal fittings
     - Float operated valves
     - Stop and service valves

7.4 Identify the types of information to be provided on a maintenance record for cold water systems.
### Learning Outcome 8
Be able to service and maintain cold water systems and components

**Assessment Criteria**

8.1 Use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of cold water system components.

8.2 Carry out routine checks on cold water system components as part of a periodic maintenance programme.
   - a. Visual inspection of pipework for leakage and adequate support
   - b. Effective operation of terminal fittings
   - c. Effective operation of float operated valves
   - d. Effective operation of stop and service valves
   - e. Condition of protected cold water storage cistern

8.3 Carry out repairs to defects in cold water system components.
   - a. Leakage of cold water system pipework and fittings – repair to water-filled pipework
   - b. Leakage or ineffective operation of
     - Terminal fittings
     - Float operated valves
     - Stop and service valves

8.4 Complete the required details contained in a simple maintenance record for a cold water system.

### Learning Outcome 9
Know the decommissioning requirements of cold water systems and components.

**Assessment Criteria**

9.1 Identify the working methods that reduce the time periods during which cold water systems need to be isolated.

9.2 State the information that needs to be provided to other persons before decommissioning work takes place.

9.3 State how to temporarily decommission cold water system components and connecting pipe work systems.

9.4 Identify the work sequences for permanently decommissioning cold water system components.

9.5 Identify the methods used during the decommissioning process to prevent the end-user from operating cold water system components.
   - a. Isolation of stop/servicing valves
   - b. Temporary capping of pipe work sections
   - c. Use of warning notices and signs

### Learning Outcome 10
Be able to decommission cold water systems and components

**Assessment Criteria**

10.1 Advise appropriate persons before cold water system components or pipework are isolated in order to undertake work.

10.2 Carry out temporary decommissioning of cold water system components and connecting pipe work systems.

10.3 Check to ensure that the decommissioning procedures carried out prevent the end-user from operating cold water system components.
### Learning Outcome 11

Know the inspection and soundness testing requirements of cold water systems and components.

**Assessment Criteria**

<table>
<thead>
<tr>
<th>11.1</th>
<th>State the checks to be carried out during a visual inspection of a cold water system to confirm that it is ready to be filled with water.</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.2</td>
<td>State how to fill cold water pipe work with water at normal operating pressure and check for leakage.</td>
</tr>
<tr>
<td>11.3</td>
<td>Identify how to carry out a soundness test to industry requirements on cold water systems pipe work and components.</td>
</tr>
<tr>
<td>11.4</td>
<td>State the flushing procedure for cold water systems and components.</td>
</tr>
<tr>
<td>11.5</td>
<td>Identify the actions that must be taken when inspection and testing reveals defects in cold water systems.</td>
</tr>
<tr>
<td></td>
<td>a. Dealing with systems that do not meet correct installation requirements</td>
</tr>
<tr>
<td></td>
<td>b. Remedial work associated with defective pipe work bracketing</td>
</tr>
<tr>
<td></td>
<td>c. Remedial work associated with leakage from pipe work systems</td>
</tr>
</tbody>
</table>

### Learning Outcome 12

Be able to inspect and soundness test cold water systems and components.

**Assessment Criteria**

<table>
<thead>
<tr>
<th>12.1</th>
<th>Carry out a visual inspection of a cold water system to confirm that it is ready to be filled with water.</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.2</td>
<td>Fill cold water pipe work with water at normal operating pressure and check for leakage.</td>
</tr>
<tr>
<td>12.3</td>
<td>Perform a soundness test to industry requirements on cold water systems pipe work and components.</td>
</tr>
<tr>
<td>12.4</td>
<td>Flush the system with wholesome water on completion of soundness testing.</td>
</tr>
</tbody>
</table>
F/602/2884 - Understand and apply domestic hot water system installation and maintenance techniques

This combination unit provides learning in the installation, maintenance, decommissioning and soundness testing of a basic range of hot water system/component types in dwellings and industrial/commercial properties (of similar size and scope to domestic dwellings). The unit covers systems in building up to 3 storeys in height with pipework up to 28mm diameter. Upon completion the learner will:

- Know the types of hot water system and their layout requirements
- Know the site preparation techniques for hot water systems and components
- Be able to apply site preparation techniques for hot water systems and components
- Know the installation requirements of hot water systems and components
- Be able to install hot water systems and components
- Know the service and maintenance requirements of hot water systems and components
- Be able to service and maintain hot water systems and components
- Know the decommissioning requirements of hot water systems and components
- Be able to decommission hot water systems and components
- Know the inspection and soundness testing requirements of hot water systems and components
- Be able to inspect and soundness test hot water systems and components

Learning Outcome 1

Know the types of hot water system and their layout requirements.

Assessment Criteria

1.1 Identify the type of hot water system from layout diagrams.
   a. Direct system
      - Conventional boiler (small hot water only boiler)
      - Immersion heater including low energy tariff types
   b. Indirect system
      - Fed by combined hot water and heating boiler
   c. Single point of use vented heaters
   d. Instantaneous hot water heaters
      - Multipoint heaters
      - Combination boilers

1.2 State the factors that need to be considered when the type of hot water system is selected for use in a building.
   a. Quantity and usage of hot water required
   b. Distance of outlet from hot water source
   c. Need for a secondary recirculation system
Learning Outcome 1  Continued

Know the types of hot water system and their layout requirements.

Assessment Criteria

1.3  Identify the working principles of hot water system components.
   a. Stop valves
   b. Fullway gate valves
   c. Servicing valves
   d. Drain valves
   e. Float operated valves
   f. Terminal fittings
      - Bib taps
      - Pillar taps
      - Mixer taps
      - Ceramic disc taps
   g. Backflow prevention devices
      - Simple air gaps
      - Single check valves
   h. Cold water feed cisterns
   i. Directly heated storage cylinders
   j. Indirectly heated storage cylinders
      - Single feed
      - Double feed
      - Combination
   k. Showers
      - Gravity mixer
      - Mains fed mixer
      - Electric instantaneous
   l. Thermostatic mixing valves
   m. Instantaneous water heater
      - Mains fed multipoint heater
      - Mains fed combination boiler
      - Single point of use vented heaters

1.4  State the typical pipe sizes used in centralised open vented hot water systems in dwellings.
   a. Primary circuit
   b. Secondary circuit

1.5  State the system layout features for the open vent and cold feed pipes of primary and secondary open vented hot water circuits.

1.6  State the connection requirements for feed and expansion cisterns into open vented primary hot water circuits.

1.7  State the system layout features for plastic feed and expansion cisterns.
   a. Typical cistern sizes for small dwellings
   b. Warning pipe (overflow) arrangements
   c. Inlet/ outlet position
   d. Position of float operated valve
   e. Position of cistern vent
   f. Service valve requirements
   g. Cistern base support requirements
## Learning Outcome 1  Continued

**Know the types of hot water system and their layout requirements.**

### Assessment Criteria

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 1.8 | Identify the type and typical sizes of open vented storage cylinder used in hot water systems in dwellings.  
   |   | a. Direct  
   |   | b. Single feed direct  
   |   | c. Double feed indirect  
   |   | d. Double feed indirect super duty recovery  
   |   | e. combination  
| 1.9 | State the system layout features for hot water heaters.  
   |   | a. Mains fed instantaneous multipoint water heaters including combination boilers  
   |   | b. Localised (point of use) open vented hot water heaters  
| 1.10 | Identify the working principles. State the typical pipe sizes used with mains fed instantaneous hot water heaters and open vented point of use water heaters in dwellings.  
| 1.11 | Identify the need for temperature control of hot water systems.  
   |   | a. Thermostats  
   |   | b. Overheat thermostats  
   |   | c. Temperature relief valves  
| 1.12 | State the factors that can lead to backflow from hot water outlets and equipment in dwellings.  
| 1.13 | Identify the standard backflow prevention devices that are used in hot water systems in dwellings supplying water to appliances.  
   |   | a. Baths  
   |   | b. Over the rim bidets  
   |   | c. Wash hand basins  
   |   | d. Sinks  
   |   | e. Mixer taps  
   |   | f. Showers  
| 1.14 | State the system layout features for the installation of hot water components.  
   |   | a. Gravity fed showers  
   |   | b. Mains fed showers  
   |   | c. Instantaneous electric showers  
   |   | d. Thermostatic mixing valves  

## Learning Outcome 2

**Know the site preparation techniques for hot water systems and components.**

### Assessment Criteria

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 2.1 | Identify the sources of information required when undertaking work on hot water systems.  
   |   | a. Statutory regulations  
   |   | b. Industry standards  
   |   | c. Manufacturer technical instructions  
| 2.2 | Identify the preparatory work required to be undertaken to the building fabric in order to install, decommission or maintain hot water systems and components.  
| 2.3 | Identify the protection measures required to the building fabric or customer property, during and on completion of work on hot water systems and components.  
| 2.4 | Identify the pipework materials and fittings required to complete work on hot water systems  

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Qualification Guide – L1, L2 and L3 NVQ Diploma in Plumbing and Heating  
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### Learning Outcome 2  
**Continued**

Know the site preparation techniques for hot water systems and components.

**Assessment Criteria**

| 2.5 | State the range of hand and power tools required to complete work on hot water systems and components. |

### Learning Outcome 3

Be able to apply site preparation techniques for hot water systems and components.

**Assessment Criteria**

<table>
<thead>
<tr>
<th>3.1</th>
<th>Check the safety of the work location in order for the work to safely proceed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Safe access and exit</td>
</tr>
<tr>
<td>b.</td>
<td>Immediate work location e.g. tripping hazards</td>
</tr>
<tr>
<td>c.</td>
<td>Appropriate risk assessments/ method statements are available</td>
</tr>
</tbody>
</table>

| 3.2 | Wear Personal Protective Equipment appropriate to the installation, decommissioning or maintenance task being carried out. |

| 3.3 | Apply protection measures to the building fabric or customer property, during and on completion of work on hot water systems and components. |

| 3.4 | Select the pipework materials and fittings required to complete work on hot water systems ensuring that they are not damaged. |

| 3.5 | Select the hand and power tools required to complete work on hot water systems and components. |

| 3.6 | Carry out preparatory work in order to install hot water systems and components. |

### Learning Outcome 4

Know the installation requirements of hot water systems and components.

**Assessment Criteria**

| 4.1 | State how to take readings of hot water supply pressure and flow rate. |

<table>
<thead>
<tr>
<th>4.2</th>
<th>State the positioning and fixing requirements of hot water pipework and components.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>In suspended timber floors</td>
</tr>
<tr>
<td>b.</td>
<td>In solid floors</td>
</tr>
<tr>
<td>c.</td>
<td>Embedded in walls</td>
</tr>
<tr>
<td>d.</td>
<td>In areas of the building subject to frost</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4.3</th>
<th>Identify how expansion and contraction may be catered for in hot water pipework containing:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Plastics</td>
</tr>
<tr>
<td>b.</td>
<td>Copper</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4.4</th>
<th>State how to select clips and brackets appropriate to the hot water system pipework and the industry recommended spacing's.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Horizontally mounted pipework</td>
</tr>
<tr>
<td>b.</td>
<td>Vertically mounted pipework</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4.5</th>
<th>State the positioning requirements of components in hot water systems.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Heaters/storage cylinders</td>
</tr>
<tr>
<td>b.</td>
<td>Cisterns – hot water feed cisterns and feed and expansion cisterns</td>
</tr>
<tr>
<td>c.</td>
<td>Drain valves</td>
</tr>
<tr>
<td>d.</td>
<td>Service valves</td>
</tr>
<tr>
<td>e.</td>
<td>Thermostatic mixing valves</td>
</tr>
<tr>
<td>f.</td>
<td>Showers – gravity fed mixer, mains fed mixer and instantaneous electric</td>
</tr>
</tbody>
</table>
### Learning Outcome 4  Continued

Know the installation requirements of hot water systems and components.

#### Assessment Criteria

| 4.6 | Identify how to measure, mark out and drill plastic storage cisterns to receive pipework connections. |
| 4.7 | Identify how to make pipework connections to storage cisterns. |
| 4.8 | Identify how to make pipework connections to open vented hot water storage cylinders. |
| 4.9 | State how to position, fix and connect new hot water pipework to outlets and supply sources. |
|   | a. Bath tap or shower mixer valve |
|   | b. Wash hand basin tap |
|   | c. Sink tap |
|   | d. Combination boiler |
|   | e. Cold water storage cistern |
|   | f. Hot water storage cylinder |
|   | g. Thermostatic mixing valve |

| 4.10 | Identify suitable methods of making new pipework connections into existing hot water system pipework. |
|      | a. Plastic |
|      | b. Copper |

| 4.11 | Identify the insulation requirements of hot water system components |
|      | a. Pipe work |
|      | b. Cisterns |
|      | c. Storage vessels |

### Learning Outcome 5

Be able to install hot water systems and components.

#### Assessment Criteria

| 5.1 | Use test instruments to take readings of the hot water supply pressure and flow rate from existing hot water outlets. |
| 5.2 | Make pipework fixings to copper and plastic pipework. |
| 5.3 | Joint hot water pipework components. |
|   | a. Copper – capillary soldered and compression |
|   | b. Plastic-push fit |
| 5.4 | Measure, mark out and drill plastic storage cisterns to receive pipework connections. |
| 5.5 | Make pipework connections to storage cisterns. |
| 5.6 | Make pipework connections to open vented hot water storage cylinders. |
| 5.7 | Position, fix and connect new hot water pipework to outlets |
| | a. Bath tap or shower mixer valve |
| | b. Wash hand basin tap |
| | c. Sink tap |
| | d. Combination boiler |
| | e. Cold water storage cistern |
| | f. Hot water storage cylinder |
| | g. Thermostatic mixing valve |
| 5.8 | Apply insulation to hot water system pipework. |
| 5.9 | Demonstrate that hot water components and pipework systems cannot be brought into operation by the end user before the work has been fully completed. |
Learning Outcome 6
Know the service and maintenance requirements of hot water systems and components.

Assessment Criteria

6.1 Identify how to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components.

6.2 Identify how to carry out routine checks on hot water components and pipework as part of a periodic maintenance programme.
   - a. Visual inspection of pipework for leakage, adequate support and insulation
   - b. Effective operation of terminal fittings
   - c. Effective operation of float operated valves
   - d. Effective operation of service valves
   - e. Condition of hot water cylinder/heater and storage cisterns
   - f. Effective operation of thermostatic control devices

6.3 State the procedures for dealing with defects in hot water components and pipework.
   - a. Incorrect support to hot water system pipework and storage cisterns
   - b. Excessive noise in pipework systems
   - c. Leakage of hot water system pipework and fittings
   - d. Cistern failure
   - e. Hot water storage cylinder/heater failure
   - f. Leakage or ineffective operation of:
     - Terminal fittings
     - Float operated valves
     - Mixer showers
     - Thermostatic mixing valves

6.4 Identify the types of information to be provided on a maintenance record for hot water systems.

Learning Outcome 7
Be able to service and maintain hot water systems and components.

Assessment Criteria

7.1 Use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components.

7.2 Carry out routine checks on hot water components and pipework as part of a periodic maintenance programme.
   - a. Visual inspection of pipework for leakage, adequate support and insulation
   - b. Effective operation of terminal fittings
   - c. Effective operation of float operated valves
   - d. Effective operation of service valves
   - e. Condition of hot water cylinder/heater and storage cisterns
   - f. Effective operation of thermostatic control devices

7.3 Carry out repairs to defects in hot water system components
   - a. Leakage of hot water system pipework and fittings – repair to water-filled pipework
   - b. Leakage or ineffective operation of:
     - Terminal fittings
     - Float operated valves
     - Stop and service valves

7.4 Complete the required details contained in a simple maintenance record for a hot water system.
### Learning Outcome 8

6. Know the decommissioning requirements of hot water systems and components.

#### Assessment Criteria

| 8.1 | Identify the working methods that reduce the time periods during which hot water systems need to be isolated. |
| 8.2 | State the information that needs to be provided to other persons before decommissioning work takes place. |
| 8.3 | State how to temporarily decommission hot water system components and connecting pipework systems. |
| 8.4 | Identify the work sequences for permanently decommissioning hot water components and pipework systems. |
| 8.5 | Identify the methods used during the decommissioning process to prevent the end-user from operating hot water system components.  
   a. Temporary capping of pipework sections  
   b. Use of warning notices and signs |

### Learning Outcome 9

Be able to decommission hot water systems and components.

#### Assessment Criteria

| 9.1 | Advise appropriate persons before hot water components or pipework are isolated in order to undertake work. |
| 9.2 | Carry out temporary decommissioning of cold water system components and connecting pipework systems. |
| 9.3 | Check to ensure that the decommissioning procedures carried out prevent the end-user from operating the hot water system components. |

### Learning Outcome 10

Know the inspection and soundness testing requirements of hot water systems and components.

#### Assessment Criteria

| 10.1 | State the checks to be carried out during a visual inspection of a hot water system to confirm that it is ready to be filled with water. |
| 10.2 | State how to fill hot water pipework with water at normal operating pressure and check for leakage. |
| 10.3 | Identify how to carry out a soundness test to industry requirements on hot water systems pipework and components. |
| 10.4 | State the flushing procedure for hot water systems and components. |
| 10.5 | Identify the actions that must be taken when inspection and testing reveals defects in hot water systems.  
   a. Dealing with systems that do not meet correct installation requirements  
   b. Remedial work associated with defective pipework bracketing  
   c. Remedial work associated with leakage from pipework systems |
<table>
<thead>
<tr>
<th>Learning Outcome 11</th>
<th>Be able to inspect and soundness test hot water systems and components</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment Criteria</strong></td>
<td></td>
</tr>
<tr>
<td>11.1</td>
<td>Carry out a visual inspection of a hot water system to confirm that it is ready to be filled with water.</td>
</tr>
<tr>
<td>11.2</td>
<td>Fill hot water pipework with water at normal operating pressure and check for leakage.</td>
</tr>
<tr>
<td>11.3</td>
<td>Perform a soundness test to industry requirements on hot water systems pipework and components.</td>
</tr>
<tr>
<td>11.4</td>
<td>Flush the system with wholesome water on completion of soundness testing.</td>
</tr>
</tbody>
</table>
Y/602/2888 - Understand and apply domestic central heating system installation and maintenance techniques

This combination unit provides basic learning in the installation, maintenance, decommissioning and soundness testing of a basic range of wet central heating system/component types in dwellings and industrial/commercial properties (of similar size and scope to domestic dwellings). The unit covers systems in buildings up to 3 storeys in height and with systems up to a maximum of 40kW heat output and pipework up to 32mm diameter. Upon completion of the unit the learner will:

- Know the uses of central heating systems in dwellings
- Know the types of central heating system and their layout requirements
- Know the site preparation techniques for central heating systems and components
- Be able to apply site preparation techniques for central heating systems and components
- Know the installation requirements of central heating systems and components
- Be able to install central heating systems and components
- Know the service and maintenance requirements of central heating systems and components
- Be able to service and maintain central heating systems and components
- Know the decommissioning requirements of central heating systems and components
- Be able to decommission central heating systems and components
- Know the inspection and soundness testing requirements of central heating systems and components
- Be able to inspect and soundness test central heating systems and components

<table>
<thead>
<tr>
<th>Learning Outcome 1</th>
<th>Know the uses of central heating systems in dwellings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment Criteria</strong></td>
<td></td>
</tr>
<tr>
<td>1.1 State the purpose of central heating systems used in dwellings.</td>
<td></td>
</tr>
<tr>
<td>1.2 Identify the different types of space heating systems used in dwellings.</td>
<td></td>
</tr>
<tr>
<td>a. Full central heating</td>
<td></td>
</tr>
<tr>
<td>b. Background heating</td>
<td></td>
</tr>
<tr>
<td>c. Selective heating</td>
<td></td>
</tr>
<tr>
<td>d. Two and one pipe systems</td>
<td></td>
</tr>
<tr>
<td>1.3 Plan the work to be undertaken to comply with industry standards and manufacturer’s guidelines taking into account risk assessment, location, ventilation</td>
<td></td>
</tr>
<tr>
<td>1.4 Confirm that the gas supply meets the industry requirements for the installation</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Outcome 2</th>
<th>Know the types of central heating system and their layout requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment Criteria</strong></td>
<td></td>
</tr>
<tr>
<td>2.1 Identify the working principles of central heating systems.</td>
<td></td>
</tr>
<tr>
<td>a. Pumped heating only system</td>
<td></td>
</tr>
<tr>
<td>b. Pumped with gravity hot water</td>
<td></td>
</tr>
<tr>
<td>c. Fully pumped with 2 x two port valves</td>
<td></td>
</tr>
<tr>
<td>d. Fully pumped with a mid-position valve</td>
<td></td>
</tr>
<tr>
<td>e. Combination boiler with pumped heating</td>
<td></td>
</tr>
</tbody>
</table>
Learning Outcome 2  Continued
Know the types of central heating system and their layout requirements

Assessment Criteria

2.2 Identify the type of central heating system from layout diagrams.
   a. Open vented
      - Pumped heating only
      - Pumped with gravity hot water including heat sink circuits
      - Fully pumped with 2 x port valves
      - Fully pumped with a mid-position valve
   b. Sealed system
      - Pumped heating only
      - Fully pumped with 2 x port valves
      - Fully pumped with a mid-position valve
      - Combination boiler with pumped heating
      - System boiler with pumped heating

2.3 State the system layout features for filling and venting systems.
   a. Open vented systems
      - Feed and expansion cistern position
      - Pump position
      - Cold feed and open vent pipe connection
      - Methods of releasing air from the system
   b. Sealed systems
      - Expansion vessel position
      - Pressure gauge, pressure relief valve and filling loop position
      - Pump position
      - Methods of releasing air from the system

2.4 State the layout features for the systems that include micro and minibore pipe work.

2.5 State the general operating principles of oil fired heat producing appliances.
   a. Open fire with high output back boilers
   b. Room heaters
   c. Cookers
   d. Independent boilers

2.6 State the general operating principles of oil fired heat producing appliances.
   a. Pressure jet
      - Traditional boilers
      - Condensing boilers
      - Combination boilers
      - Freestanding boilers
      - Wall mounted boilers
      - Open flued boilers
      - Room sealed boiler
   b. Vaporising
      - Open flued cookers
Learning Outcome 2  Continued
Know the types of central heating system and their layout requirements

Assessment Criteria

2.7 State the general operating principles of gas fired heat producing appliances.
   a. Open flued boilers
   b. Room sealed boilers
   c. Traditional boilers
   d. Condensing boilers
   e. Combination boilers
   f. System boilers
   g. Freestanding boilers
   h. Wall mounted boilers
   i. Fan assisted boilers

2.8 State the operating principles of heat emitters.
   a. Panel radiators
   b. Column radiators
   c. Low surface temperature radiators
   d. Fan convectors
      - Wall mounted
      - Kick space
   e. Towel warmers
   f. Towel warmers with integral panel radiators

2.9 State the operating principles of central heating control components.
   a. Radiator valves – thermostatic and manual valves
   b. Automatic air vents
   c. Motorised valves – two port and three port mid position and diverter
   d. Hot water storage cylinders
   e. Feed and expansion cisterns
   f. Circulating pumps
   g. Automatic bypass valves
   h. Thermo-mechanical cylinder control valves
   i. Anti-gravity valves
   j. Drain valves
   k. Timing devices – clocks and programmers
   l. Room thermostats
   m. Cylinder thermostats and overheat protection devices
   n. Frost and pipe combined thermostats

2.10 State the operating principles of devices used in central heating systems to minimise the build-up of sediment.

Learning Outcome 3
Know the site preparation techniques for central heating systems and components

Assessment Criteria

3.1 Identify the sources of information required when undertaking work on central heating systems.
   a. Statutory regulations
   b. Industry standards
   c. Manufacturer technical instructions

3.2 Identify the preparatory work required to be carried out to the building fabric in order to install, decommission or maintain central heating systems.
### Learning Outcome 3  Continued

Know the site preparation techniques for central heating systems and components  

**Assessment Criteria**

| 3.3 | Identify the protection measures required to the building fabric or customer property, during and on completion of work on central heating systems and components. |
| 3.4 | Identify the pipework materials and fittings required to complete work on central heating systems ensuring that they are not damaged. |
| 3.5 | State the range of hand and power tools required to complete work on central heating systems. |

### Learning Outcome 4

Be able to apply site preparation techniques for central heating systems and components

**Assessment Criteria**

| 4.1 | Check the safety of the work location in order for the work to safely proceed. |
| a. | Safe access and exit |
| b. | Immediate work location e.g. tripping hazards |
| c. | Appropriate risk assessments/ method statements are available |

| 4.2 | Wear Personal Protective Equipment relevant to the installation, decommissioning or maintenance task being carried out. |
| 4.3 | Apply protection measures to the building fabric or customer property, during and on completion of work on central heating systems and components. |
| 4.4 | Select the pipework materials and fittings required to complete work on central heating systems ensuring that they are not damaged. |
| 4.5 | Select the hand and power tools required to complete work on central heating systems. |
| 4.6 | Carry out preparatory work in order to install central heating systems. |

### Learning Outcome 5

Know the installation requirements of central heating systems and components

**Assessment Criteria**

| 5.1 | State the procedures required to assemble valves to radiators and mount radiators on wall surfaces. |
| 5.2 | State the positioning and fixing requirements of central heating pipework and components. |
| a. | In suspended timber floors |
| b. | In solid floors |
| c. | Embedded in walls |
| d. | In all areas of the building subject to frost |
| 5.3 | Identify how expansion and contraction may be catered for in central heating pipework containing. |
| a. | Plastics |
| b. | Cooper |
| 5.4 | State how to select clips and brackets appropriate to the hot water system pipework and the industry recommended spacing’s. |
| a. | Horizontally mounted pipework |
| b. | Vertically mounted pipework |
| 5.5 | Identify how to select joints for use in central heating system pipework. |
| a. | LCS threaded joints |
| b. | Plastic- pushfit joints |
| c. | Capillary solder joints |
| d. | Compression joints |
Learning Outcome 5  Continued

Know the installation requirements of central heating systems and components

Assessment Criteria

5.6 State the positioning and fixing requirements of components in central heating systems.
   a. Radiator valves – thermostatic and manual valves
   b. Automatic air vents
   c. Hot water storage cylinders
   d. Feed and expansion cisterns
   e. Motorised valves – two port and three port mid position and diverter
   f. Circulating pumps
   g. Automatic bypass valves
   h. Thermo mechanical cylinder control valve
   i. Anti-gravity valve
   j. Drain valves
   k. Timing devices – clocks and programmers
   l. Room thermostats
   m. Cylinder thermostats and overheat protection devices
   n. Frost and pipe combined thermostat

5.7 Identify suitable methods for making new central heating pipework connections to components.
   a. Boilers
   b. Central heating control system components
   c. Heat emitters
   d. Hot water storage cylinders
   e. Feed and expansion cisterns

5.8 State how to position, fix and connect new central heating pipework to components.
   a. Panel radiators
   b. Boilers
   c. Control components
   d. Hot water storage cylinders
   e. Filling and venting components

5.9 Identify suitable methods for making new central heating pipework connections into existing central heating circuits.
   a. Within a one or two pipe copper system
   b. Within a one or two pipe low carbon steel system
   c. To a microbore or minibore system

5.10 Identify the insulation requirements of central heating system components
    a. Pipework
    b. Cisterns

Learning Outcome 6

Be able to install central heating systems and components

Assessment Criteria

6.1 Assemble heat emitter components.
6.2 Make pipework fixings to copper and low carbon steel central heating system pipework.
6.3 Joint central heating pipework systems.
   a. LCS threaded joints
   b. Capillary solder joints
   c. Compression joints
### Learning Outcome 6  Continued

Be able to install central heating systems and components

**Assessment Criteria**

6.4 Position, fix and connect new central heating pipework to components Heat emitters.
   a. Boilers
   b. Control components
   c. Hot water storage cylinders
   d. Filling and venting components

6.5 Apply insulation to central heating system pipework.

6.6 Demonstrate that central heating components and pipework systems cannot be brought into operation by the end user before the work has been fully completed.

### Learning Outcome 7

Know the service and maintenance requirements of central heating systems and components

**Assessment Criteria**

7.1 Identify how to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components.

7.2 Identify how to carry out routine checks on central heating components and pipework systems as part of a periodic maintenance programme.
   a. Visual inspection of pipework for leakage and adequate support
   b. Poor circulation in heat emitters
   c. Poor flow rate through heating systems
   d. Venting of gas build up within heat emitters
   e. Operation of control components
   f. Effective operation of thermostats
   g. Operation/ adjustment – system filling and venting components

7.3 State the procedures for dealing with defects in central heating components and pipework.
   a. Failure of control components
   b. Leakage in system pipework
   c. Leakage from heat emitters
   d. Replacement of control valves
   e. Replacement of heat emitters
   f. Replacement of hot water storage cylinders

7.4 Identify the types of information to be provided on a maintenance record for central heating systems.

### Learning Outcome 8

Be able to service and maintain central heating systems and components

**Assessment Criteria**

8.1 Use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components.

8.2 Carry out routine checks on central heating components and pipework systems as part of a periodic maintenance programme.
   a. Visual inspection of pipework for leakage and adequate support
   b. Venting of gas build up within heat emitters
   c. Operation of control components
   d. Effective operation of thermostats
   e. Operation/ adjustment – system filling and venting components
### Learning Outcome 8  Continued

**Be able to service and maintain central heating systems and components**

**Assessment Criteria**

- **8.3** Carry out repairs to defects in central heating system components.
  - a. Replacement of a radiator valve on a heat emitter
  - b. Replacement of a radiator in an existing system
- **8.4** Complete the required details contained in a simple maintenance record for a central heating system.

### Learning Outcome 9

**Know the decommissioning requirements of central heating systems and components**

**Assessment Criteria**

- **9.1** Identify working methods that reduce the periods during which central heating systems are not available to building users.
- **9.2** State the information that needs to be provided to other persons before decommissioning work takes place.
- **9.3** State how to temporarily decommission central heating and connecting pipework systems.
- **9.4** Identify the work sequences for permanently decommissioning central heating and pipework systems.
- **9.5** Identify the procedures for safely draining and disposing of central heating system contents.
- **9.6** Identify the methods used during the decommissioning process to prevent the end-user from operating the appliance or system.
  - a. Isolation of the fuel/electricity supply to the system
  - b. Temporary capping of pipework sections
  - c. Use of warning notices and signs

### Learning Outcome 10

**Be able to decommission central heating systems and components.**

**Assessment Criteria**

- **10.1** Advise appropriate persons before central heating components or pipework are isolated in order to undertake work.
- **10.2** Carry out temporary decommissioning of central heating system components and connecting pipework systems.
- **10.3** Check to ensure that the decommissioning procedures carried out prevent the end-user from operating the appliance or system.
  - a. Isolation of the fuel/electricity supply to the system
  - b. Temporary capping of pipework sections
  - c. Use of warning notices and signs

### Learning Outcome 11

**Know the inspection and soundness testing requirements of central heating systems and components**

**Assessment Criteria**

- **11.1** 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.
- **11.2** State how to fill central heating systems with water at normal operating pressure and check for leakage.
- **11.3** Identify how to carry out a soundness test to industry requirements on central heating systems pipework and components.
Learning Outcome 11  Continued
Know the inspection and soundness testing requirements of central heating systems and components

Assessment Criteria

11.4 Identify the actions that must be taken when inspection and testing reveals defects in central heating systems.
   a. Dealing with systems that do not meet correct installation requirements
   b. Remedial work associate with defective pipework bracketing
   c. Remedial work associated with defective control valves
   d. Remedial work associated with leakage from pipework systems

Learning Outcome 12
Be able to inspect and soundness test central heating systems and components

Assessment Criteria

12.1 Carry out a visual inspection of a central heating system to confirm that it is ready to be filled with water.
12.2 Fill central heating systems with water at normal operating pressure and check for leakage
12.3 Perform a soundness test to industry requirements on central heating systems pipework and components.
F/602/2917 - Understand and apply domestic rainwater system installation and maintenance techniques

This combination unit provides learning in the installation and maintenance of gravity rainwater systems that are installed on dwellings and industrial/commercial properties (of similar size and scope to domestic dwellings) in buildings up to 3 storeys in height. Upon completion the learner will:

- Know the general principles of gravity rainwater systems
- Know the layout requirements of gravity rainwater systems
- Know the site preparation techniques for gravity rainwater systems
- Be able to apply site preparation techniques for gravity rainwater systems
- Know the installation requirements of gravity rainwater systems
- Be able to install gravity rainwater systems
- Know the service and maintenance requirements of gravity rainwater systems
- Be able to service and maintain gravity rainwater systems
- Know the inspection and testing requirements of gravity rainwater systems
- Be able to inspect and test gravity rainwater systems

<table>
<thead>
<tr>
<th>Learning Outcome 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Know the general principles of gravity rainwater systems</strong></td>
</tr>
<tr>
<td><strong>Assessment Criteria</strong></td>
</tr>
<tr>
<td>1.1 State the purpose of gravity rainwater systems used on dwellings.</td>
</tr>
<tr>
<td>1.2 Identify the working principles of gravity rainwater systems used on dwellings.</td>
</tr>
<tr>
<td>1.3 State the common gravity rainwater system component materials.</td>
</tr>
<tr>
<td>a. PVC-U</td>
</tr>
<tr>
<td>b. Extruded Aluminium</td>
</tr>
<tr>
<td>c. Cast Iron</td>
</tr>
<tr>
<td>1.4 Identify the different types of gutter systems used on dwellings.</td>
</tr>
<tr>
<td>a. Half round</td>
</tr>
<tr>
<td>b. Square</td>
</tr>
<tr>
<td>c. Ogee</td>
</tr>
<tr>
<td>d. High capacity</td>
</tr>
<tr>
<td>1.5 Identify the different types of rainwater pipework used with gutter systems on dwellings.</td>
</tr>
<tr>
<td>a. Round section</td>
</tr>
<tr>
<td>b. Square section</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Outcome 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Know the layout requirements of gravity rainwater systems</strong></td>
</tr>
<tr>
<td><strong>Assessment Criteria</strong></td>
</tr>
<tr>
<td>2.1 Identify the factors which are used to determine the type (size) of gutter system used on a dwelling.</td>
</tr>
<tr>
<td>a. Rainfall intensity</td>
</tr>
<tr>
<td>b. Roof area</td>
</tr>
<tr>
<td>c. Running outlet position</td>
</tr>
<tr>
<td>d. Gutter fall</td>
</tr>
<tr>
<td>e. Changes of direction in the gutter run</td>
</tr>
<tr>
<td>f. Customer preference</td>
</tr>
</tbody>
</table>
**Learning Outcome 2  Continued**

**Know the layout requirements of gravity rainwater systems**

**Assessment Criteria**

2.2 Identify the jointing procedures for gutter systems.
   a. PVC-U
   b. Extruded Aluminium
   c. Cast Iron

2.3 State the purpose of components used in an eaves gutter system
   a. Running outlets
   b. Gutter angles
   c. Gutter unions
   d. Stop ends
   e. Specialist unions between different gutter materials

2.4 State how building features determine gutter bracket selection for buildings.
   a. Fascia boards
   b. Exposed rafters (no fascia boards)
   c. No fascia board or exposed rafters (direct fixings to masonry surfaces)

2.5 State the purpose of components used in rainwater pipework.
   a. Offsets
   b. Angles
   c. Branches
   d. Hopper heads
   e. Shoes
   f. Specialist connectors to the drainage system

**Learning Outcome 3**

**Know the site preparation techniques for gravity rainwater systems**

**Assessment Criteria**

3.1 Identify the sources of information required when carrying out work on gravity rainwater systems.
   a. Statutory regulations
   b. Industry standards
   c. Manufacturer technical instructions

3.2 Identify the preparatory work required to be carried out to the building fabric in order to install or maintain gravity rainwater systems.

3.3 State the types of pre-existing damage to the existing building fabric or customer property that may be found before commencing work on gravity rainwater systems.
   a. Building wall surfaces
   b. Existing gravity rainwater system components

3.4 Identify the protection measures required to the building fabric or customer property, during work on gravity rainwater systems.

3.5 Identify the pipework materials and fittings required to complete work on gravity rainwater systems.

3.6 Identify the hand and power tools required to complete work on gravity rainwater systems.
Learning Outcome 4
Be able to apply site preparation techniques for gravity rainwater systems

Assessment Criteria

4.1 Check the safety of the work location in order for the work to safely proceed.
   a. Safe access
   b. Immediate work location e.g. tripping hazards
   c. Appropriate risk assessments/ method statements are available

4.2 Wear Personal Protective Equipment relevant to the installation or maintenance task being carried out

4.3 Apply protection measures to the building fabric or customer property, during work on gravity rainwater systems.

4.4 Select the pipework materials and fittings required to complete work on gravity rainwater systems ensuring that they are not damaged.

4.5 Select the hand and power tools required to complete work on gravity rainwater systems.

Learning Outcome 5
Know the installation requirements of gravity rainwater systems

Assessment Criteria

5.1 Identify how expansion and contraction may be catered for in PVC-u gravity rainwater systems.

5.2 State the positioning and fixing requirements of gutter system components.
   a. Gutter brackets – fascia, rafter and drive-in types
   b. Running outlets
   c. Gutter angles
   d. Gutter unions
   e. Stop ends
   f. Specialist unions between different gutter materials

5.3 Identify how to install lengths of PVC-u gutter and make joints to gutter systems.
   a. Running outlet
   b. Gutter angle
   c. Gutter union
   d. Stop ends

5.4 Identify how to select brackets for rainwater pipework and space them at appropriate intervals

5.5 Identify suitable methods for making new rainwater pipework connections to the drainage system.
   a. Discharge to gully using a shoe
   b. Direct connection to drainage bend
   c. Direct connection to gulley
   d. Direct connection to a soakaway

5.6 Identify suitable methods for making new PVC-u pipework connections into existing rainwater pipework.
### Learning Outcome 6

**Be able to install gravity rainwater systems**

**Assessment Criteria**

<table>
<thead>
<tr>
<th>Number</th>
<th>Task Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1</td>
<td>Position and fix eaves gutter brackets at recommended spacing intervals.</td>
</tr>
<tr>
<td>6.2</td>
<td>Install lengths of PVC-u gutter and make joints to gutter systems.</td>
</tr>
<tr>
<td></td>
<td>a. Running outlet</td>
</tr>
<tr>
<td></td>
<td>b. Gutter angle</td>
</tr>
<tr>
<td></td>
<td>c. Gutter union</td>
</tr>
<tr>
<td></td>
<td>d. Stop ends</td>
</tr>
<tr>
<td>6.3</td>
<td>Make pipework fixings to rainwater pipework.</td>
</tr>
<tr>
<td>6.4</td>
<td>Install lengths of rainwater pipework and make connections</td>
</tr>
<tr>
<td></td>
<td>a. To existing drainage systems</td>
</tr>
<tr>
<td></td>
<td>b. To eaves gutter systems using offset connection</td>
</tr>
</tbody>
</table>

### Learning Outcome 7

**Know the service and maintenance requirements of gravity rainwater systems**

**Assessment Criteria**

<table>
<thead>
<tr>
<th>Number</th>
<th>Task Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1</td>
<td>Identify how to carry out routine checks on gravity rainwater systems as part of a periodic maintenance programme.</td>
</tr>
<tr>
<td></td>
<td>a. Visual inspection of guttering and rainwater pipework for leakage and adequate support</td>
</tr>
<tr>
<td></td>
<td>b. Visual inspection of guttering and rainwater pipework for damage</td>
</tr>
<tr>
<td>7.2</td>
<td>State the procedures for dealing with defects in gravity rainwater systems.</td>
</tr>
<tr>
<td></td>
<td>a. Leakage from systems</td>
</tr>
<tr>
<td></td>
<td>b. Blockages in systems</td>
</tr>
<tr>
<td></td>
<td>c. Improper support to PVC-u gutter systems</td>
</tr>
<tr>
<td>7.3</td>
<td>Identify the procedures for safely handling gravity rainwater system components that may be contaminated with foul waste.</td>
</tr>
</tbody>
</table>

### Learning Outcome 8

**Be able to service and maintain gravity rainwater systems**

**Assessment Criteria**

<table>
<thead>
<tr>
<th>Number</th>
<th>Task Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.1</td>
<td>Carry out routine checks on gravity rainwater systems as part of a periodic maintenance programme.</td>
</tr>
<tr>
<td></td>
<td>a. Visual inspection of guttering and rainwater pipework for leakage and adequate support</td>
</tr>
<tr>
<td></td>
<td>b. Visual inspection of guttering and rainwater pipework for damage</td>
</tr>
<tr>
<td>8.2</td>
<td>Carry out routine maintenance procedures on gravity rainwater systems</td>
</tr>
<tr>
<td></td>
<td>a. Replacement of a section of gutter</td>
</tr>
<tr>
<td></td>
<td>b. Replacement of a gutter union</td>
</tr>
</tbody>
</table>

### Learning Outcome 9

**Know the inspection and testing requirements of gravity rainwater systems**

**Assessment Criteria**

<table>
<thead>
<tr>
<th>Number</th>
<th>Task Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.1</td>
<td>State the checks to be carried out during a visual inspection of a gravity rainwater system to confirm that it is ready to receive rainwater.</td>
</tr>
<tr>
<td>9.2</td>
<td>State the test arrangements for gravity rainwater systems to check for leakage.</td>
</tr>
<tr>
<td>Learning Outcome 9</td>
<td>Continued</td>
</tr>
<tr>
<td>-------------------</td>
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</tr>
<tr>
<td><strong>Assessment Criteria</strong></td>
<td></td>
</tr>
<tr>
<td>9.3 Identify the actions that must be taken when inspection and testing reveals defects in gravity rainwater systems.</td>
<td></td>
</tr>
<tr>
<td>a. Dealing with systems that do not meet correct installation requirements</td>
<td></td>
</tr>
<tr>
<td>b. Remedial work associated with defective gutter and pipework bracketing</td>
<td></td>
</tr>
<tr>
<td>c. Remedial work associated with leakage from systems</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Outcome 10</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment Criteria</strong></td>
</tr>
<tr>
<td>10.1 Carry out a visual inspection of a gravity rainwater system to confirm that it is ready to receive rainwater.</td>
</tr>
<tr>
<td>10.2 Test the gravity rainwater system for leakage using an appropriate source of water.</td>
</tr>
</tbody>
</table>
J/602/2921 - Understand and apply domestic above ground drainage system installation and maintenance techniques

This combination unit provides learning in the installation and maintenance of gravity rainwater systems that are installed on dwellings and industrial/commercial properties (of similar size and scope to domestic dwellings) in buildings up to 3 storeys in height. Upon completion of this unit the learner will:

- Know the uses of sanitary appliances and their operating principles
- Know the types of sanitary pipework system and system layout requirements
- Know the site preparation techniques for sanitary appliances and connecting pipework systems
- Be able to apply site preparation techniques for sanitary appliances and connecting pipework systems
- Know the installation requirements of sanitary appliances and connecting pipework systems
- Be able to install sanitary appliances and connecting pipework systems
- Know the service and maintenance requirements of sanitary appliances and connecting pipework systems
- Be able to service and maintain sanitary appliances and connecting pipework systems
- Know the decommissioning requirements of sanitary appliances and connecting pipework systems
- Be able to decommission sanitary appliances and connecting pipework systems
- Know the inspection and soundness testing requirements of sanitary appliances and connecting pipework systems
- Be able to inspect and soundness test sanitary appliances and connecting pipework systems

**Learning Outcome 1**

Know the uses of sanitary appliances and their operating principles

**Assessment Criteria**

1.1 State the purpose of sanitary appliances used in dwellings.
1.2 Identify the different types of sanitary appliances used in dwellings.
1.3 Identify the working principles of sanitary appliances.
   a. Conventional WCs (not macerators)
   b. Baths
   c. Bidets
   d. Wash hand basins
   e. Showers/cubicles
   f. Sinks (not waste disposal units)
   g. Urinals

**Learning Outcome 2**

Know the types of sanitary pipework system and system layout requirements.

**Assessment Criteria**

2.1 Identify the types of sanitary pipework system and state where they may be used in dwellings.
   a. Primary ventilated stack system
   b. Secondary ventilated stack system
   c. Ventilated branch discharge system

2.2 State the factors that lead to trap seal loss in sanitary pipework systems.
### Learning Outcome 2  Continued

**Know the types of sanitary pipework system and system layout requirements.**

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.3 State the system layout features for discharge stacks (wetted portion) at the foot of the stack in buildings up to 5 storeys in height.</td>
</tr>
<tr>
<td>a. Type of bend</td>
</tr>
<tr>
<td>b. Proximity of low level connections</td>
</tr>
<tr>
<td>2.4 State the system layout features for discharge stacks (wetted portion).</td>
</tr>
<tr>
<td>a. Soil stack sizes based on WC outlet size</td>
</tr>
<tr>
<td>b. Waste stack sizes serving waste appliances only</td>
</tr>
<tr>
<td>c. Use of bends in the wetted portion of the stack</td>
</tr>
<tr>
<td>2.5 State the system layout features for branch discharge pipework.</td>
</tr>
<tr>
<td>a. Layout of unventilated and ventilated branch discharge pipework – maximum length of pipework and pipework gradient</td>
</tr>
<tr>
<td>b. Sizes of branch discharge pipework for soil and waste appliances</td>
</tr>
<tr>
<td>c. Use of traps and self-sealing valves in preventing noxious smells in buildings</td>
</tr>
<tr>
<td>d. Methods of ventilating branch discharge pipework</td>
</tr>
<tr>
<td>e. Methods of connecting multiple waste appliances to branch discharge pipework</td>
</tr>
<tr>
<td>f. Methods of connecting branch discharge pipework into the main stack</td>
</tr>
<tr>
<td>2.6 State the system layout features for stack ventilation (dry portion of the stack).</td>
</tr>
<tr>
<td>a. Proximity of vent outlet to open-able windows</td>
</tr>
<tr>
<td>b. Use of air admittance valves</td>
</tr>
<tr>
<td>2.7 State the system layout features for systems and appliances located on the ground floor.</td>
</tr>
<tr>
<td>a. Stub stack systems</td>
</tr>
<tr>
<td>b. Waste appliance connections to gullies</td>
</tr>
<tr>
<td>c. Waste appliance connections direct to drain</td>
</tr>
<tr>
<td>d. WC connection direct to drain</td>
</tr>
</tbody>
</table>

### Learning Outcome 3

**Know the site preparation techniques for sanitary appliances and connecting pipework systems**

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Identify the sources of information required when carrying out work on sanitary appliances and pipework systems.</td>
</tr>
<tr>
<td>a. Statutory regulations</td>
</tr>
<tr>
<td>b. Industry standards</td>
</tr>
<tr>
<td>c. Manufacturer technical instructions</td>
</tr>
<tr>
<td>3.2 Identify the preparatory work required to be carried out to the building fabric in order to install, decommission or maintain sanitary appliances and pipework systems.</td>
</tr>
<tr>
<td>3.3 Identify the protection measures required to the building fabric or customer property, during and on completion of work on sanitary appliances and pipework systems.</td>
</tr>
<tr>
<td>3.4 Identify the pipework materials and fittings required to complete work on sanitary pipework systems.</td>
</tr>
<tr>
<td>3.5 Identify the hand and power tools required to complete work on sanitary appliances and pipework systems.</td>
</tr>
</tbody>
</table>
### Learning Outcome 4

**Be able to apply site preparation techniques for sanitary appliances and connecting pipework systems**

**Assessment Criteria**

4.1 Check the safety of the work location in order for the work to safely proceed.
   - a. Safe access and exit
   - b. Immediate work location e.g. tripping hazards
   - c. Appropriate risk assessments/ method statements are available

4.2 Wear Personal Protective Equipment relevant to the installation, decommissioning or maintenance task being carried out.

4.3 Apply protection measures to the building fabric or customer property, during and on completion of work on sanitary appliances and pipework systems.

4.4 Select the pipework materials and fittings required to complete work on sanitary pipework systems ensuring that they are not damaged.

4.5 Select the hand and power tools required to complete work on sanitary appliances and pipework systems.

4.6 Carry out preparatory work in order to install sanitary appliances and pipework systems.

### Learning Outcome 5

**Know the installation requirements of sanitary appliances and connecting pipework systems**

**Assessment Criteria**

5.1 Identify how to assemble sanitary appliance fixtures and fittings.
   - a. Waste fittings to appliances
   - b. Terminal fittings to appliances
   - c. Flushing cistern assemblies
   - d. Pre-fabricated bath supports and fixings

5.2 Identify how to make joints to sanitary pipework systems.
   - a. Ring seal joints
   - b. Solvent weld joints
   - c. Compression joints
   - d. Specialist joints such as pan connectors

5.3 Identify how expansion and contraction may be catered for in plastics pipework.
   - a. Ring seal joints
   - b. Solvent weld joints
   - c. Compression joints

5.4 State the positioning and fixing requirements of sanitary appliances.
   - a. Conventional WCs (not macerators)
   - b. Baths
   - c. Bidets
   - d. Wash hand basins
   - e. Showers/cubicles
   - f. Sinks (not waste disposal units)
   - g. Urinals

5.5 State how to select brackets appropriate to the sanitary pipework and the industry recommended spacing’s.
   - a. Horizontally mounted pipework
   - b. Vertically mounted pipework
# Learning Outcome 5  Continued

**Know the installation requirements of sanitary appliances and connecting pipework systems**

## Assessment Criteria

5.6 Identify the suitability of below ground drainage systems to receive foul soil and waste water.
   - Combined drainage systems
   - Separate drainage systems
   - Partially separate drainage systems

5.7 Identify suitable methods for making new plastic pipework connections.
   - Soil stack at ground level to below ground plastic, clay or cast iron drainage pipework
   - Waste pipework discharging to ground floor gullies
   - Stub waste connection to ground floor drainage pipework
   - WC pan connector direct to ground floor drain

5.8 Identify suitable methods for making new plastic pipework connections into existing soil and waste systems.
   - Soil and waste connections to existing cast iron pipework
   - Soil and waste pipework to existing plastic pipework

---

# Learning Outcome 6

**Be able to apply site preparation techniques for sanitary appliances and connecting pipework systems.**

## Assessment Criteria

6.1 Assemble sanitary appliance fixtures and fittings.
   - Waste fittings to appliances
   - Terminal fittings to appliances
   - Flushing cistern assemblies
   - Pre-fabricated bath supports and fixings

6.2 Joint sanitary pipework systems.
   - Ring seal joints
   - Solvent weld joints
   - Compression joints
   - Specialist joints such as pan connectors

6.3 Position and fix bathroom appliances to new systems pipework.
   - Bath or shower tray
   - Wash hand basin
   - WC

6.4 Make plastic sanitary pipework connections.
   - To existing below ground drainage systems
   - From new sanitary appliances into existing sanitary pipework systems

6.5 Demonstrate that sanitary appliances or pipework systems cannot be brought into operation by the end user before the work has been fully completed.
## Learning Outcome 7

**Know the service and maintenance requirements of sanitary appliances and connecting pipe work systems**

### Assessment Criteria

<table>
<thead>
<tr>
<th>Learning Objective</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1</td>
<td>Identify how to use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components.</td>
</tr>
<tr>
<td>7.2</td>
<td>Identify how to carry out routine checks on sanitary appliances and pipework systems as part of a periodic maintenance programme.</td>
</tr>
<tr>
<td></td>
<td>a. Visual inspection of pipe work for leakage and adequate support</td>
</tr>
<tr>
<td></td>
<td>b. Operation of flushing cisterns/mechanisms</td>
</tr>
<tr>
<td></td>
<td>c. Fitting of effective waste outlet plugs</td>
</tr>
<tr>
<td></td>
<td>d. Effective operation of appliance traps/ self sealing valves</td>
</tr>
<tr>
<td>7.3</td>
<td>State the procedures for dealing with defects in sanitary pipe work systems.</td>
</tr>
<tr>
<td></td>
<td>a. Leakage from plastic soil and waste pipe work</td>
</tr>
<tr>
<td></td>
<td>b. Improper support to plastic pipe work systems</td>
</tr>
<tr>
<td></td>
<td>c. Loss of trap seal at sanitary appliances</td>
</tr>
<tr>
<td></td>
<td>d. Blockage in above ground soil and waste pipe work</td>
</tr>
<tr>
<td></td>
<td>e. Blockage in below ground drainage systems</td>
</tr>
<tr>
<td>7.4</td>
<td>Identify the types of information to be provided on a maintenance record for sanitary appliances and pipe work systems.</td>
</tr>
</tbody>
</table>

## Learning Outcome 8

**Be able to apply site preparation techniques for sanitary appliances and connecting pipe work systems**

### Assessment Criteria

<table>
<thead>
<tr>
<th>Learning Objective</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.1</td>
<td>Use manufacturer instructions and job maintenance schedules to establish the periodic servicing requirements of system components.</td>
</tr>
<tr>
<td>8.2</td>
<td>Carry out routine checks on sanitary appliances and pipe work systems as part of a periodic maintenance programme.</td>
</tr>
<tr>
<td></td>
<td>a. Visual inspection of pipe work for leakage and adequate support</td>
</tr>
<tr>
<td></td>
<td>b. Operation of flushing cisterns/mechanisms</td>
</tr>
<tr>
<td></td>
<td>c. Fitting of effective waste outlet plugs</td>
</tr>
<tr>
<td></td>
<td>d. Effective operation of appliance traps/ self-sealing valves</td>
</tr>
<tr>
<td>8.3</td>
<td>Carry out repairs to defects in sanitary pipe work systems.</td>
</tr>
<tr>
<td></td>
<td>a. Leakage from plastic soil and waste pipe work</td>
</tr>
<tr>
<td></td>
<td>b. Loss of trap seal at waste appliances</td>
</tr>
<tr>
<td></td>
<td>c. Blockage in above ground sanitary appliances</td>
</tr>
<tr>
<td>8.4</td>
<td>Complete the required details contained in a simple maintenance record for a sanitation system.</td>
</tr>
</tbody>
</table>

## Learning Outcome 9

**Know the decommissioning requirements of sanitary appliances and connecting pipework systems**

### Assessment Criteria

<table>
<thead>
<tr>
<th>Learning Objective</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.1</td>
<td>Identify working methods that reduce the periods during which toilet and washing facilities are not available to building users.</td>
</tr>
<tr>
<td>9.2</td>
<td>State the information that needs to be provided to other persons before decommissioning work takes place.</td>
</tr>
</tbody>
</table>
### Learning Outcome 9  Continued
Know the decommissioning requirements of sanitary appliances and connecting pipework systems

**Assessment Criteria**

| 9.3 | Identify the safety procedures for safely handling sanitary appliances and pipe work components that may be contaminated with foul waste. |
| 9.4 | Identify how to temporarily decommission sanitary appliances and connecting pipework systems. |
| 9.5 | Identify the work sequences for permanently decommissioning sanitary appliances and pipe work systems. |
| 9.6 | Identify the methods used during the decommissioning process to prevent the end-user from operating the appliance or system. |
  | a. Temporary capping of pipe work sections |
  | b. Use of warning notices and signs |

### Learning Outcome 10
Be able to decommission sanitary appliances and connecting pipe work systems

**Assessment Criteria**

| 10.1 | Advise appropriate persons before a sanitary appliance or pipe work system is isolated in order to undertake work. |
| 10.2 | Carry out temporary decommissioning of sanitary appliances and connecting pipe work systems. |
| 10.3 | Check to ensure that the decommissioning procedures carried out prevent the end-user from operating the appliance or system. |
  | a. Temporary capping of pipe work sections |
  | b. Use of warning notices and signs |

### Learning Outcome 11
Know the inspection and soundness testing requirements of sanitary appliances and connecting pipe work systems

**Assessment Criteria**

| 11.1 | State the checks to be carried out during a visual inspection of a sanitation system to confirm that it is ready to receive foul water. |
| 11.2 | Identify how to carry out an air test on a sanitary pipe work system to industry requirements. |
| 11.3 | Identify the actions that must be taken when inspection and testing reveals defects in sanitary pipe work systems. |
  | a. Dealing with systems that do not meet correct installation requirements |
  | b. Remedial work associated with defective pipe work bracketing |
  | c. Remedial work associated with leakage from pipe work systems |

### Learning Outcome 12
Be able to inspect and soundness test sanitary appliances and connecting pipe work systems

**Assessment Criteria**

| 12.1 | Carry out a visual inspection of a sanitation system to confirm that it is ready to receive foul water. |
| 12.2 | Perform an air test on a sanitary pipe work system to industry requirements. |
T/602/2493 - Apply safe working practices in building services engineering working environment

The performance unit provides job competence in a basic range of level 2 health and safety requirements through formal assessment in the workplace. The learner will:

- Be able to demonstrate personal health and safety precautions in the workplace
- Be able to prepare and use access equipment in the workplace
- Be able to check that the work area is safe in order to carry out work
- Be able to liaise with those responsible for health and safety in the workplace

<table>
<thead>
<tr>
<th>Learning Outcome 1</th>
<th>Be able to demonstrate personal health and safety precautions in the workplace</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment Criteria</td>
<td>1.1 Demonstrate that appropriate personal protective equipment is used throughout work activities.</td>
</tr>
<tr>
<td></td>
<td>1.2 Ensure that health &amp; safety precautions are in place.</td>
</tr>
<tr>
<td></td>
<td>a. First aid kit provision</td>
</tr>
<tr>
<td></td>
<td>b. Fire extinguisher provision</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Outcome 2</th>
<th>Be able to prepare and use access equipment in the workplace</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment Criteria</td>
<td>2.1 Use risk assessments to identify safe methods of working at height.</td>
</tr>
<tr>
<td></td>
<td>2.2 Check access equipment for safe condition prior to use.</td>
</tr>
<tr>
<td></td>
<td>2.3 Perform the safe erection of access equipment.</td>
</tr>
<tr>
<td></td>
<td>2.4 Demonstrate the safe use of access equipment.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Outcome 3</th>
<th>Be able to check that the work area is safe in order to carry out work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment Criteria</td>
<td>3.1 Carry out a check of the work location for health and safety hazards.</td>
</tr>
<tr>
<td></td>
<td>3.2 Verify that access and exit routes to and from the immediate work location are safe and free from obstructions.</td>
</tr>
<tr>
<td></td>
<td>3.3 Demonstrate safe working practices when working with heat producing equipment.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Outcome 4</th>
<th>Be able to liaise with those responsible for health and safety in the workplace</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment Criteria</td>
<td>4.1 Demonstrate methods of recording accidents in the accident book in accordance with company procedures.</td>
</tr>
<tr>
<td></td>
<td>4.2 Demonstrate methods of reporting hazards and accidents in accordance with company procedures.</td>
</tr>
</tbody>
</table>
D/602/2939 - Install and Maintain domestic plumbing and heating systems

This performance unit confirms job competence at Level 2 in the installation, maintenance decommissioning and soundness testing of a range of basic plumbing and heating systems and components in dwellings and industrial/commercial properties (of similar size and scope to domestic dwellings). The learner will:

- Be able to prepare sites for the installation of plumbing and heating systems and components in the workplace
- Be able to install plumbing and heating systems and components in the workplace
- Be able to soundness test plumbing and heating systems and components in the workplace
- Be able to decommission plumbing and heating systems in the workplace
- Be able to maintain plumbing and heating components in the workplace

### Learning Outcome 1
Be able to prepare sites for the installation of plumbing and heating systems and components in the workplace

#### Assessment Criteria

1.1 Check that all necessary job information is available before commencing the installation work.
1.2 Liaise with other persons to confirm the detail of the installation work to be carried out.
1.3 Comply with health and safety requirements when carrying out the installation work.
1.4 Prepare a safe and unobstructed access route to the work areas to carry out the installation work.
1.5 Check that all required tools, equipment and materials are available to undertake the installation work.
1.6 Use job information to identify the location of the building fabric that requires preparatory work to be carried out.
1.7 Report any pre-existing damage to the building fabric or customer property to other persons before carrying out the installation work.
1.8 Provide protection to the building fabric or customer property as the work progresses.
1.9 Carry out preparatory work to the building fabric.
   a. Lifting timber floor surfaces
   b. Cutting holes and notches in timber floor joists
   c. Cutting chases in wall or floor surfaces

### Learning Outcome 2
Be able to install plumbing and heating systems and components in the workplace

#### Assessment Criteria

2.1 Confirm that the incoming or outgoing main supplies meet the requirements of the system or component being installed.
2.2 Measure and mark out the position of the components to be installed.
   a. System pipe work
   b. Main system components
   c. System controls
2.3 Make pipe work and component fixings to the building fabric.
2.4 Position and fix pipe work and components to the building fabric.
   a. Copper
   b. Plastics
**Learning Outcome 2  Continued**

**Be able to install plumbing and heating systems and components in the workplace**

**Assessment Criteria**

2.5 Connect pipe work to system controls and main components.
   a. Cold water systems
   b. Hot water systems
   c. Central heating systems
   d. Sanitation systems
   e. Gravity rainwater systems

2.6 Connect system pipe work to incoming supplies or outgoing services.
   a. Existing system pipe work and components
   b. Cold water supply pipe work
   c. Below ground drainage pipe work

2.7 Carry out installation work minimising the wastage of equipment and materials.

2.8 Take precautions to ensure that the system cannot be brought into operation before the installation work is fully completed.

**Learning Outcome 3**

**Be able to soundness test plumbing and heating systems and components in the workplace**

**Assessment Criteria**

3.1 Carry out a visual inspection of the system or component to be tested to make sure that it is ready to be filled with water.

3.2 Charge the system to normal operating pressure and check for leakage.
   a. Cold water systems
   b. Hot water systems
   c. Central heating systems

3.3 Perform a soundness test to industry requirements on the installed system or component.
   a. Cold water systems
   b. Hot water systems
   c. Central heating systems
   d. Sanitation systems
   e. Gravity rainwater systems

3.4 Flush the system with cold water on completion of soundness testing.

3.5 Rectify any leakage from the system or component found during the soundness test procedure.

**Learning Outcome 4**

**Be able to decommission plumbing and heating systems in the workplace.**

**Assessment Criteria**

4.1 Check that all necessary job information is available before commencing the decommissioning work.

4.2 Liaise with other persons to confirm the detail of the decommissioning work to be carried out.

4.3 Arrange for temporary supplies or services to be available for the duration of decommissioning.

4.4 Comply with health and safety requirements when carrying out decommissioning work.

4.5 Prepare a safe and unobstructed access route to the work areas to carry out the decommissioning work.
### Learning Outcome 4  Continued

Be able to decommission plumbing and heating systems in the workplace.

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4.6</strong> Check that all required tools, equipment and materials are available to undertake the decommissioning work.</td>
</tr>
<tr>
<td><strong>4.7</strong> Report any pre-existing damage to the building fabric or customer property to other persons before carrying out the decommissioning work. Provide protection to the building fabric or customer property as the work progresses.</td>
</tr>
</tbody>
</table>
| **4.9** Isolate the system from the supply source or outgoing service.  
  a. Turn off the electricity and fuel supply to the system  
  b. Turn off the water supply to the system  
  c. Prevent the use of sanitary appliances |
| **4.10** Drain and safely dispose of the system contents.  
  a. Cold water systems  
  b. Hot water systems  
  c. Central heating systems |
| **4.11** Take precautions to ensure that the system cannot be brought back into operation before the decommissioning work is complete. |
| **4.12** Advise other persons that the system has been successfully decommissioned. |

### Learning Outcome 5

Be able to maintain plumbing and heating components in the workplace.

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5.1</strong> Check that all necessary job information is available before commencing the maintenance work.</td>
</tr>
<tr>
<td><strong>5.2</strong> Liaise with other persons to confirm the detail of the maintenance work to be carried out.</td>
</tr>
<tr>
<td><strong>5.3</strong> Comply with health and safety requirements when carrying out maintenance work.</td>
</tr>
<tr>
<td><strong>5.4</strong> Prepare a safe and unobstructed access route to the work areas to carry out the maintenance work.</td>
</tr>
<tr>
<td><strong>5.5</strong> Check that all required tools, equipment and materials are available to undertake the maintenance work.</td>
</tr>
<tr>
<td><strong>5.6</strong> Report any pre-existing damage to the building fabric or customer property to other persons before carrying out the maintenance work.</td>
</tr>
</tbody>
</table>
| **5.7** Provide protection to the building fabric or customer property as the work progresses. Isolate the component from the supply source or outgoing service.  
  a. Turn off the electricity and fuel supply to the component  
  b. Turn off the water supply to the component  
  c. Prevent the use of sanitary appliances |
| **5.8** Drain the component contents. |
| **5.9** Take precautions to ensure that the component cannot be brought back into operation before the maintenance work is complete. |
| **5.10** Carry out the maintenance or replacement of the component to industry requirements. |
| **5.11** Reinstall the supply or service to the component and check it for correct operation. |
| **5.12** Advise other persons that work on the system or component has been successfully completed. |
| **5.13** Complete the details contained in simple maintenance records. |
Unit Ref: R/602/2971 – Install and maintain domestic heating systems

The unit confirms job competence at Level 2 in the installation, maintenance decommissioning and soundness testing of a range of basic domestic heating and hot water systems and components in dwellings. The learner will:

- Be able to prepare sites for the installation of domestic heating and hot water systems and components in the workplace
- Be able to install domestic heating and hot water systems and components in the workplace
- Be able to soundness test domestic heating and hot water systems and components in the workplace
- Be able to decommission domestic heating and hot water systems in the workplace
- Be able to maintain domestic heating and hot water components in the workplace

<table>
<thead>
<tr>
<th>Learning Outcome 1</th>
<th>Be able to prepare sites for the installation of domestic heating and hot water systems and components in the workplace</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment Criteria</strong></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Check that all necessary job information is available before commencing the installation work.</td>
</tr>
<tr>
<td>1.2</td>
<td>Liaise with other persons to confirm the detail of the installation work to be carried out.</td>
</tr>
<tr>
<td>1.3</td>
<td>Comply with health and safety requirements when carrying out the installation work.</td>
</tr>
<tr>
<td>1.4</td>
<td>Prepare a safe and unobstructed access route to the work areas to carry out the installation work.</td>
</tr>
<tr>
<td>1.5</td>
<td>Check that all required tools, equipment and materials are available to undertake the installation work.</td>
</tr>
<tr>
<td>1.6</td>
<td>Use job information to identify the location of the building fabric that requires preparatory work to be carried out.</td>
</tr>
<tr>
<td>1.7</td>
<td>Report any pre-existing damage to the building fabric or customer property to other persons before carrying out the installation work</td>
</tr>
<tr>
<td>1.8</td>
<td>Provide protection to the building fabric or customer property as the work progresses.</td>
</tr>
<tr>
<td>1.9</td>
<td>Carry out preparatory work to the building fabric.</td>
</tr>
<tr>
<td></td>
<td>a. Lifting timber floor surfaces</td>
</tr>
<tr>
<td></td>
<td>b. Cutting holes and notches in timber floor joists</td>
</tr>
<tr>
<td></td>
<td>c. Cutting chases in wall or floor surfaces</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Outcome 2</th>
<th>Be able to install domestic heating and hot water systems and components in the workplace</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment Criteria</strong></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Confirm that the incoming or outgoing main supplies meet the requirements of the system or component being installed.</td>
</tr>
<tr>
<td>2.2</td>
<td>Measure and mark out the position of the components to be installed.</td>
</tr>
<tr>
<td></td>
<td>a. System pipe work</td>
</tr>
<tr>
<td></td>
<td>b. Main system components</td>
</tr>
<tr>
<td></td>
<td>c. System controls</td>
</tr>
<tr>
<td>2.3</td>
<td>Make pipe work and component fixings to the building fabric.</td>
</tr>
</tbody>
</table>
### Learning Outcome 2  Continued

Be able to install domestic heating and hot water systems and components in the workplace

**Assessment Criteria**

<table>
<thead>
<tr>
<th>2.4</th>
<th>Position and fix pipe work and components to the building fabric.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. Copper</td>
</tr>
<tr>
<td></td>
<td>b. Plastics</td>
</tr>
<tr>
<td>2.5</td>
<td>Connect pipe work to system controls and main components.</td>
</tr>
<tr>
<td></td>
<td>a. Cold water systems (connections into)</td>
</tr>
<tr>
<td></td>
<td>b. Hot water systems</td>
</tr>
<tr>
<td></td>
<td>c. Central heating systems</td>
</tr>
<tr>
<td>2.6</td>
<td>Connect system pipe work to hot and cold water systems.</td>
</tr>
<tr>
<td>2.7</td>
<td>Carry out installation work using methods and techniques which minimise the wastage of equipment and materials</td>
</tr>
<tr>
<td>2.8</td>
<td>Take precautions to ensure that the system cannot be brought into operation before the installation work is fully completed</td>
</tr>
</tbody>
</table>

### Learning Outcome 3

Be able to soundness test domestic heating and hot water systems and components in the workplace

**Assessment Criteria**

| 3.1 | Carry out a visual inspection of the system or component to be tested to make sure that it is ready to be filled with water. |
| 3.2 | Charge the system to normal operating pressure and check for leakage. |
|     | a. Cold water systems (connections from existing system pipework or cold water system installed by others) |
|     | b. Hot water systems                                             |
|     | c. Central heating systems                                       |
| 3.3 | Perform a soundness test to industry requirements on the installed system or component. |
|     | a. Hot water systems                                             |
|     | b. Central heating systems                                       |
| 3.4 | Flush the system with water on completion of soundness testing.  |
| 3.5 | Rectify any leakage from the system or component found during the soundness test procedure. |

### Learning Outcome 4

Be able to decommission domestic heating and hot water systems in the workplace

**Assessment Criteria**

| 4.1 | Check that all necessary job information is available before commencing the decommissioning work. |
| 4.2 | Liaise with other persons to confirm the detail of the decommissioning work to be carried out. |
| 4.3 | Arrange for temporary supplies or services to be available for the duration of decommissioning. |
| 4.4 | Comply with health and safety requirements when carrying out decommissioning work. |
| 4.5 | Prepare a safe and unobstructed access route to the work areas to carry out the decommissioning work. |
| 4.6 | Check that all required tools, equipment and materials are available to undertake the decommissioning work. |
### Learning Outcome 4  Continued

Be able to decommission domestic heating and hot water systems in the workplace

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.7 Report any pre-existing damage to the building fabric or customer property to other persons before carrying out the decommissioning work.</td>
</tr>
<tr>
<td>4.8 Provide protection to the building fabric or customer property as the work progresses.</td>
</tr>
<tr>
<td>4.9 Isolate the system from the supply source.</td>
</tr>
<tr>
<td>a. Turn off the electricity and fuel supply to the system</td>
</tr>
<tr>
<td>b. Turn off the water supply to the system</td>
</tr>
<tr>
<td>4.10 Drain and safely dispose of the system contents.</td>
</tr>
<tr>
<td>a. Hot water systems</td>
</tr>
<tr>
<td>b. Central heating systems</td>
</tr>
<tr>
<td>4.11 Take precautions to ensure that the system cannot be brought back into operation before the decommissioning work is complete.</td>
</tr>
<tr>
<td>4.12 Advise other persons that the system has been successfully decommissioned.</td>
</tr>
</tbody>
</table>

### Learning Outcome 5

Be able to maintain domestic heating and hot water components in the workplace

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 Check that all necessary job information is available before commencing the maintenance work.</td>
</tr>
<tr>
<td>5.2 Liaise with other persons to confirm the detail of the maintenance work to be carried out.</td>
</tr>
<tr>
<td>5.3 Comply with health and safety requirements when carrying out maintenance work.</td>
</tr>
<tr>
<td>5.4 Prepare a safe and unobstructed access route to the work areas to carry out the maintenance work.</td>
</tr>
<tr>
<td>5.5 Check that all required tools, equipment and materials are available to undertake the maintenance work.</td>
</tr>
<tr>
<td>5.6 Report any pre-existing damage to the building fabric or customer property to other persons before carrying out the maintenance work.</td>
</tr>
<tr>
<td>5.7 Provide protection to the building fabric or customer property as the work progresses.</td>
</tr>
<tr>
<td>5.8 Isolate the component from the supply source or outgoing service.</td>
</tr>
<tr>
<td>a. Turn off the electricity and fuel supply to the component</td>
</tr>
<tr>
<td>b. Turn off the water supply to the component</td>
</tr>
<tr>
<td>5.9 Drain the component contents.</td>
</tr>
<tr>
<td>5.10 Take precautions to ensure that the component cannot be brought back into operation before the maintenance work is complete.</td>
</tr>
<tr>
<td>5.11 Carry out the maintenance or replacement of the component to industry requirements.</td>
</tr>
<tr>
<td>5.12 Reinstate the supply or service to the component and check it for correct operation.</td>
</tr>
<tr>
<td>5.13 Advise other persons that work on the system or component has been successfully completed.</td>
</tr>
<tr>
<td>5.14 Complete the details contained in simple maintenance records.</td>
</tr>
</tbody>
</table>
R/602/2498 - Understand how to organise resources within BSE

This knowledge unit provides learning in the basic supervisory skills required to organise and coordinate the work of self and a small team of craft operatives in undertaking work in the building services industry. Upon completion of the unit the learners will:

- Know the responsibilities of relevant people in the building services industry
- Know how to oversee building services work
- Know how to produce risk assessments and method statements for the building services industry
- Know how to plan work programmes for work tasks in the building services industry

Learning Outcome 1

Know the responsibilities of relevant people in the building services industry

Assessment Criteria

1.1 Define the types of client that are encountered when working:
   a. Private customer
      - Direct communication
      - Through customer representatives managing agents
   b. Contracting customer
   c. Internal customer – within same company

1.2 Specify the types of communication that may be required with clients throughout the progress of a job

1.3 Specify the types of communication that may be required with the site management team:
   a. Architect
   b. Quantity surveyor
   c. Buyer/Estimator
   d. Surveyor
   e. Project manager/Clerk of Works
   f. Structural engineer
   g. Building services engineer
   h. Construction manager

1.4 Define the typical site responsibilities for craft operatives in the workplace:
   a. Apprentices/trainees
   b. Level 2 craft level qualified staff
      - Limited self-responsibility
   c. Level 3 craft level qualified staff
      - Supervision of self and other staff members

1.5 Specify the different methods of supervising individuals that can be used:
   a. Styles of supervision
   b. Methods of motivating staff

1.6 Define the job responsibilities when supervising staff:
   a. Identifying the competence of subordinates to undertake work
   b. Identifying when direct supervision or detailed direction is required
   c. Specific health and safety issues
      - Responsibility for planning safe working for subordinates
      - How to adjust work schedules when health and safety problems delay works
Learning Outcome 2
Know how to oversee building services work

Assessment Criteria

2.1 Specify how to deal with variations to works:
   a. Prescribed by the work environment
      - Communication to the client
      - Agreement to extra time and costs
   b. Prescribed by the customer
      - Agreement to extra time and costs

2.2 Clarify how to undertake ongoing monitoring of the work progress against the work programme to ensure:
   a. Safety
   b. Cost effectiveness
   c. Quality

2.3 Clarify how to deal with problems that arise with deficiencies in work performance that could affect:
   a. Safety
   b. Cost effectiveness
   c. Quality

Learning Outcome 3
Know how to produce risk assessments and method statements for the building services industry

Assessment Criteria

3.1 Define the levels of risk presented by work situations
3.2 Define the hazards presented by work situations
3.3 Specify the methods used to carry out a risk assessment for a task:
   a. Methods of assessing risk
   b. Risk calculation formula
   c. Presentation of a risk assessment

3.4 Identify how to produce a method statement for areas of work with safety risk:
   a. Information to be provided in a method statement
   b. Presentation of a method statement

Learning Outcome 4
Know how to plan work programmes for work tasks in the building services industry

Assessment Criteria

4.1 Specify the types of work programme that would be used for:
   a. Private installation work
   b. Private service/maintenance work
   c. New-build installation contract work
   d. Service/maintenance contract work

4.2 State the process for planning work activities against job specifications:
   a. The scope, purpose and requirements of the work
   b. Identification of work responsibilities
   c. External factors that affect timeframe
<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4.3</strong> State the process for selecting the required resources against the job specification:</td>
</tr>
<tr>
<td>a. Materials</td>
</tr>
<tr>
<td>b. Plant</td>
</tr>
<tr>
<td>c. Vehicles</td>
</tr>
<tr>
<td>d. Equipment</td>
</tr>
<tr>
<td><strong>4.4</strong> Specify material delivery requirements against work programmes and the impact that the non-availability of materials may have on work progress:</td>
</tr>
<tr>
<td>a. Work in private properties</td>
</tr>
<tr>
<td>b. Work on new-build housing</td>
</tr>
<tr>
<td>c. Work on commercial contracts</td>
</tr>
<tr>
<td>d. Avoiding loss of materials on site (theft)</td>
</tr>
<tr>
<td><strong>4.5</strong> Define the factors which affect working time allocation to work activities:</td>
</tr>
<tr>
<td>a. Labour resources</td>
</tr>
<tr>
<td>b. Planning work with other trades</td>
</tr>
<tr>
<td>c. Material deliveries</td>
</tr>
<tr>
<td><strong>4.6</strong> Identify how to produce simple work programmes:</td>
</tr>
<tr>
<td>a. Simple bar (progress) charts</td>
</tr>
</tbody>
</table>
K/502/8930 - Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques

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. Upon completion of the unit the learners will:

- Know the legislation relating to the installation and maintenance of cold water supplied for domestic purposes
- Know the types of cold water system layout used in multi-storey dwellings
- Know the types of cold water system layout used with single occupancy dwellings fed by private water supplies
- Know the requirements for backflow protection in plumbing systems
- Know the uses of specialist components in cold water systems
- Know the design techniques for cold water systems
- Be able to apply design techniques for cold water systems
- Know the fault diagnosis and rectification procedures for cold water systems and components
- Be able to diagnose and rectify faults in cold water systems and components
- Know the commissioning requirements of cold water systems and components
- Be able to commission cold water systems and components

### Learning Outcome 1
Know the legislation relating to the installation and maintenance of cold water supplied for domestic purposes

#### Assessment Criteria

1.1 Interpret the legislation controlling the installation and use of water systems:
   - a. Supplied from a water undertaker
   - b. Supplied form a private source

1.2 Clarify the notification requirements for work on wholesome and recycled water systems:
   - a. Water undertaker
   - b. Building control or self-certification

1.3 Differentiate between installer and user responsibilities under water legislation

### Learning Outcome 2
Know the types of cold water system layout used in multi-storey dwellings

#### Assessment Criteria

2.1 State the cold water system component layout features for multi-storey dwellings:
   - a. Supplied direct from the main
   - b. Using break cistern arrangements
   - c. Providing drinking water
<table>
<thead>
<tr>
<th>Learning Outcome 2</th>
<th>Continued</th>
</tr>
</thead>
<tbody>
<tr>
<td>Know the types of cold water system layout used in multi-storey dwellings</td>
<td></td>
</tr>
<tr>
<td><strong>Assessment Criteria</strong></td>
<td></td>
</tr>
<tr>
<td>2.2 State the system layout features for large scale storage cisterns used in multi-storey cold water systems for dwellings:</td>
<td></td>
</tr>
<tr>
<td>a. Warning/overflow pipe</td>
<td></td>
</tr>
<tr>
<td>b. Alternative filling methods using</td>
<td></td>
</tr>
<tr>
<td>- Float switches and solenoid valves</td>
<td></td>
</tr>
<tr>
<td>- Specialist inlet valves</td>
<td></td>
</tr>
<tr>
<td>c. Interlinking multiple cisterns</td>
<td></td>
</tr>
<tr>
<td>d. Use of sectional cisterns</td>
<td></td>
</tr>
<tr>
<td>2.3 State the system layout features for break cisterns used in multi-storey cold water systems for dwellings</td>
<td></td>
</tr>
<tr>
<td>2.4 Define the function of components used in boosted cold water systems in multi-storey dwellings:</td>
<td></td>
</tr>
<tr>
<td>a. Booster pumps</td>
<td></td>
</tr>
<tr>
<td>- Sets with integral controls</td>
<td></td>
</tr>
<tr>
<td>- Self-assembled sets</td>
<td></td>
</tr>
<tr>
<td>a. Pressure/expansion vessels</td>
<td></td>
</tr>
<tr>
<td>b. Pressure switch (transducer)</td>
<td></td>
</tr>
<tr>
<td>c. Float switch</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Outcome 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Know the types of cold water system layout used with single occupancy dwellings fed by private water supplies</td>
</tr>
<tr>
<td><strong>Assessment Criteria</strong></td>
</tr>
<tr>
<td>3.1 Propose the methods of providing private water supplies to single occupancy dwellings:</td>
</tr>
<tr>
<td>a. Pumped from wells and boreholes</td>
</tr>
<tr>
<td>b. Collected from surface water sources – streams and springs</td>
</tr>
<tr>
<td>c. Use of externally sited break cisterns</td>
</tr>
<tr>
<td>3.2 Propose the methods of treating water for use in single occupancy dwellings:</td>
</tr>
<tr>
<td>a. Localised water filtration units</td>
</tr>
<tr>
<td>b. Localised water treatment units – ultra violet</td>
</tr>
<tr>
<td>3.3 State the system layout features for cold water systems fed from private water supplies:</td>
</tr>
<tr>
<td>a. Conventional direct or indirect systems from an incoming supply</td>
</tr>
<tr>
<td>b. Boosted (pumped) supply from a well or borehole</td>
</tr>
<tr>
<td>c. Boosted (pumped) supply from a low level internal or external break cistern</td>
</tr>
<tr>
<td>3.4 Define the method of operation of the components used in a boosted (pumped) cold water supply system from private sources for single occupancy dwellings:</td>
</tr>
<tr>
<td>a. Small booster pump sets which incorporate all controls and components</td>
</tr>
<tr>
<td>b. Boosted system with separate controls and components</td>
</tr>
<tr>
<td>c. Use of accumulators in increasing system flow rate</td>
</tr>
</tbody>
</table>
### Learning Outcome 4
Know the requirements for backflow protection in plumbing systems

#### Assessment Criteria

4.1 Interpret the five fluid risk levels as laid down in water legislation

4.2 Define terminology used when selecting and applying backflow prevention devices:
   a. Point of use protection
   b. Whole site or zone protection

4.3 Propose the installation situations in which non-mechanical backflow prevention devices may be used:
   a. Type AA – air gap with unrestricted discharge above spill over level
   b. Type AB – air gap with weir overflow
   c. Type AD – air gap with injector
   d. Type AG – air gap with minimum size circular overflow
   e. Type AUK1 – air gap with interposed cistern
   f. Type AUK2 – air gaps for taps and combination taps
   g. Type AUK3 – air gaps for taps and combination taps
   h. Type DC pipe interrupter with permanent atmospheric vent

4.4 Propose the installation situations in which mechanical backflow prevention devices may be used:
   a. Type BA – reduced pressure zone valve
   b. Type DB – pipe interrupter with permanent atmospheric vent and moving element
   c. Type EC/ED – double check valves
   d. Type HUK1 – hose union tap with double check valves
   e. Type CA – non verifiable disconnector
   f. Type EA/EB – single check valves
   g. Type HA – hose union backflow preventer
   h. Type HC – diverter with automatic return

4.5 Determine methods of preventing cross connection in systems that contain non-wholesome water sources

### Learning Outcome 5
Know the uses of specialist components in cold water systems

#### Assessment Criteria

5.1 Analyse the working principles of cold water system components:
   a. Infra-red operated taps
   b. Concussive taps
   c. Combination bath tap and shower head
   d. Flow limiting valves
   e. Spray taps
   f. Urinal – water conservation controls
   g. Shower pumps – single and twin impellor
   h. Pressure reducing valves
   i. Shock arrestors/mini expansion vessels

5.2 Evaluate the use of components in cold water systems to overcome temperature and pressure effects caused by the installation of backflow prevention devices
### Learning Outcome 6
Know the design techniques for cold water systems

#### Assessment Criteria

<table>
<thead>
<tr>
<th>6.1</th>
<th>Interpret information sources when undertaking design work on cold water systems:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Statutory regulations</td>
</tr>
<tr>
<td>b.</td>
<td>Industry standards</td>
</tr>
<tr>
<td>c.</td>
<td>Manufacturer technical instructions</td>
</tr>
<tr>
<td>d.</td>
<td>Verbal and written feedback from the customer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6.2</th>
<th>Clarify how to take measurements of building features in order to carry out design calculations:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>From plans, drawings and specifications</td>
</tr>
<tr>
<td>b.</td>
<td>From site</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6.3</th>
<th>Calculate the size of cold water system components used in single occupancy dwellings:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Cistern</td>
</tr>
<tr>
<td>b.</td>
<td>Pipework</td>
</tr>
<tr>
<td>c.</td>
<td>Pump</td>
</tr>
<tr>
<td>d.</td>
<td>Pressure vessel</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6.4</th>
<th>Clarify how to present design calculations in an acceptable format:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Using basic not to scale line drawings</td>
</tr>
<tr>
<td>b.</td>
<td>Details for insertion into a quotation or tender for work in a small-scale dwelling</td>
</tr>
</tbody>
</table>

### Learning Outcome 7
Be able to apply design techniques for cold water systems

#### Assessment Criteria

<table>
<thead>
<tr>
<th>7.1</th>
<th>Use information sources when undertaking design work for cold water systems:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Statutory regulations</td>
</tr>
<tr>
<td>b.</td>
<td>Industry standards</td>
</tr>
<tr>
<td>c.</td>
<td>Manufacturer technical instructions</td>
</tr>
<tr>
<td>d.</td>
<td>Verbal and written feedback from the customer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7.2</th>
<th>Calculate the size of cold water system components used in single occupancy dwellings:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Cistern</td>
</tr>
<tr>
<td>b.</td>
<td>Pipework</td>
</tr>
<tr>
<td>c.</td>
<td>Pump</td>
</tr>
<tr>
<td>d.</td>
<td>Pressure vessel</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7.3</th>
<th>Present design calculations in an acceptable format:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Using basic not to scale line drawings</td>
</tr>
<tr>
<td>b.</td>
<td>Details for insertion into a quotation or tender for work in a small-scale dwelling</td>
</tr>
</tbody>
</table>

### Learning Outcome 8
Know the fault diagnosis and rectification procedures for cold water systems and components

#### Assessment Criteria

<table>
<thead>
<tr>
<th>8.1</th>
<th>State the methods of obtaining details of system faults from end users</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.2</td>
<td>Interpret manufacturer instructions and industry standards to establish the diagnostic requirements of cold water system components</td>
</tr>
</tbody>
</table>
Learning Outcome 8  Continued

Know the fault diagnosis and rectification procedures for cold water systems and components

Assessment Criteria

8.3 Propose routine checks and diagnostics on cold water system components as part of a fault finding process:
   a. Checking components for correct operating pressures and flow rates
   b. Cleaning system components (including dismantling and reassembly)
   c. Checking for correct component operation
      - Pumps
      - Pressure switches (transducers)
      - Float switches
      - Expansion and pressure vessels
      - Gauges and controls
   d. Checking for correct operation of treatment devices
      - Water filters
      - Water softeners

8.4 Specify methods of repairing faults in cold water system components:
   a. Pumps
   b. Expansion/pressure vessels
   c. Pressure switches (transducers)
   d. Float switches
   e. Gauges and controls

8.5 Specify methods of safely isolating cold water systems or components to prevent them being brought into operation before the work has been fully completed

8.6 Define procedures for carrying out diagnostic tests to locate faults in cold water system components:
   a. Booster (pump) set to a system
   b. Backflow prevention devices

8.7 Specify methods for diagnosing and preventing corrosion within cold water system pipework:
   a. Electrolytic corrosion
   b. Blue water corrosion

Learning Outcome 9

Be able to diagnose and rectify faults in cold water systems and components

Assessment Criteria

9.1 Use manufacturer instructions and industry standards to establish the diagnostic requirements of cold water system components

9.2 Isolate cold water systems or components to prevent them being brought into operation before the work has been fully completed

9.3 Carry out diagnostic tests to locate faults in cold water system components and carry out repair work:
   a. Booster (pump) set to a system
   b. Backflow prevention devices
### Learning Outcome 10

**Know the commissioning requirements of cold water systems and components**

**Assessment Criteria**

<table>
<thead>
<tr>
<th>10.1</th>
<th>Interpret information sources required to complete commissioning work on cold water systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.2</td>
<td>State how to fill cold water pipework with water at normal operating pressure and check for leakage</td>
</tr>
</tbody>
</table>
| 10.3 | Identify how to conduct a soundness test on cold water systems:  
  a. Metallic systems  
  b. Plastic pipework systems |
| 10.4 | Specify the disinfection procedures for cold water systems and the circumstances in which disinfection should be applied |
| 10.5 | State the flushing procedure for cold water systems and components |
| 10.6 | Clarify how to take flow rate and pressure readings from new and existing cold water systems |
| 10.7 | Specify the actions that must be taken when commissioning reveals defects in cold water systems:  
  a. Dealing with systems that do not meet correct installation requirements  
  b. Micro-biological contamination within a cold water systems  
  c. Remedial work associated with defective components |
| 10.8 | State the procedure for notifying works carried out to the relevant authority |
| 10.9 | Propose the range of information that would be detailed on a commissioning record for a cold water system |
| 10.10 | Propose the points to be covered when handing over a completed system to the end-user |

### Learning Outcome 11

**Be able to commission cold water systems and components**

**Assessment Criteria**

<table>
<thead>
<tr>
<th>11.1</th>
<th>Carry out a visual inspection of a boosted cold water system to confirm that it is ready to be filled with water</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.2</td>
<td>Charge cold water pipework with water at normal operating pressure and check for leakage</td>
</tr>
<tr>
<td>11.3</td>
<td>Perform a soundness test to industry requirements on cold water systems pipework and components</td>
</tr>
<tr>
<td>11.4</td>
<td>Perform a disinfection procedure on a cold water system to industry requirements</td>
</tr>
<tr>
<td>11.5</td>
<td>Flush the system with wholesome water on completion of soundness testing</td>
</tr>
<tr>
<td>11.6</td>
<td>Use test instruments to take readings of the water supply pressure and flow rate</td>
</tr>
</tbody>
</table>
| 11.7 | Adjust and set controls to achieve system design requirements:  
  a. Pressure at outlets  
  b. Flow rate at outlets |
K/502/9155 - Understand and apply domestic hot water system installation, commissioning, service and maintenance techniques

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. Upon completion of the unit the learners will:

- Know the types of hot water system and their layout requirements
- Know the uses of specialist components in hot water systems
- Know the design techniques for hot water systems
- Be able to apply design techniques for hot water systems
- Know the installation requirements of hot water systems and components
- Be able to install hot water systems and components
- Know the fault diagnosis and rectification procedures for hot water systems and components
- Be able to diagnose and rectify faults in hot water systems and components
- Know the commissioning requirements of hot water systems and components
- Be able to commission hot water systems and components

### Learning Outcome 1

**Know the types of hot water system and their layout requirements**

#### Assessment Criteria

1.1 Compare the types of hot water supply systems used in dwellings:
   a. Centralised systems
      - Unvented hot water systems
      - Open vented hot water systems
   b. Localised systems
      - Unvented point of use heaters
      - Instantaneous heaters

1.2 Identify hot water system pipework layout features for dwellings:
   a. Centralized unvented hot water systems
   b. Larger systems requiring a secondary circulation system

1.3 Confirm the recommended design temperatures within hot water systems:
   a. Hot water storage vessel
   b. Hot water outflow
   c. Secondary return
   d. At point of use
      - Instantaneous heaters
      - Storage system
      - Thermostatic mixing valve installations

1.4 Evaluate the various types of unvented hot water system:
   a. Indirect storage systems
   b. Direct storage systems
      - Electrically heated
      - Gas or oil fired
   c. Small point of use (under sink)

1.5 Clarify the use of cold water accumulators in unvented hot water systems
## Learning Outcome 1  Continued

Know the types of hot water system and their layout requirements

### Assessment Criteria

<table>
<thead>
<tr>
<th>Learning Area</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.6</td>
<td>Define the function of components in unvented hot water systems:</td>
</tr>
<tr>
<td></td>
<td>a. Safety devices</td>
</tr>
<tr>
<td></td>
<td>- Control thermostat</td>
</tr>
<tr>
<td></td>
<td>- Overheat thermostat (thermal cut-out)</td>
</tr>
<tr>
<td></td>
<td>- Temperature relief valve</td>
</tr>
<tr>
<td></td>
<td>b. Functional devices</td>
</tr>
<tr>
<td></td>
<td>- Line strainer</td>
</tr>
<tr>
<td></td>
<td>- Pressure reducing valve</td>
</tr>
<tr>
<td></td>
<td>- Single check valve</td>
</tr>
<tr>
<td></td>
<td>- Expansion device (vessel or integral to cylinder)</td>
</tr>
<tr>
<td></td>
<td>- Expansion relief valve</td>
</tr>
<tr>
<td></td>
<td>- Tundish arrangements</td>
</tr>
<tr>
<td></td>
<td>- Application of composite valves</td>
</tr>
<tr>
<td>1.7</td>
<td>Specify the layout features for temperature and expansion relief pipe in unvented hot water systems</td>
</tr>
<tr>
<td>1.8</td>
<td>Specify the layout features for pipework systems incorporating secondary circulation:</td>
</tr>
<tr>
<td></td>
<td>a. Pump type and location</td>
</tr>
<tr>
<td></td>
<td>b. Timing devices</td>
</tr>
<tr>
<td></td>
<td>c. Prevention of reverse circulation</td>
</tr>
<tr>
<td></td>
<td>d. Methods of balancing circuits</td>
</tr>
<tr>
<td>1.9</td>
<td>State how trace heating can be used as an alternative to a secondary circulation system</td>
</tr>
</tbody>
</table>

## Learning Outcome 2

Know the uses of specialist components in hot water systems

### Assessment Criteria

<table>
<thead>
<tr>
<th>Learning Area</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Analyse the working principles of hot water system components:</td>
</tr>
<tr>
<td></td>
<td>a. Infra-red operated taps</td>
</tr>
<tr>
<td></td>
<td>b. Concussive taps</td>
</tr>
<tr>
<td></td>
<td>c. Combination bath tap and shower head</td>
</tr>
<tr>
<td></td>
<td>d. Flow limiting valves</td>
</tr>
<tr>
<td></td>
<td>e. Spray taps</td>
</tr>
<tr>
<td></td>
<td>f. Shower pumps – single and twin impellor</td>
</tr>
<tr>
<td></td>
<td>g. Pressure reducing valves</td>
</tr>
<tr>
<td></td>
<td>h. Show arrestors/mini expansion vessels</td>
</tr>
<tr>
<td>2.2</td>
<td>Evaluate the use of components in hot water systems to overcome temperature and pressure effects caused by the installation of backflow prevention devices</td>
</tr>
</tbody>
</table>
## Learning Outcome 3
Know the design techniques for hot water systems

### Assessment Criteria

3.1 Define the factors which affect the selection of hot water systems for single occupancy dwellings

3.2 State the criteria used then selecting hot water system and component types:
   - a. Customer needs
   - b. Building layout and features
   - c. Suitability of system
   - d. Energy efficiency
   - e. Environmental impact

3.3 Interpret information sources when undertaking design work on hot water systems:
   - a. Statutory regulations
   - b. Industry standards
   - c. Manufacturer technical instructions
   - d. Verbal and written feedback from the customer

3.4 Clarify how to take measurements of building features in order to carry out design calculations:
   - a. From plans, drawings and specifications
   - b. From site

3.5 Calculate the size of hot water system components used in single occupancy dwellings:
   - a. Cistern
   - b. Hot water storage vessel
   - c. Pipework
   - d. Secondary circulation pump
   - e. Booster pump (shower and full system)

3.6 Clarify how to present calculations in an acceptable format:
   - a. Using basic not to scale line drawings
   - b. Details for insertion into a quotation or tender for work in a small-scale dwelling

## Learning Outcome 4
Be able to apply design techniques for hot water systems

### Assessment Criteria

4.1 Use information sources when undertaking design work for hot water systems:
   - a. Statutory regulations
   - b. Industry standards
   - c. Manufacturer technical instructions
   - d. Verbal and written feedback from the customer

4.2 Calculate the size of hot water system components used in single occupancy dwellings:
   - a. Cistern
   - b. Cylinder
   - c. Pipework
   - d. Secondary circulation pump
   - e. Booster pump (shower and full system)

4.3 Present design calculations in an acceptable format
   - a. Using basic not to scale line drawings
   - b. Details for insertion into a quotation or tender for a work in a small scale dwelling
### Learning Outcome 4
**Continued**

Be able to apply design techniques for hot water systems

**Assessment Criteria**

4.3 Present design calculations in an acceptable format
   - c. Using basic not to scale line drawings
   - d. Details for insertion into a quotation or tender for a work in a small scale dwelling

### Learning Outcome 5

Know the installation requirements of hot water systems and components

**Assessment Criteria**

5.1 Define the terms balanced and unbalanced supply pressures in unvented hot water storage systems
5.2 Specify the positioning and fixing requirements of components and unvented hot water systems:
   - a. Safety devices
     - Control thermostat
     - Overheat thermostat (thermal cut-out)
     - Temperature relief valve
   - b. Functional devices
     - Line strainer
     - Pressure reducing valve
     - Single check valve
     - Expansion relief valve (vessel or integral to cylinder)
     - Tundish arrangements
     - Application of composite valves
5.3 State the pipe size and positioning methods for safety relief pipework connected to unvented hot water cylinder safety valves:
   - a. D1 section
   - b. Tundish
   - c. D2 pipework
   - d. Correction termination
5.4 State the positioning and fixing requirements of components of secondary circulation systems:
   - a. System pipework
   - b. Pump
   - c. Control valves
   - d. Timing devices
   - e. Reverse circulation control valves
   - f. Pipework insulation
### Learning Outcome 6

Be able to install hot water systems and components

#### Assessment Criteria

6.1 Connect pipework to an unvented hot water system:
   - a. Incoming supply pipework
     - Line strainer
     - Pressure reducing valve
   - b. Expansion vessel
   - c. Storage cylinder
   - d. Check valve

6.2 Position, fix and connect new hot water safety relieve pipework:
   - a. D1 pipework
   - b. Tundish
   - c. D2 pipework
   - d. Correction termination

### Learning Outcome 7

Know the fault diagnosis and rectification procedures for hot water systems and components

#### Assessment Criteria

7.1 Specify the periodic servicing requirements of hot water systems

7.2 State the methods of obtaining details of system faults from end users

7.3 Interpret manufacturer instructions and industry standards to establish the diagnostic requirements of hot water system components

7.4 Propose routine checks and diagnostics on hot water system components as part of a fault finding process:
   - a. Checking components for correct operating pressures, temperatures and flow rates
   - b. Cleaning system components (including dismantling and reassembling)
   - c. Checking for correct operation of system components
     - Thermostats
     - Pumps
     - Timing devices
     - Expansion and pressure levels
     - Gauges and controls
   - d. Checking for correct operation of system safety valves:
     - Temperature relief
     - Expansion

7.5 Specify methods of repairing faults in hot water system components:
   - a. Pumps
   - b. Expansion/pressure
   - c. Vessels safety valves
     - Temperature relief
     - Expansion relief
   - d. Thermostats
   - e. Gauges and controls

7.6 Specify methods of safety isolation hot water systems or components to prevent them being brought into operation before work has been fully completed
### Learning Outcome 7  Continued

**Know the fault diagnosis and rectification procedures for hot water systems and components**

**Assessment Criteria**

<table>
<thead>
<tr>
<th>7.7</th>
<th>Define procedures for carrying out diagnostic tests to locate faults in hot water system components:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Shower booster pump unit</td>
</tr>
<tr>
<td>b.</td>
<td>Safety devices</td>
</tr>
<tr>
<td>c.</td>
<td>Expansion devices</td>
</tr>
<tr>
<td>d.</td>
<td>Thermostats</td>
</tr>
</tbody>
</table>

### Learning Outcome 8

**Be able to diagnose and rectify faults in hot water systems and components**

**Assessment Criteria**

<table>
<thead>
<tr>
<th>8.1</th>
<th>Use manufacturer instructions and industry standards to establish the diagnostic requirements of hot water system components</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.2</td>
<td>Isolate hot water systems or components to prevent them being brought into operation before the work has been fully completed</td>
</tr>
<tr>
<td>8.3</td>
<td>Carry out diagnostic tests to locate faults in hot water system components and carry out repair work</td>
</tr>
<tr>
<td></td>
<td>a. Shower booster pump unit</td>
</tr>
<tr>
<td></td>
<td>b. Safety devices</td>
</tr>
<tr>
<td></td>
<td>c. Expansion devices</td>
</tr>
<tr>
<td></td>
<td>d. Thermostats</td>
</tr>
<tr>
<td>8.4</td>
<td>Carry out the periodic service of an unvented hot water storage system</td>
</tr>
</tbody>
</table>

### Learning Outcome 9

**Know the commissioning requirements of hot water systems and components**

**Assessment Criteria**

<table>
<thead>
<tr>
<th>9.1</th>
<th>Interpret information sources required to complete commissioning work on hot water systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.2</td>
<td>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</td>
</tr>
<tr>
<td>9.3</td>
<td>State how to fill hot water pipework with water at normal operating pressure and check for leakage</td>
</tr>
<tr>
<td>9.4</td>
<td>Identify how to conduct a soundness test on hot water systems:</td>
</tr>
<tr>
<td></td>
<td>a. Metallic systems</td>
</tr>
<tr>
<td></td>
<td>b. Plastic pipework systems</td>
</tr>
<tr>
<td>9.5</td>
<td>State the flushing procedure for hot water systems and components</td>
</tr>
<tr>
<td>9.6</td>
<td>Clarify how to take flow rate and pressure readings from new and existing hot water outlets</td>
</tr>
<tr>
<td>9.7</td>
<td>State how to balance a secondary circulation system during commissioning activities</td>
</tr>
<tr>
<td>9.8</td>
<td>Specify the actions that must be taken when commissioning reveals defects in hot water systems:</td>
</tr>
<tr>
<td></td>
<td>a. Dealing with systems that do not meet correct installation requirements</td>
</tr>
<tr>
<td></td>
<td>b. Remediial work associated with defective components</td>
</tr>
<tr>
<td>9.9</td>
<td>State the procedure for notifying works carried out to the relevant authority</td>
</tr>
</tbody>
</table>
### Learning Outcome 9  Continued

**Assessment Criteria**

1. **9.10** Propose the range of information that would be detailed on a commissioning record for a hot water system.
2. **9.11** Propose the points to be covered when handing over a completed system to the end-user.

### Learning Outcome 10

**Be able to commission hot water systems and components**

**Assessment Criteria**

1. **10.1** Carry out a visual inspection of an unvented hot water system to confirm that it is ready to be filled with water.
2. **10.2** Charge hot water pipework with water at normal operating pressure and check for leakage.
3. **10.3** Perform a soundness test to industry requirements on hot water systems pipework and components.
4. **10.4** Flush the system with wholesome water on completion of soundness testing.
5. **10.5** Use test instruments to take readings of the water supply pressure and flow rate.
6. **10.6** Adjust and set system controls to achieve system design requirements:
   a. Pressure at outlets
   b. Flow rate at outlets
M/502/9156 - Understand and apply domestic central heating system installation, commissioning, service and maintenance techniques

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. Upon completion of the unit the learners will:

- Know the types of central heating system and their layout requirements
- Know the design techniques for central heating systems
- Be able to apply design techniques for central heating systems
- Know the installation requirements of central heating systems and components
- Be able to install central heating systems and components
- Know the fault diagnosis and rectification procedures for central heating systems and components
- Be able to diagnose and rectify faults in central heating systems and components
- Know the commissioning requirements of central heating systems and components
- Be able to commission central heating systems and components

## Learning Outcome 1

**Know the types of central heating system and their layout requirements**

### Assessment Criteria

1.1 Define the space heating zoning requirements under statutory legislation for larger single occupancy dwellings

1.2 Define the function of components used in central heating systems:
   - Zone control valves for multiple space heating applications with appropriate time and temperature control arrangements
   - Controllers
     - Weather compensation
     - Delayed start
     - Optimum start
     - Home automation systems

1.3 Analyse the operating principles of environmental heat sources used in conjunction with central heating systems:
   - Heat pumps
     - Ground source
     - Air source
   - Micro combined heat and power

1.4 Identify the layout features of underfloor central heating systems

1.5 Analyse the working principles of underfloor central heating system pipework and components
   - Use of manifolds
   - Controls system application - time and temperature to space heating zones
   - Underfloor pipework arrangements from manifold to room

1.6 Identify the system layout features for multiple boiler installations incorporating low loss headers
### Learning Outcome 1  Continued

**Knowledge the types of central heating system and their layout requirements**

#### Assessment Criteria

1.7 Analyse functional flow wiring diagrams to determine the method of control operation for central heating systems:
   
   a. Pumped heating only systems  
   b. Pumped heating systems with combination boilers  
   c. Pumped heating with gravity hot water systems  
   d. Fully pumped incorporating 3 port valves – mid position and diverter valves  
   e. Fully pumped incorporating 2 x two port valves  
   f. Fully pumped incorporating hot water and multiple space heating zones  
   g. Fully pumped incorporating weather compensation, optimum start or delayed start controllers  
   h. Multiple boiler controls application  
   i. Application of frost thermostats and boilers with pump overrun facility

### Learning Outcome 2

**Know the design techniques for central heating systems**

#### Assessment Criteria

2.1 Define the factors which affect the selection of central heating systems for dwellings

2.2 State the criteria used when selecting heating system and component types:
   a. Customers' needs  
   b. Building layout and features  
   c. Suitability of system  
   d. Energy efficiency  
   e. Environmental impact

2.3 Interpret information sources when undertaking design work on central heating systems:
   a. Statutory regulations  
   b. Industry standards  
   c. Manufacturer technical instructions  
   d. Verbal and written feedback from the customer

2.4 Clarify how to take measurements of building features in order to carry out design calculations:
   a. From plans, drawings and specifications  
   b. From site

2.5 Justify the selection of system and control types for single family dwellings

2.6 State the principles of heat loss and gain in dwellings:
   a. Through the building fabric  
   b. Due to ventilation

2.7 Evaluate the heating requirements of rooms in dwellings when designing a central heating system:
   a. Room size  
   b. Temperature required – indoor to outdoor  
   c. Air change rate

2.8 Specify the methods of sizing pipework and circulators for central heating systems:
   a. Pipe sizing calculations – space heating and hot water circuits  
   b. Pump sizing calculations
### Learning Outcome 2  Continued

Know the design techniques for central heating systems

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2.9</strong> Justify the selection criteria for boilers in dwellings:</td>
</tr>
<tr>
<td>a. Space heating load</td>
</tr>
<tr>
<td>b. Hot water heating load</td>
</tr>
<tr>
<td>c. Heat loss from pipework</td>
</tr>
<tr>
<td>d. Factors for intermittent heating</td>
</tr>
<tr>
<td><strong>2.10</strong> Clarify how to size expansion vessels for sealed central heating systems and feed and expansion cisterns for open vented systems</td>
</tr>
<tr>
<td><strong>2.11</strong> Clarify the design principles for underfloor central heating systems:</td>
</tr>
<tr>
<td>a. Combined with radiators</td>
</tr>
<tr>
<td>b. Stand alone</td>
</tr>
<tr>
<td><strong>2.12</strong> Calculate the size of central heating components used in single occupancy dwellings:</td>
</tr>
<tr>
<td>a. Heat emitter size</td>
</tr>
<tr>
<td>b. Hot water heating load</td>
</tr>
<tr>
<td>c. Pipe size</td>
</tr>
<tr>
<td>d. Pump size</td>
</tr>
<tr>
<td>e. Boiler size</td>
</tr>
<tr>
<td><strong>2.13</strong> Clarify how to present design calculations in an acceptable format:</td>
</tr>
<tr>
<td>a. Using basic not to scale line drawings</td>
</tr>
<tr>
<td>b. Details for insertion into a quotation or tender for work in a small-scale dwelling</td>
</tr>
</tbody>
</table>

### Learning Outcome 3

Be able to apply design techniques for central heating systems

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3.1</strong> Use information sources when undertaking design work for central heating systems:</td>
</tr>
<tr>
<td>a. Statutory regulations</td>
</tr>
<tr>
<td>b. Industry standards</td>
</tr>
<tr>
<td>c. Manufacturer technical instructions</td>
</tr>
<tr>
<td>d. Verbal and written feedback from the customer</td>
</tr>
<tr>
<td><strong>3.2</strong> Calculate the size of central heating components used in single occupancy dwellings:</td>
</tr>
<tr>
<td>a. Heat emitter size</td>
</tr>
<tr>
<td>b. Hot water heating load</td>
</tr>
<tr>
<td>c. Pipe size</td>
</tr>
<tr>
<td>d. Pump size</td>
</tr>
<tr>
<td>e. Boiler size</td>
</tr>
<tr>
<td><strong>3.3</strong> Present design calculations in an acceptable format:</td>
</tr>
<tr>
<td>a. Using basic not to scale line drawings</td>
</tr>
<tr>
<td>b. Details for insertion into a quotation or tender for work in a small-scale dwelling</td>
</tr>
</tbody>
</table>
### Learning Outcome 4

**Know the installation requirements of central heating systems and components**

**Assessment Criteria**

| 4.1 | Specify the positioning and fixing requirements of components in underfloor central heating systems: |
|     | a. Manifolds |
|     | b. Pipework arrangements (cabling) |
|     | c. Pipework installation techniques |
|     |   - Solid floor |
|     |   - Suspended timber floor |

| 4.2 | Specify the positioning, fixing and connection requirements of new central heating components for sealed central heating systems: |
|     | a. Connections to a boiler |
|     | b. Fully pumped central heating control components – mid position or 2 x two port valve arrangement |
|     | c. Sealed system components |
|     | d. Connections to panel radiators or underfloor heating manifold |
|     | e. Connections to hot water cylinder |

| 4.3 | Specify the positioning and fixing requirements of multiple boiler installations with low loss headers |

### Learning Outcome 5

**Be able to install central heating systems and components**

**Assessment Criteria**

| 5.1 | Connect pipework to an underfloor central heating system |
| 5.2 | Position, fix and connect new central heating components for a sealed central heating system: |
|     | a. Connections to a boiler |
|     | b. Fully pumped central heating control components – mid position or 2 x two port valve arrangement |
|     | c. Sealed system components |
|     | d. Connections to panel radiators or underfloor heating manifold |
|     | e. Connections to hot water cylinder |

### Learning Outcome 6

**Know the fault diagnosis and rectification procedures for central heating systems and components**

**Assessment Criteria**

| 6.1 | Specify the periodic servicing requirements of central heating systems |
| 6.2 | State the methods of obtaining details of system faults from end users |
| 6.3 | Interpret manufacturer instructions and industry standards to establish the diagnostic requirements of central heating system components |
**Learning Outcome 6  Continued**

Know the fault diagnosis and rectification procedures for central heating systems and components

**Assessment Criteria**

6.4  Propose routine checks and diagnostics on central heating system components as part of a fault finding process:
   a. Checking components for correct operation – pressure settings, temperature and circulation
   b. Cleaning system components (including dismantling and reassembly)
   c. Checking for blockages in heat emitters and pipework
   d. Checking for correct operation of system components
      - Circulating pumps
      - Control components
      - Expansion vessels
      - Pressure relief valves
      - Feed and expansion cisterns

6.5  Specify methods of repairing faults in central heating system components:
   a. Sealed and open vented – fill and vent pipework and components
   b. Circulating pumps
   c. Central heating control components
      - Motorised valves
      - Timing devices
      - Thermostats
      - Specialist controls – weather compensation, delayed and optimum start
   d. Blockages in heat emitters and pipework by power flushing

6.6  Specify methods of safely isolating central heating systems or components to prevent them being brought into operation before the work has been fully completed

6.7  Define procedures for carrying out diagnostic tests to locate faults in central heating system components:
   a. Replacement of circulating pumps
   b. Sealed heating system components
   c. Control components

---

**Learning Outcome 7**

Be able to diagnose and rectify faults in central heating systems and components

**Assessment Criteria**

7.1  Use manufacturer instructions and industry standards to establish the diagnostic requirements of central heating system components

7.2  Isolate central heating systems or components to prevent them being brought into operation before the work has been fully completed

7.3  Carry out diagnostic tests to locate faults in central heating system components and carry out repair work:
   a. Replacement of a circulating pump
   b. Sealed heating system components
   c. Control components
   d. Clean system components using power
### Learning Outcome 8

**Know the commissioning requirements of central heating systems and components**

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.1 Interpret information sources required to complete commissioning work on central heating systems</td>
</tr>
<tr>
<td>8.2 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</td>
</tr>
<tr>
<td>8.3 State how to fill central heating pipework with water at normal operating pressure and check for leakage</td>
</tr>
<tr>
<td>8.4 Identify how to conduct a soundness test on central heating systems:</td>
</tr>
<tr>
<td>a. Metallic systems</td>
</tr>
<tr>
<td>b. Plastic pipework systems</td>
</tr>
<tr>
<td>8.5 Specify the flushing requirements including the use of chemical treatments for new and existing central heating systems:</td>
</tr>
<tr>
<td>a. Cold and hot flushing</td>
</tr>
<tr>
<td>b. Power flushing</td>
</tr>
<tr>
<td>c. System additives</td>
</tr>
<tr>
<td>- Neutralisers</td>
</tr>
<tr>
<td>- Control components</td>
</tr>
<tr>
<td>- Cleansers</td>
</tr>
<tr>
<td>- Corrosion inhibitors</td>
</tr>
<tr>
<td>8.6 Specify the method required to balance a central heating system during commissioning activities</td>
</tr>
<tr>
<td>8.7 Specify the actions that must be taken when commissioning reveals defects in central heating systems:</td>
</tr>
<tr>
<td>a. Dealing with systems that do not meet correct installation requirements</td>
</tr>
<tr>
<td>b. Defects in the connection of components in systems</td>
</tr>
<tr>
<td>c. Unbalanced systems – poor circulation</td>
</tr>
<tr>
<td>d. Poor boiler connection into a low loss header</td>
</tr>
<tr>
<td>e. Remedial work associated with defective components</td>
</tr>
<tr>
<td>8.8 Propose the range of information that would be detailed on a commissioning record for a central heating system</td>
</tr>
<tr>
<td>8.9 State the procedure for notifying works carried out to the relevant authority</td>
</tr>
<tr>
<td>8.10 Propose the points to be covered when handing over a completed system to the end-user</td>
</tr>
</tbody>
</table>

### Learning Outcome 9

**Be able to commission central heating systems and components**

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.1 Carry out a visual inspection of a central heating system to confirm that it is ready to be filled with water</td>
</tr>
<tr>
<td>9.2 Charge central heating components with water at normal operating pressure and check for leakage</td>
</tr>
<tr>
<td>9.3 Perform a soundness test to industry requirements on central heating systems pipework and components</td>
</tr>
<tr>
<td>9.4 Flush and treat a central heating system with appropriate additives:</td>
</tr>
<tr>
<td>a. System cleanser/neutraliser</td>
</tr>
<tr>
<td>b. System inhibitor</td>
</tr>
<tr>
<td>9.5 Balance a central heating system to meet design requirements</td>
</tr>
</tbody>
</table>
T/502/9157 - Understand and carry out electrical work on domestic plumbing and heating systems and components

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. Upon completion of the unit the learners will:

- Know the electrical standards that apply to the mechanical services industry
- Know the principles of electricity supply to dwellings
- Know the layout features of electrical circuits in dwellings
- Understand the electrical industry safe isolation procedure
- Be able to carry out the electrical industry safe isolation procedure
- Know the site preparation techniques for the electrical connection of mechanical services components in dwellings
- Be able to apply site preparation techniques for the electrical connection of mechanical services components in dwellings
- Understand the installation and connection requirements of electrically operated mechanical services components
- Be able to install and connect electrically operated mechanical services components
- Know the inspection and testing requirements of electrically operated mechanical services components
- Be able to inspect and test electrically operated mechanical services components
- Know the procedures for safely diagnosing and rectifying faults in electrically operated mechanical services components
- Be able to safely diagnose and rectify faults in electrically operated mechanical services components

Learning Outcome 1
Know the electrical standards that apply to the mechanical services industry

Assessment Criteria

1.1 State the statutory legislation and guidance information that applies to electrical supply and control of domestic mechanical services systems and their components
   a. General legislation
   b. Construction specific legislation
   c. Mechanical services specific legislation
      - Professional body guidance
   d. Codes of practice
   e. Manufacturer installation & service/maintenance instructions
   f. Manufacturer user instructions

1.2 Identify the range of information that would be detailed on a minor works certificate for an electrical system or component

1.3 Specify the procedure for notifying works carried out to the relevant authority
### Learning Outcome 2

**Know the principles of electricity supply to dwellings**

**Assessment Criteria**

2.1 Specify the methods by which electricity is generated:
   - a. Basic power station operation
   - b. Principles of generation
   - c. Types of supply
     - Single phase
     - Three-phase and neutral

2.2 Specify the methods by which generated electricity is distributed to dwellings:
   - a. Basic operation of the national grid and local distribution systems
     - Sub-stations
     - Supply transformers
     - Local distribution of three – and single-phase supplies to premises

2.3 State the purpose of electrical components at entry to the property:
   - a. Main fuse (single phase) and cable head connection
   - b. Meter
   - c. Consumer unit
   - d. Main earth terminal

### Learning Outcome 3

**Know the layout features of electrical circuits in dwellings**

**Assessment Criteria**

3.1 Define the system layout features for electrical circuits in dwellings:
   - a. Ring main circuit
   - b. Radial circuit
   - c. Fixed appliance supplies
     - Cooker
     - Immersion heater
     - Instantaneous shower
     - Lighting
     - Macerator WC
     - Central heating controls
     - Shower pump/Jacuzzi
     - Heat producing or cooling appliances

3.2 Specify the types of cables and cords used for the installation of electrical equipment in domestic mechanical services systems

3.3 State the applications and limitations of the types of cable and conductors used for the installation of electrical equipment in mechanical services systems

3.4 Clarify the difference between class 1 and class 2 electrical equipment
Learning Outcome 3  Continued

Know the layout features of electrical circuits in dwellings

Assessment Criteria

3.5 Define the function of electrically operated components used in domestic mechanical services systems:
- Flame rectification devices
- Flame suppression devices
- Solenoid valves
- Thermistors
- Thermocouples
- Micro switches
- Relays
- Printed circuit boards
- Pressure switches
- Pumps
- Fans

Control components
- Thermostats
- Programmers/timers
- Electrically operated control valves
- Wiring centres

Switches
- Rocker plate (with/without cpc) – single and double pole
- Pull cord

3.6 Define the operating principles of electrical circuit protection devices:
   a. Miniature circuit breakers
   b. Residual current devices including RCBOs
   c. Fuses
      - Re-wireable
      - Cartridge
      - High breaking capacity

3.7 Clarify the need for, and requirements of earthing systems:
   a. Main earthing systems
   b. TT system
   c. TN - S system
   d. TN-C-S system
   e. Protective equipotential bonding
   f. High risk rooms (zones) in dwellings
   g. Supplementary earthing (bonding)
   h. Temporary continuity bonding

3.8 Identify the warning notices to be applied to consumer units
### Learning Outcome 4

**Understand the electrical industry safe isolation procedure**

**Assessment Criteria**

<table>
<thead>
<tr>
<th>Clause</th>
<th>Description</th>
</tr>
</thead>
</table>
| 4.1 | Identify the test equipment required to prove that circuits to be worked on are dead:  
  a. Approved voltage indicating device  
  b. Proving unit |
| 4.2 | Specify the electrical industry agreed procedure for safe isolation of electrical circuits:  
  a. Select the approved voltage indicating device and test on a known supply  
  b. Locate and identify the isolation point for the equipment to be worked on  
  c. Isolate the supply and prevent re-energisation  
  d. Verify that the equipment is dead  
  e. Fit warning labels  
  f. Re-check the approved voltage indicating on a known supply for correct function |
| 4.3 | Clarify the methods of ensuring that circuits cannot be re-activated while work is taking place on them:  
  a. Use of locking devices  
  b. Device retention (fuse removal) |

### Learning Outcome 5

**Be able to carry out the electrical industry safe isolation procedure**

**Assessment Criteria**

<table>
<thead>
<tr>
<th>Clause</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>Check to ensure that test equipment is safe to be used</td>
</tr>
<tr>
<td>5.2</td>
<td>Carry out the safe isolation procedure to industry standards</td>
</tr>
</tbody>
</table>

### Learning Outcome 6

**Know the site preparation techniques for the electrical connection of mechanical services components in dwellings**

**Assessment Criteria**

<table>
<thead>
<tr>
<th>Clause</th>
<th>Description</th>
</tr>
</thead>
</table>
| 6.1 | Identify the required sources of information when carrying out work on electrical systems:  
  a. Statutory regulations  
  b. Industry standards  
  c. Manufacturer technical instructions |
| 6.2 | 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 |
| 6.3 | 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:  
  a. Building wall/floor surfaces  
  b. Existing electrical system components  
  c. Building décor and carpets |
| 6.4 | State how to carry out simple electrical calculations:  
  a. Ohm’s law  
  b. Power consumption of electrical circuits  
  c. Basic over-current protection device size  
  d. Voltage, current and resistance in series and parallel circuits |
<table>
<thead>
<tr>
<th>Learning Outcome 6  Continued</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Know the site preparation techniques for the electrical connection of mechanical services components in dwellings</strong></td>
</tr>
<tr>
<td><strong>Assessment Criteria</strong></td>
</tr>
<tr>
<td>6.5 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:</td>
</tr>
<tr>
<td>a. Building wall/floor surfaces</td>
</tr>
<tr>
<td>b. Existing and new electrical systems and kitchen furniture</td>
</tr>
<tr>
<td>c. Building décor and carpets</td>
</tr>
<tr>
<td>6.6 Identify the cable, materials and fittings required to complete work on electrical systems</td>
</tr>
<tr>
<td>6.7 Identify the hand and power tools required to complete work on electrical systems</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Outcome 7</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Be able to apply site preparation techniques for the electrical connection of mechanical services components in dwellings</strong></td>
</tr>
<tr>
<td><strong>Assessment Criteria</strong></td>
</tr>
<tr>
<td>7.1 Check the safety of the work location in order for the work to safely proceed:</td>
</tr>
<tr>
<td>a. Safe access and exit</td>
</tr>
<tr>
<td>b. Immediate work location e.g. tripping hazards</td>
</tr>
<tr>
<td>c. Appropriate risk assessments/ method statements are followed</td>
</tr>
<tr>
<td>7.2 Wear Personal Protective Equipment relevant to the installation, decommissioning or maintenance tasks being carried out</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Outcome 8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Understand the installation and connection requirements of electrically operated mechanical services components</strong></td>
</tr>
<tr>
<td><strong>Assessment Criteria</strong></td>
</tr>
<tr>
<td>8.1 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</td>
</tr>
<tr>
<td>8.2 State the procedure for sizing electrical materials and components:</td>
</tr>
<tr>
<td>a. Basic cable sizing procedure domestic type cables and cords</td>
</tr>
<tr>
<td>b. Basic circuit protection device sizing procedure –domestic circuit types</td>
</tr>
<tr>
<td>8.3 Specify the method used to select suitable cables and cords for components and circuits:</td>
</tr>
<tr>
<td>a. Selection of appropriate multi-core cable</td>
</tr>
<tr>
<td>b. Selection of appropriate multi-core cords</td>
</tr>
<tr>
<td>c. Selection of pvc single conductors</td>
</tr>
</tbody>
</table>
### Learning Outcome 8  Continued

Understand the installation and connection requirements of electrically operated mechanical services components

#### Assessment Criteria

<table>
<thead>
<tr>
<th>8.4 Specify the requirements for protecting cables installed in the building fabric and terminating in enclosures:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Protection methods in wall and floor surfaces</td>
</tr>
<tr>
<td>- Embedded (sheathing) – depth of cover, application of RCD protection</td>
</tr>
<tr>
<td>- Exposed (mini-trunking)</td>
</tr>
<tr>
<td>- Within ducting</td>
</tr>
<tr>
<td>- Within timber stud partitions</td>
</tr>
<tr>
<td>- Within timber floor structures</td>
</tr>
<tr>
<td>b. Junction boxes</td>
</tr>
<tr>
<td>c. Switch/socket boxes</td>
</tr>
<tr>
<td>- Countersunk</td>
</tr>
<tr>
<td>- Pattresses</td>
</tr>
<tr>
<td>- Surface mounted</td>
</tr>
<tr>
<td>d. Wiring centres</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>8.5 Define the types of cable termination methods approved for use in dwellings</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Screw terminals</td>
</tr>
<tr>
<td>b. Pillar terminals</td>
</tr>
<tr>
<td>c. Claw and washer terminals</td>
</tr>
<tr>
<td>d. Crimping</td>
</tr>
<tr>
<td>e. Strip connectors</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>8.6 Specify the method of installation and wiring termination for fixed electrical appliances</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. From consumer unit</td>
</tr>
<tr>
<td>- Macerator WC</td>
</tr>
<tr>
<td>- Central heating control system</td>
</tr>
<tr>
<td>- Instantaneous shower</td>
</tr>
<tr>
<td>- Immersion heater</td>
</tr>
<tr>
<td>- Shower pump/Jacuzzi</td>
</tr>
<tr>
<td>b. From fused-spur connection unit</td>
</tr>
<tr>
<td>- Central heating control system</td>
</tr>
<tr>
<td>- Shower pump/Jacuzzi</td>
</tr>
<tr>
<td>c. From existing appliance supply point</td>
</tr>
<tr>
<td>- Macerator WC</td>
</tr>
<tr>
<td>- Central heating control system</td>
</tr>
<tr>
<td>- Shower pump/Jacuzzi</td>
</tr>
<tr>
<td>- Immersion heater</td>
</tr>
<tr>
<td>- Shower</td>
</tr>
</tbody>
</table>
### Learning Outcome 9

**Be able to install and connect electrically operated mechanical services components**

#### Assessment Criteria

9.1 Carry out the electrical wiring of a central heating control system from an existing fused spur connection unit:
   - a. Fully pumped system incorporating all necessary control components
   - b. Positioning and fixing of all necessary enclosures, switches and circuit protection devices
   - c. Correct routing, installation and termination of appropriate cables and cords to control system components
   - d. Correct earthing provision for all components and exposed metallic parts of the system

9.2 Carry out the replacement of electrical cords from an existing isolation point to the fixed appliance:
   - a. Immersion heater
   - b. WC macerator unit
   - c. Shower pump

9.3 Apply temporary continuity bonding to metallic pipework prior to making pipework connections

### Learning Outcome 10

**Know the inspection and testing requirements of electrically operated mechanical services components**

#### Assessment Criteria

10.1 Specify the requirements of a visual inspection of completed electrical installation work for domestic mechanical services systems prior to electrical inspection and testing

10.2 Define the equipment used for electrical testing of mechanical services components and its calibration requirements

10.3 Identify the importance of carrying out tests on dead circuits wherever possible

10.4 State the purpose of the electrical testing procedures for new and existing circuits:
   - a. Polarity
   - b. Earth continuity
   - c. Insulation resistance
   - d. Earth fault loop impedance
   - e. Residual current device

10.5 Clarify the requirements for carrying out functional testing of electrical components

10.6 Clarify the procedure for final handover of electrical circuits that supply electrically operated domestic mechanical services components:
   - a. Installation completion of certification
   - b. Demonstration to the user
### Learning Outcome 11

**Be able to inspect and test electrically operated mechanical services components**

#### Assessment Criteria

11.1 Carry out the inspection and testing of a completed central heating controls system:
   - a. Visual inspection
   - b. Selection and use of appropriate test equipment
   - c. Appropriate circuit testing
     - Polarity
     - Earth continuity
     - Insulation resistance
   - d. Functional testing
   - e. Completion of a minor works certificate

11.2 Carry out the inspection and testing of existing electrical circuits following replacement of electrical cords:
   - a. Immersion heater
   - b. WC macerator unit
   - c. Shower pump

### Learning Outcome 12

**Know the procedures for safely diagnosing and rectifying faults in electrically operated mechanical services components**

#### Assessment Criteria

12.1 State the methods of obtaining details of system faults from end users

12.2 Identify and use manufacturer instructions and industry standards to establish the diagnostic requirements of electrical system components

12.3 Identify the electrical test equipment used to undertake fault diagnostics

12.4 Identify the situations in which dead testing of components can be carried out

12.5 Identify the situations in which live testing of components may be necessary and the safety precautions required
Learning Outcome 12  Continued

Know the procedures for safely diagnosing and rectifying faults in electrically operated mechanical services components

Assessment Criteria

12.6 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:
   a. Appliance components
      - Flame rectification devices
      - Flame suppression devices
      - Solenoid valves
      - Thermistors
      - Thermocouples
      - Micro switches
      - Relays
      - Pressure switches
      - Printed circuit boards
      - Pumps
      - Fans
   b. Control components
      - Thermostats
      - Programmers/timers
      - Electrically operated control valves
      - Wiring centres
   c. Switches
      - Rocker plate (with/without cpc) - single and double pole
      - Pull cord

12.7 State the methods of correcting deficiencies in electrical components:
   a. Inadequate earthing provision
   b. Defective cable positioning (aged cables/ proximity to other services)
   c. Failed electrical components
   d. Incorrect polarity
   e. Provision of inadequate circuit protection devices

Learning Outcome 13

Be able to safely diagnose and rectify faults in electrically operated mechanical services components

Assessment Criteria

13.1 Safely isolate electrical systems or components to prevent them being brought into operation before the work has been fully completed
13.2 Carry out diagnostic checks to electrical circuits:
   a. Inadequate earthing provision
   b. Defective cable routing
   c. Defective termination
   d. Incorrect polarity
   e. Provision of inadequate circuit protection devices
**Learning Outcome 13 Continued**

Be able to safely diagnose and rectify faults in electrically operated mechanical services components

**Assessment Criteria**

<table>
<thead>
<tr>
<th>13.3</th>
<th>State the methods of correcting deficiencies in electrical components:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Replacement of a motorised valve head gear</td>
</tr>
<tr>
<td>b.</td>
<td>Boiler components replacement</td>
</tr>
<tr>
<td></td>
<td>- Thermistor</td>
</tr>
<tr>
<td></td>
<td>- Thermocouples</td>
</tr>
<tr>
<td></td>
<td>- Pressure switches</td>
</tr>
<tr>
<td>c.</td>
<td>Control components</td>
</tr>
<tr>
<td></td>
<td>- Thermostats</td>
</tr>
<tr>
<td></td>
<td>- Programmers/timers</td>
</tr>
<tr>
<td>d.</td>
<td>Shower control components</td>
</tr>
</tbody>
</table>
D/502/9296 - Understand and apply domestic sanitation system installation, commissioning, service and maintenance techniques

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. Upon completion of the unit the learners will:

- Know the types of sanitation system and their layout requirements
- Know the design techniques for sanitation and rainwater systems
- Be able to apply design techniques for sanitation and rainwater systems
- Understand the installation requirements of sanitation system components
- Know the fault diagnosis and rectification procedures for sanitary pipework systems and components
- Be able to diagnose and rectify faults in sanitary pipework systems and components
- Know the commissioning requirements of sanitary pipework systems and components
- Be able to commission sanitary pipework systems and components

### Learning Outcome 1

**Know the types of sanitation system and their layout requirements**

**Assessment Criteria**

1.1 State the use of air admittance valves in above ground sanitary pipework systems:
   a. Types of air admittance valves
   b. Their suitability of use in the various types of pipework system
   c. Application on multi-dwelling housing estates

1.2 Clarify the statutory requirements for the provision of sanitary facilities and equipment in dwellings for the disabled:
   a. Spacing requirements of the human body
   b. Appliance space requirements for the disabled

1.3 Analyse the working principles and layout features for foul tanks in sanitation systems:
   a. Cesspits
   b. Septic tanks

1.4 State the periodic maintenance and cleaning requirements of foul tanks:
   a. Cesspits
   b. Septic tanks

1.5 Analyse the working principles and system layout features of specialist sanitary components:
   a. WC macerators
   b. Waste water lifters
   c. Sink waste disposals
## Learning Outcome 2

Know the design techniques for sanitation and rainwater systems

### Assessment Criteria

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Define the factors which affect the selection of sanitation systems for dwellings</td>
</tr>
<tr>
<td>2.2</td>
<td>State the criteria used when selecting sanitation systems and appliances:</td>
</tr>
<tr>
<td></td>
<td>a. Customers’ needs</td>
</tr>
<tr>
<td></td>
<td>b. Building layout and features</td>
</tr>
<tr>
<td></td>
<td>c. Suitability of system</td>
</tr>
<tr>
<td></td>
<td>d. Energy efficiency</td>
</tr>
<tr>
<td></td>
<td>e. Environmental impact</td>
</tr>
<tr>
<td>2.2</td>
<td>Interpret information sources required when undertaking design work for sanitation systems:</td>
</tr>
<tr>
<td></td>
<td>a. Statutory regulations</td>
</tr>
<tr>
<td></td>
<td>b. Industry standards</td>
</tr>
<tr>
<td></td>
<td>c. Manufacturer technical instructions</td>
</tr>
<tr>
<td></td>
<td>d. Verbal and written feedback from the customer</td>
</tr>
<tr>
<td>2.3</td>
<td>Specify the fire stopping arrangements required under statutory legislation as they apply to sanitary pipework passing between fire compartments in a dwelling</td>
</tr>
<tr>
<td>2.4</td>
<td>Calculate the sanitary provision requirements for dwellings</td>
</tr>
<tr>
<td>2.5</td>
<td>Clarify the method of sizing and selecting the correct gradient for branch pipework used in sanitary pipework systems</td>
</tr>
<tr>
<td>2.6</td>
<td>Clarify the methods used when designing a sanitary pipework system:</td>
</tr>
<tr>
<td></td>
<td>a. Main stack size</td>
</tr>
<tr>
<td></td>
<td>b. Branch pipework sizes</td>
</tr>
<tr>
<td></td>
<td>c. Ventilation requirements</td>
</tr>
<tr>
<td></td>
<td>- Air admittance valves</td>
</tr>
<tr>
<td></td>
<td>- Ventilating pipes</td>
</tr>
<tr>
<td>2.7</td>
<td>Clarify the methods used when designing a rainwater system:</td>
</tr>
<tr>
<td></td>
<td>a. Roof area calculations</td>
</tr>
<tr>
<td></td>
<td>b. Gutter type selection</td>
</tr>
<tr>
<td></td>
<td>c. Outlet positioning</td>
</tr>
<tr>
<td>2.8</td>
<td>Calculate the size of sanitary pipework used in single occupancy dwellings:</td>
</tr>
<tr>
<td></td>
<td>a. Main stack size</td>
</tr>
<tr>
<td></td>
<td>b. Branch pipework size</td>
</tr>
<tr>
<td></td>
<td>c. Stack vent size</td>
</tr>
<tr>
<td>2.9</td>
<td>Calculate the size of rainwater system components used with single occupancy and multiple terraced properties:</td>
</tr>
<tr>
<td></td>
<td>a. Outlet requirements</td>
</tr>
<tr>
<td></td>
<td>b. Gutter requirements</td>
</tr>
<tr>
<td></td>
<td>c. Rainwater pipe requirements</td>
</tr>
<tr>
<td>2.10</td>
<td>Clarify how to present design calculations in an acceptable format:</td>
</tr>
<tr>
<td></td>
<td>a. Using basic not to scale line drawings</td>
</tr>
<tr>
<td></td>
<td>b. Details for insertion into a quotation or tender for work in a small-scale dwelling</td>
</tr>
</tbody>
</table>
### Learning Outcome 3

Be able to apply design techniques for sanitation and rainwater systems

**Assessment Criteria**

3.1 Use information sources when undertaking design work for sanitation systems:
   - a. Statutory regulations
   - b. Industry standards
   - c. Manufacturer technical instructions
   - d. Verbal and written feedback from the customer

3.2 Calculate the size of sanitary pipework used in single occupancy dwellings. Simple calculations of:
   - a. Main stack size
   - b. Branch pipework size
   - c. Stack vent size

3.3 Calculate the size of rainwater system components used with single occupancy and multiple terraced properties:
   - a. Outlet requirements
   - b. Gutter requirements
   - c. Rainwater pipe requirements

3.4 Present design calculations in an acceptable format:
   - a. Using basic not to scale line drawings
   - b. Details for insertion into a quotation or tender for work in a small-scale dwelling

### Learning Outcome 4

Understand the installation requirements of sanitation system components

**Assessment Criteria**

4.1 State the layout features for walk in wet rooms in dwellings

4.2 Specify the installation and fixing methods for components of walk in wet rooms used in dwellings
   - a. Glass sanitary appliances
   - b. Antique style sanitary appliances
   - c. Sanitary appliances with floor mounted taps

4.3 State how to assemble and prepare for the installation of sanitation system components:
   - a. WC macerator
   - b. Waste water lifter
   - c. Sink waste disposal unit

4.4 Specify the methods for positioning and fixing WC macerators and waste water lifters:
   - a. Reference to manufacturer’s instructions
   - b. Vertical lift position
   - c. Use of long radius bends
   - d. Pipework material selection and assembly

4.6 Specify the methods for positioning and fixing sink waste disposal units:
   - a. Reference to manufacturer’s instructions
   - b. Trapping and branch discharge pipework requirements
### Learning Outcome 5

**Know the fault diagnosis and rectification procedures for sanitary pipework systems and components**

#### Assessment Criteria

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

### Learning Outcome 6

**Be able to diagnose and rectify faults in sanitary pipework systems and components**

#### Assessment Criteria

- **6.1** Use manufacturer instructions and industry standards to establish the diagnostic requirements of sanitation system components
- **6.2** Isolate sanitation system components to prevent them being brought into operation before the work has been fully completed
- **6.3** Carry out diagnostic tests to locate faults in macerator units

### Learning Outcome 7

**Know the commissioning requirements of sanitary pipework systems and components**

#### Assessment Criteria

- **7.1** Interpret information sources required to complete commissioning work on sanitation systems
- **7.2** State the checks to be carried out during a visual inspection of a sanitation system to confirm that it is ready to be operated
- **7.3** Identify how to carry out an air test on a sanitary pipework system to industry requirements
- **7.4** State how to performance test sanitation systems to test for trap seal retention
- **7.5** Specify the commissioning procedures for macerator type WCs
- **7.6** Specify the actions that must be taken when commissioning reveals defects in sanitation systems
- **7.7** Propose the range of information that would be detailed on a commissioning record for a sanitation system
- **7.8** State the procedure for notifying works carried out to the relevant authority
- **7.9** Propose the points to be covered when handing over a completed system to the end-user
### Learning Outcome 8
Be able to commission sanitary pipework systems and components

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.1 Carry out a visual inspection of a sanitation system to confirm that it is ready to be operated</td>
</tr>
<tr>
<td>8.2 Perform an air test on a sanitary pipework system to industry requirements</td>
</tr>
<tr>
<td>8.3 Carry out a performance test on a sanitary pipework system to check for effective trap seal retention:</td>
</tr>
<tr>
<td>a. Branch discharge pipework</td>
</tr>
<tr>
<td>- Test for self siphonage</td>
</tr>
<tr>
<td>- Test for induced siphonage</td>
</tr>
<tr>
<td>b. Main discharge stack</td>
</tr>
<tr>
<td>- Test for induced siphonage and compression</td>
</tr>
<tr>
<td>8.4 Commission a WC with macerator pump installation</td>
</tr>
</tbody>
</table>
This performance unit confirms job competence at Level 3 in the selection of components, installation, commissioning and fault diagnosis & rectification of a range of advanced plumbing & heating systems and components in dwellings and industrial/commercial properties (of similar size and scope to domestic dwellings). Upon completion of the unit the learners will:

- Be able to select plumbing and heating systems and components for application the workplace
- Be able to prepare work sites for the installation of plumbing and heating systems and components in the workplace
- Be able to install plumbing and heating systems and components in the workplace
- Be able to commission plumbing and heating systems in the workplace
- Be able to diagnose faults in plumbing and heating components in the workplace
- Be able to rectify faults in plumbing and heating components in the workplace

**Learning Outcome 1**

Be able to select plumbing and heating systems and components for application the workplace

### Assessment Criteria

<table>
<thead>
<tr>
<th>1.1 Obtain details of the customer job requirement:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. By face to face site visit</td>
</tr>
<tr>
<td>b. By taking details from plans, drawings and specifications</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.2 Discuss and agree initial system and component options with the customer:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Cold water systems</td>
</tr>
<tr>
<td>b. Hot water systems</td>
</tr>
<tr>
<td>c. Central heating systems</td>
</tr>
<tr>
<td>d. Sanitation systems and sanitary appliances</td>
</tr>
<tr>
<td>e. Gravity rainwater systems</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.3 Calculate the size and quantities of components required for systems installation</th>
</tr>
</thead>
</table>

| 1.4 Present design calculations and information to the customer |

<table>
<thead>
<tr>
<th>1.5 Obtain agreement from the customer to progress plumbing and heating work:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Items of small jobbing (maintenance) type work</td>
</tr>
<tr>
<td>b. Full system/component installation work</td>
</tr>
</tbody>
</table>

| 1.6 Apply changes to customer job requirements and obtain customer agreement to those changes |

**Learning Outcome 2**

Be able to prepare work sites for the installation of plumbing and heating systems and components in the workplace

### Assessment Criteria

<table>
<thead>
<tr>
<th>2.1 Use job information to plan the installation work</th>
</tr>
</thead>
</table>

| 2.2 Confirm the position of pipework and components with other persons before commencing the installation work |

| 2.3 Comply with health and safety requirements when carrying out the installation work |

| 2.4 Prepare a safe and unobstructed access route to the work areas to carry out the installation work |

| 2.5 Arrange for all tools, equipment and materials to be available to undertake the installation work |

| 2.6 Use job information to identify the location of the building fabric that requires preparatory work to be carried out |
Learning Outcome 2  Continued

Be able to prepare work sites for the installation of plumbing and heating systems and components in the workplace

Assessment Criteria

2.7 Prepare a safe and unobstructed access route to the work areas to carry out the installation work
2.8 Arrange for all tools, equipment and materials to be available to undertake the installation work
2.9 Use job information to identify the location of the building fabric that requires preparatory work to be carried out
2.10 Report any pre-existing damage to the building fabric or customer property to other persons before carrying out the installation work
2.11 Provide protection to the building fabric or customer property as the work progresses
2.12 Carry out preparatory work to the building fabric

Learning Outcome 3

Be able to install plumbing and heating systems and components in the workplace

Assessment Criteria

3.1 Confirm that the incoming or outgoing main supplies meet the requirements of the system or component being installed
3.2 Measure and mark out the position of the components to be installed:
   a. System pipework
   b. Main system components
   c. System controls
3.3 Make pipework and component fixings to the building fabric
3.4 Position and fix pipework and components to the building fabric:
   a. Copper
   b. Plastics
3.5 Connect pipework to system controls and main components:
   a. Cold water systems
   b. Hot water systems
   c. Central heating systems
   d. Sanitation systems
3.6 Connect system pipework to incoming supplies or outgoing services:
   a. Existing system pipework and components
   b. Cold water supply pipework
   c. Below ground drainage pipework
3.7 Carry out installation work minimising the wastage of equipment and materials
3.8 Take precautions to ensure that the system cannot be brought into operation before the installation work is fully completed
### Learning Outcome 4

**Be able to commission plumbing and heating systems in the workplace**

**Assessment Criteria**

- **4.1** Carry out a visual inspection of the system to be tested to make sure that it is ready to be filled with water
- **4.2** Charge the system to normal operating pressure and check for leakage:
  - A. Cold water systems
  - B. Hot water systems
  - C. Central heating systems
- **4.3** Perform a soundness test to industry requirements on the installed system:
  - A. Cold water systems
  - B. Hot water systems
  - C. Central heating systems
  - D. Sanitation systems
- **4.4** Flush the system with cold water on completion of soundness testing
- **4.5** Rectify any leakage from the system found during the soundness test procedure
- **4.6** Re-fill the system treating the contents with additives as appropriate
- **4.7** Operate the system and take performance readings in order to compare them to the design specifications
  - A. Mechanical component readings
  - B. Electrical component readings
- **4.8** Adjust system controls to establish that the system operates to its design specifications
- **4.9** Carry out remedial work to systems when commissioning reveals that the system does not work to the design specifications
- **4.10** Prepare commissioning records for completed systems
- **4.11** Instruct the customer in the efficient and effective operation of the system

### Learning Outcome 5

**Be able to diagnose faults in plumbing and heating components in the workplace**

**Assessment Criteria**

- **5.1** Use job information to plan the fault diagnosis work
- **5.2** Comply with health and safety requirements when carrying out fault diagnosis work
- **5.3** Prepare a safe and unobstructed access route to the work areas to carry out the fault diagnosis work
- **5.4** Arrange for all required tools, equipment and materials to be available to undertake the fault diagnosis work
- **5.5** Report any pre-existing damage to the building fabric or customer property to other persons before carrying out the fault diagnosis work
- **5.6** Provide protection to the building fabric or customer property as the work progresses
- **5.7** Establish details of the fault from other persons
- **5.8** Test the component to diagnose the cause of the fault
Learning Outcome 6
Be able to rectify faults in plumbing and heating components in the workplace

Assessment Criteria

| 6.1 | Liaise with other persons to reach agreement on the rectification work to be carried out |
| 6.2 | Isolate unsafe components that are not to be rectified and leave the component in a safe condition |
| 6.3 | Isolate the component from the supply source or outgoing service: |
|     | a. Turn off the electricity and fuel supply to the component |
|     | b. Turn off the water supply to the component |
|     | c. Prevent the use of sanitary appliances |
| 6.4 | Drain the component contents |
| 6.5 | Take precautions to ensure that the component cannot be brought back into operation before the rectification work is complete |
| 6.6 | Carry out the rectification or replacement of the component to industry requirements |
| 6.7 | Reinstate the supply or service to the component |
| 6.8 | Liaise with other persons to reach agreement on the rectification work to be carried out |
| 6.9 | Isolate unsafe components that are not to be rectified and leave the component in a safe condition |
| 6.10 | Isolate the component from the supply source or outgoing service: |
|      | a. Turn off the electricity and fuel supply to the component |
|      | b. Turn off the water supply to the component |
|      | c. Prevent the use of sanitary appliances |
| 6.11 | Drain the component contents |
| 6.12 | Take precautions to ensure that the component cannot be brought back into operation before the rectification work is complete |
| 6.13 | Carry out the rectification or replacement of the component to industry requirements |
| 6.14 | Reinstate the supply or service to the component |
| 6.15 | Test the component for effective operation |
| 6.16 | Advise other persons that work on the system or component has been successfully completed |
| 6.17 | Complete the details contained in a maintenance record for the system or component |
A/502/8933 - Install, commission, service and maintain domestic heating systems

This performance unit confirms job competence at Level 3 in the selection of components, installation, commissioning and fault diagnosis and rectification of a range of domestic heating systems and components. Upon completion of the unit the learners will:

- Be able to select domestic heating and hot water systems and components for application the workplace
- Be able to prepare work sites for the installation of domestic heating and hot water systems and components in the workplace
- Be able to install domestic heating and hot water systems and components in the workplace
- Be able to commission domestic heating and hot water systems in the workplace
- Be able to diagnose faults in domestic heating and hot water components in the workplace
- Be able to rectify faults in domestic heating and hot water components in the workplace

### Learning Outcome 1

Be able to select domestic heating and hot water systems and components for application the workplace

**Assessment Criteria**

1.1 Obtain details of the customer job requirement:
   - By face to face site visit
   - By taking details from plans, drawings and specifications

1.2 Discuss and agree initial system and component options with the customer:
   - Hot water systems
   - Central heating systems

1.3 Calculate the size and quantities of components required for systems installation

1.4 Present design calculations and information to the customer

1.5 Obtain agreement from the customer to progress domestic heating and hot water work:
   - Items of small jobbing (maintenance) type work
   - Full system/component installation work

1.6 Apply changes to customer job requirements and obtain customer agreement to those changes

### Learning Outcome 2

Be able to prepare work sites for the installation of domestic heating and hot water systems and components in the workplace

**Assessment Criteria**

2.1 Use job information to plan the installation work

2.2 Confirm the position of pipework and components with other persons before commencing the installation work

2.3 Comply with health and safety requirements when carrying out the installation work

2.4 Prepare a safe and unobstructed access route to the work areas to carry out the installation work

2.5 Arrange for all tools, equipment and materials to be available to undertake the installation work

2.6 Use job information to identify the location of the building fabric that requires preparatory work to be carried out

2.7 Report any pre-existing damage to the building fabric or customer property to other persons before carrying out the installation work
Learning Outcome 2

Be able to prepare work sites for the installation of domestic heating and hot water systems and components in the workplace

Assessment Criteria

2.8 Provide protection to the building fabric or customer property as the work progresses
2.9 Carry out preparatory work to the building fabric

Learning Outcome 3

Be able to install domestic heating and hot water systems and components in the workplace

Assessment Criteria

3.1 Confirm that the incoming main supplies meet the requirements of the system or component being installed
3.2 Measure and mark out the position of the components to be installed:
   a. System pipework
   b. Main system components
   c. System controls
3.3 Make pipework and component fixings to the building fabric
3.4 Position and fix pipework and components to the building fabric:
   a. Copper
   b. Plastics
3.5 Connect pipework to system controls and main components:
   a. Hot water systems
   b. Central heating systems
3.6 Connect system pipework to incoming supplies
3.7 Carry out installation work minimising the wastage of equipment and materials
3.8 Take precautions to ensure that the system cannot be brought into operation before the installation work is fully completed

Learning Outcome 4

Be able to commission domestic heating and hot water systems in the workplace

Assessment Criteria

4.1 Carry out a visual inspection of the system to be tested to make sure that it is ready to be filled with water
4.2 Charge the system to normal operating pressure and check for leakage:
   a. Hot water systems
   b. Central heating systems
4.3 Perform a soundness test to industry requirements on the installed system:
   a. Hot water systems
   b. Central heating systems
4.4 Flush the system with cold water on completion of soundness testing
4.5 Rectify any leakage from the system found during the soundness test procedure
4.6 Re-fill the system treating the contents with additives as appropriate
4.7 Operate the system and take performance readings in order to compare them to the design specifications
   a. Mechanical component readings
   b. Electrical component readings
### Learning Outcome 4  Continued

Be able to commission domestic heating and hot water systems in the workplace

**Assessment Criteria**

- **4.8** Adjust system controls to establish that the system operates to its design specifications
- **4.9** Carry out remedial work to systems when commissioning reveals that the system does not work to the design specifications
- **4.10** Prepare commissioning records for completed systems
- **4.11** Instruct the customer in the efficient and effective operation of the system

### Learning Outcome 5

Be able to diagnose faults in domestic heating and hot water components in the workplace

**Assessment Criteria**

- **5.1** Use job information to plan the fault diagnosis work
- **5.2** Comply with health and safety requirements when carrying out fault diagnosis work
- **5.3** Prepare a safe and unobstructed access route to the work areas to carry out the fault diagnosis work
- **5.4** Arrange for all required tools, equipment and materials to be available to undertake the fault diagnosis work
- **5.5** Report any pre-existing damage to the building fabric or customer property to other persons before carrying out the fault diagnosis work
- **5.6** Provide protection to the building fabric or customer property as the work progresses
- **5.7** Establish details of the fault from other persons
- **5.8** Test the component to diagnose the cause of the fault

### Learning Outcome 6

Be able to rectify faults in domestic heating and hot water components in the workplace

**Assessment Criteria**

- **6.1** Liaise with other persons to reach agreement on the rectification work to be carried out
- **6.2** Isolate unsafe components that are not to be rectified and leave the component in a safe condition
- **6.3** Isolate the component from the supply source:
  - a. Turn off the electricity supply and fuel supply source to the component
  - b. Turn off the water supply to the component
- **6.4** Drain the component contents
- **6.5** Take precautions to ensure that the component cannot be brought back into operation before the rectification work is complete
- **6.6** Carry out the rectification or replacement of the component to industry requirements
- **6.7** Reinstate the supply or service to the component
- **6.8** Test the component for effective operation
- **6.9** Advise other persons that work on the system or component has been successfully completed
- **6.10** Complete the details contained in a maintenance record for the system or component
J/502/9390 - Understand core gas safety principles for natural gas within domestic building services engineering

This knowledge unit provides learning in legislation, (natural gas and LPG) characteristic of combustion and basic principles of requirements for ventilation, chimneys, check and set pressures and gas rates relating to meters and appliances, and effective flue operation and identifying and responding to unsafe gas situations. Upon completion of the unit the learners will:

- Know the gas legislation that applies to the domestic mechanical services industry
- Know how domestic NG and LPG supplies are metered, regulated and controlled
- Know how to take pressure readings in domestic gas systems and check meter regulators
- Know the operating principles of appliance gas safety devices and controls
- Know how to install NG and LPG gas pipework and fittings
- Know how to test for tightness of a gas pipework system and purge the system
- Know the characteristics, combustion process and the types of burners used with natural gas and LPG
- Know the ventilation requirements of gas appliances installed in dwellings
- Know the standards of chimneys and flue systems to be used with gas appliances
- Know how to re-establish gas supplies and relight appliances
- Know how to check and set appliance burner pressures and gas rates
- Know how to test gas appliance flue systems for effective operation
- Know how to identify and respond to unsafe gas situations
- Know the general requirements of LPG systems

Learning Outcome 1
Know the gas legislation that applies to the domestic mechanical services industry

Assessment Criteria

1.1 Define the types of statutory legislation and guidance information that applies to gas installation and maintenance work in the industry
   - Gas safety legislation
   - Approved codes of practice
   - Industry standards for NG and LPG
   - Manufacturer installation and service/maintenance instructions

1.2 Identify laid down responsibilities under gas safety legislation
   - Business registration and competence
   - Personnel registration and competence
   - Landlords
   - Consumers – private householders and tenants

1.3 Analyse and interpret the requirements of specific gas safety legislation

1.4 Define the range of information that would be contained within a commissioning record for a gas system or component

1.5 Identify the procedure for notifying works carried out to the approved gas registration provider
## Learning Outcome 2

Know how domestic NG and LPG supplies are metered, regulated and controlled

### Assessment Criteria

**2.1** Interpret the gas safety legislation that applies to the installation of gas meters and regulators  
   a. Gas operative responsibilities  
   b. Meter housing and compartment labels  
   c. Medium pressure installations  

**2.2** Describe the installation, operation and positioning requirements for Emergency Control Valves (ECV) to include:  
   a. Natural gas/LPG meter installations  
   b. Remote meter installations  
   c. Multiple occupancy meter installations  
   d. Meter Inlet Valves (MIV)

**2.3** Explain the installation, operation and positioning requirements for appliance isolation valves (AIV)

**2.4** Describe the associated labels required for ECV's

**2.5** Identify the gas supply route to domestic properties  
   a. The natural gas network  
   b. Components of the network  
   c. Pressure tiers within the network

**2.6** Define the methods of entry and layout features of natural gas service pipework to Domestic dwellings  
   a. Minimum depth of service pipework  
   b. Types of domestic gas meter housings and compartments  
   c. Surface mounted meter boxes  
   d. Semi-concealed meter boxes  
   e. Built-in meter boxes  
   f. Purpose built meter housings  
   g. Medium pressure installations  
   h. Multi-occupancy installation - remote meters  
   i. Primary meter installations  
   j. Use of secondary meters  
   k. Use of pre-payment meters  
   l. Use of meter labels – secondary and primary meters  

**2.7** State the operation and accuracy of gas positive displacement meter

**2.8** Identify the procedure to take when a fault is diagnosed on an emergency control valve

**2.9** Define the characteristics of meters used in domestic dwellings  
   a. U6  
   b. E6  
   c. Semi-concealed  
   d. Inferential  
   e. Rotary  
   f. Positive displacement
### Learning Outcome 2  Continued

**Assessment Criteria**

2.10 Define the operating principles of domestic regulators and governors
   - a. The construction of a regulator
   - b. The operation of a gas meter regulator
   - c. Identification of medium pressure meter and regulator installation
   - d. Maintaining correct installation operating pressures
   - e. Checking and/or setting correct installation operating pressures

### Learning Outcome 3

**Assessment Criteria**

3.1 Specify the procedures for taking pressure readings in domestic gas supply systems
   - a. Measurement of pressure
   - b. Types of pressure gauges
   - c. Use of pressure gauges
   - d. Procedures for taking pressure readings
     - Static pressure at the meter
     - Working pressure at the meter
     - Working pressure at appliances

3.2 Identify the factors which can affect the pressure readings at meter regulators
   - a. Factors affecting pressure loss
   - b. Effects of low flow rates and high flow rates on regulator outlet pressures (19 – 23 mbar)
   - c. Effects of pressure absorption across the primary meter installation

3.3 Describe the process for setting
   - a. Meter regulators low and medium pressure
   - b. LPG regulators

3.4 State the procedures to take when incorrect pressure readings are encountered in gas supply systems

### Learning Outcome 4

**Assessment Criteria**

4.1 Interpret the gas safety legislation that applies to gas safety devices and controls
4.2 Define the types of gas control devices used for gas appliances and their operating principles
   - a. Pressure regulators
   - b. Low pressure cut-off valves
   - c. Thermal cut-off valves
   - d. Gas cocks/valves
   - e. Cooker hotplate lid control valves
   - f. Electric solenoid valves
   - g. Excess flow valves
**Learning Outcome 4  Continued**

Know the operating principles of appliance gas safety devices and controls

**Assessment Criteria**

4.3 Define the types and operating principles of flame protection devices used in gas appliances

4.4 Define the types and operating principles of flame protection devices used in gas appliances
   a. Vapour pressure devices
   b. Thermoelectric valves
   c. Flame conduction and rectification systems
   d. Interrupter devices
   e. Atmosphere sensing devices
   f. Spillage detection devices
   g. Multifunctional control valves

4.5 Define the types and operating principles of thermostats used to control heat emitted from gas appliances
   a. Bimetallic
   b. Liquid expansion
   c. Vapour pressure
   d. Electrical control
   e. Electrical overheat/limit
   f. Thermistors

**Learning Outcome 5**

Know how to install NG and LPG gas pipework and fittings

**Assessment Criteria**

5.1 Interpret the gas safety legislation that applies to the installation of gas pipework and fitting

5.2 Clarify the materials suitable for gas pipework and fittings
   a. Standards for pipework and fittings
   b. Materials used
      - Copper
      - Low carbon steel
      - Steel semi-rigid

5.3 Identify the acceptable jointing methods for pipework used for domestic gas supplies
   a. Cleansing agents
   b. Jointing methods
      - Copper to copper
      - Mild steel to mild steel
      - Copper to mild steel
      - Steel semi-rigid pipework and termination
   c. Application of unions and compression fittings
   d. Movable appliance hoses
   e. Hoses

5.4 Calculate gas pipe sizes for domestic NG and LPG supply systems
   a. Supply from meter to appliance branches
   b. Supply from main branch connection to appliance termination

5.5 Clarify the circumstances in which polyethylene pipework may be used for domestic gas supply pipework
Learning Outcome 5  Continued

Know how to install NG and LPG gas pipework and fittings

Assessment Criteria

5.6 Specify the correct positioning, support and fixing requirements for gas supply pipework
   a. pipework
   b. Mild steel pipework
   c. Steel semi-rigid pipework
   d. Requirements for sleeving pipework
      - Through building features such as walls and into meter boxes
   e. External surface mounted installation pipework
   f. Ventilation size requirements for pipework installed within ducts
   g. Ventilation requirements for protected shafts and voids
   h. Accommodation for thermal movement of pipework

5.7 Specify the installation requirements for gas supply pipework
   a. Exterior pipework
   b. Pipework installed between joists in suspended floors or roof spaces
      - Solid timber; Metal web; Timber engineered; Installed across solid timber joists fitted with flooring
   c. Installed in floors or walls
      - Sheathing requirements; Buried in concrete floors/walls; Installed behind dry lined walls; Installed within stud partition walls; Installed under the base of a wall or foundation

5.8 Specify the provision of safety and control measures to gas supply pipework
   a. Positioning requirements adjacent to other services
   b. Corrosion protection
   c. Gas pipe identification
   d. Main equipotential bonding (minimum cross sectional area)
   e. Disconnection of pipes and fittings – use of temporary continuity bond

5.9 Specify the requirements for pipework to multi-occupancy dwellings
   a. Safety requirements for fire stopping in buildings containing flats or maisonettes
   b. Safety requirements for pipework inside a protected shaft or other fire escape route

5.10 State the precautions to be taken when making new connections into an existing gas pipework system
   a. Breaking gas connections to an appliance
   b. Fixing requirements for installation pipework when connected to a meter not securely restrained

5.11 State the precautions to be taken when using an exposed flame for soldering joints on existing gas pipework systems

Learning Outcome 6

Know how to test for tightness of a gas pipework system and purge the system

Assessment Criteria

6.1 Interpret the gas safety legislation that applies to the tightness testing of gas installations
6.2 Define the acronyms and symbols used within the industry standards for tightness testing
<table>
<thead>
<tr>
<th>Learning Outcome 6</th>
<th>Continued</th>
</tr>
</thead>
<tbody>
<tr>
<td>Know how to test for tightness of a gas pipework system and purge the system</td>
<td></td>
</tr>
</tbody>
</table>

**Assessment Criteria**

6.3 **State the types of pressure gauge suitable for carrying out a tightness test and identify the requirements for the accuracy of reading**

6.4 **Identify the points when tightness testing of an installation should be carried out**
   a. Before work commences on existing systems
   b. On completion of work on new and existing gas systems
   c. Following the report of a gas escape

6.5 **Clarify how differing system types and configurations impacts on the tightness testing procedure**
   a. Maximum installation volume for individual tightness tests (0.035m³)
      - Calculating pipe volume; Fittings volume; Meter volume
   b. Pipe diameter up to (35mm)
   c. Inlet pressure exceeds 75 mbar without meter inlet valve
   d. Different meter types
      - Diaphragm U6/G4/U16/G10; Ultrasonic E6; Single dwellings; Multiple dwellings with emergency control valves only
   e. Anti-tamper devices

6.6 **Determine the tightness testing procedures for gas supply systems**
   a. Testing new installation pipework (no meter connected)
   b. Testing new installations (meter connected) with or without appliances connected
   c. Testing existing installations (meter connected) with or without appliances connected
   d. Testing existing medium pressure fed installations without a meter inlet valve fitted

6.7 **Specify the actions to take to investigate and repair suspected leakage from gas supplies and components**
   a. Use of gas detection equipment
   b. Use of leak detection fluid

6.8 **Specify the actions to be taken when a smell of gas persists following a gas tightness test**
   a. When the emergency control valve / additional emergency control valve / meter inlet valve is turned off
   b. When a leaking installation cannot be repaired

6.9 **Describe the requirements to issue gas testing and purging certificates**

6.10 **State the purging methods and requirements for systems that have undergone tightness testing**
   a. Volume 0.2m³ or less
   b. Volume over 0.2m³
### Learning Outcome 7

Know the characteristics, combustion process and the types of burners used with natural gas and LPG

### Assessment Criteria

| 7.1 | Interpret the gas safety legislation that applies to the burner settings of gas appliances |
| 7.2 | Define the different types of gases used to supply appliances in domestic dwellings |
| | a. Chemical symbols |
| | - Methane (CH₄) |
| | - Propane (C₃H₈) |
| | - Butane (C₄H₁₀) |
| | b. Gas characteristics |
| | c. Viscosity |
| | d. Families of gas |
| | - 1st, 2nd and 3rd families |
| | e. Relative density of gases compared to air |
| | f. Explosive mixtures |
| 7.3 | Identify the combustion process with gases used in dwellings |
| | a. combustion equation |
| | b. Air requirements for combustion |
| | c. Main constituents of complete combustion |
| | d. Main constituents of incomplete combustion |
| | - Carbon Monoxide; Soot deposits |
| | e. Flammability limits of gases |
| | f. Causes of incomplete combustion |
| | g. Calorific Values of gases |
| | - Gross; Net; British thermal units (BTU’s); Kilowatts (kW); Use of conversion charts |
| | h. Wobbe number of gases |
| 7.4 | Identify the potential effects of Carbon Monoxide when incomplete combustion takes place |
| | a. Effects of exposure to Carbon Monoxide on the human body |
| | b. Symptoms of CO poisoning |
| | c. Advice to give to a person who describes symptoms of being affected by products of combustion |
| 7.5 | State typical ambient levels of carbon dioxide and identify critical levels and the potential effects on the gas combustion process |
| 7.6 | Specify the measures necessary to ensure that exposure to Carbon Monoxide does not take place/ is minimised |
| | a. Primary measures – correct appliance installation and maintenance |
| | b. Secondary measures – use of Carbon Monoxide detectors |
| | c. Types of CO detectors available and standards of manufacture |
| | d. The positioning requirements for Carbon Monoxide detectors |
| | e. The associated maintenance requirements of CO detectors |
| | f. Other sources of Carbon Monoxide in dwellings |
| | g. Causes of activation of CO detectors and indicators |
Learning Outcome 7  Continued

Know the characteristics, combustion process and the types of burners used with natural gas and LPG

Assessment Criteria

7.7 Define the layout features and operating principles of gas appliance burners
   a. Pre and post aerated burners
   b. Premix burners
   c. Forced draught burners
   d. Radiant burners

7.8 Define the key terms related to gas appliance burners
   a. Flame speed
   b. Ignition temperature
   c. Venturi
   d. Burner head
   e. Burner (flame) retention

7.9 Identify how to diagnose faults in gas appliance burners
   a. Flame picture
   b. Sooting
   c. Discolouration
   d. Flame Chilling
   e. Linting
   f. Condition of the burner
   g. Air supply faults
   h. Condition and size of injectors

7.10 Clarify the reasons for burner faults that result in incomplete combustion
   a. Gas rate / pressure settings
   b. Effects of excessive pressure at the appliance (flame lift)
   c. Aeration
   d. Vitiation
   e. Light back
   f. Flame chilling

Learning Outcome 8

Know the ventilation requirements of gas appliances installed in dwellings

Assessment Criteria

8.1 Interpret the gas safety legislation that applies to the ventilation requirements of gas appliances

8.2 Calculate the ventilation requirements for open flued and flueless gas appliances
   a. Adventitious air supplies
   b. Gross and net calorific values of appliances
   c. For multiple appliance installations in the same room/space
      - Multiple open flued and flueless appliances
      - Open flued and flueless appliances

8.3 Calculate the ventilation required for appliances located in compartments
   a. Open flued appliances
   b. Room sealed appliances
Learning Outcome 8 Continued

Know the ventilation requirements of gas appliances installed in dwellings

Assessment Criteria

8.4 Identify the types of grilles and vents available for ventilation
   a. Types of grilles and vents
   b. Sizing of grilles and vents (free area availability)

8.5 Calculate the free area of unmarked grilles and vents

8.6 Specify the acceptable locations for ventilation to appliances
   a. Restrictions to ventilator/grille locations
   b. Installation of vents through walls (including cavity walls)
   c. Ventilation paths via other rooms
   d. Ventilation paths to compartments including ducts
   e. Siting of ventilation
      - Wall
      - Window
      - floor/ceiling (ducted and un-ducted)

8.7 Clarify the effect that other heat producing appliances and other types of extraction have on the requirement for ventilation of gas appliances
   a. Oil or solid fuel appliances and flue systems
   b. Passive stack ventilation
   c. Extractor fans
   d. Cooker hoods
   e. Tumble driers

8.8 Specify the ventilation requirements of open flued and flued decorative effect space heaters
   a. Single appliances
   b. In rooms with multiple appliances
   c. Oil and solid fuel appliances

Learning Outcome 9

Know the standards of chimneys and flue systems to be used with gas appliances

Assessment Criteria

9.1 Interpret the legislation that applies to chimneys and flues that serve gas appliances
   a. Gas safety legislation
   b. Exchange of information and planning requirements for chimneys

9.2 State how gas appliances are classified according to the type of chimney or flue used
   a. Flueless
   b. Open flued
      - Natural draught
      - Forced (fanned) draught
   c. Room sealed
      - Natural draught
      - Forced (fanned) draught
      - Vertex type appliances

9.3 Identify the working principles of flue systems serving gas appliances
   a. Open flued chimneys
   b. Room sealed - natural draught
   c. Room sealed - fanned draught
   d. Vertex type flues
### Learning Outcome 9  Continued

**Know the standards of chimneys and flue systems to be used with gas appliances**

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.4 State the types and general layout features of chimney and flue construction</td>
</tr>
<tr>
<td>a. Rigid chimney types</td>
</tr>
<tr>
<td>- Brick / masonry</td>
</tr>
<tr>
<td>- Pre-cast flue blocks</td>
</tr>
<tr>
<td>- Metallic (single and double wall flues)</td>
</tr>
<tr>
<td>b. Flexible metallic liner installation</td>
</tr>
<tr>
<td>c. Use of flue box systems</td>
</tr>
<tr>
<td>d. Shared (common) chimney systems - SE and U Ducts</td>
</tr>
<tr>
<td>9.5 Specify the requirements for new and existing chimney/flue installation</td>
</tr>
<tr>
<td>a. Minimum cross sectional area of new chimney installations to serve appliances</td>
</tr>
<tr>
<td>b. Types of flue liners – during construction (salt glazed, clay etc.)</td>
</tr>
<tr>
<td>- Poured/pumped concrete flue liners; Pre-cast flue blocks; Flexible flue liners</td>
</tr>
<tr>
<td>c. Restrictions on the use of poured concrete liners</td>
</tr>
<tr>
<td>9.6 Specify the requirements for new and existing chimney/flue installation</td>
</tr>
<tr>
<td>a. Pre-cast flue design</td>
</tr>
<tr>
<td>- Minimum cross sectional area of new gas flue blocks; Minimum requirement of vertical flue blocks before off sets; Jointing material for pre-cast flue blocks; Minimum flue size diameter for connecting pre-cast transfer blocks to termination point; Effects of temperature on installation requirements for pre-cast flues</td>
</tr>
<tr>
<td>b. Flexible flue liners</td>
</tr>
<tr>
<td>- Sealing and support requirements for flexible flue liners in chimneys; Flexible liner components; Termination of flue liners</td>
</tr>
<tr>
<td>9.7 Define the design requirements of flues used with gas appliances</td>
</tr>
<tr>
<td>a. Requirements of designer, builder, provider or installer when installing gas chimneys</td>
</tr>
<tr>
<td>b. Requirements for chimney/hearth certificates</td>
</tr>
<tr>
<td>c. Chimney system design</td>
</tr>
<tr>
<td>- Distance requirements when passing through combustible material</td>
</tr>
<tr>
<td>- Special requirements for chimneys passing adjacent to combustible material or through other dwellings</td>
</tr>
<tr>
<td>d. Temperature effects and condensation problems caused by flue pipe runs</td>
</tr>
<tr>
<td>9.8 Define the design requirements of flues used with gas appliances</td>
</tr>
<tr>
<td>a. Requirements for the catchment space to open flued space heaters</td>
</tr>
<tr>
<td>b. Open flued chimney system</td>
</tr>
<tr>
<td>- Parts of an open flue chimney system</td>
</tr>
<tr>
<td>c. Room-sealed chimney system</td>
</tr>
<tr>
<td>- Parts of an room sealed flue chimney system</td>
</tr>
<tr>
<td>- Natural and fanned draught</td>
</tr>
<tr>
<td>9.9 Specify the requirements for the provision of hearths to gas appliances</td>
</tr>
</tbody>
</table>
## Learning Outcome 9  Continued

Know the standards of chimneys and flue systems to be used with gas appliances

### Assessment Criteria

<table>
<thead>
<tr>
<th>9.10</th>
<th>Specify the requirements for the termination of flue systems serving gas appliances</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Room sealed flue positions</td>
</tr>
<tr>
<td>b.</td>
<td>Condensing appliances</td>
</tr>
<tr>
<td>c.</td>
<td>Terminal guard requirements</td>
</tr>
<tr>
<td>d.</td>
<td>Open flue terminal positions</td>
</tr>
<tr>
<td></td>
<td>- Flue/ chimney outlet locations/terminal positions - before 2001</td>
</tr>
<tr>
<td></td>
<td>- Flue chimney outlet locations/terminal positions - after 2001</td>
</tr>
<tr>
<td></td>
<td>- Methods of dealing with down-draught on steeply pitched roofs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>9.11</th>
<th>Specify the requirements for installing chimney fans to open flues/chimney systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Requirements prior to installing fans in secondary flues</td>
</tr>
<tr>
<td>b.</td>
<td>Additional safety requirements when fans are installed in secondary flues</td>
</tr>
<tr>
<td>c.</td>
<td>Requirements for fan dilution and shared open flue, fanned draught systems in</td>
</tr>
<tr>
<td></td>
<td>domestic dwellings</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>9.12</th>
<th>Specify the flueing requirements for balanced compartments used with open flued</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Compartment construction</td>
</tr>
<tr>
<td>b.</td>
<td>Ducted air positioning</td>
</tr>
<tr>
<td>c.</td>
<td>Cross sectional areas of air inlet ducts</td>
</tr>
</tbody>
</table>

## Learning Outcome 10

Know how to re-establish gas supplies and relight appliances

### Assessment Criteria

<table>
<thead>
<tr>
<th>10.1</th>
<th>Interpret the gas safety legislation that applies to re-establishing gas supplies and relighting appliances</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>10.2</th>
<th>State the correct action to be taken when a non-commissioned appliance is identified</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>10.3</th>
<th>State the actions to be taken if pipework and appliances are not commissioned when the gas supply to the property is re-established</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>10.4</th>
<th>Identify the procedures for re-establishing gas supplies and relighting appliances</th>
</tr>
</thead>
</table>

## Learning Outcome 11

Know how to check and set appliance burner pressures and gas rates

### Assessment Criteria

<table>
<thead>
<tr>
<th>11.1</th>
<th>Identify the methods of determining and/or setting gas appliance working pressures</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Fixed rated appliances</td>
</tr>
<tr>
<td>b.</td>
<td>Range rated appliances</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>11.2</th>
<th>Identify the methods of determining gas rates at appliances</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Use of manufacturer data (appliance input)</td>
</tr>
<tr>
<td>b.</td>
<td>Use of meter test dial/index for calculation of gas consumption rate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>11.3</th>
<th>Calculate the gas consumption rates for gas appliances</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Imperial rated meters</td>
</tr>
<tr>
<td>b.</td>
<td>Metric rated meters</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>11.4</th>
<th>Identify and rectify faults discovered during testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Excessive pressure loss at the appliance</td>
</tr>
<tr>
<td>b.</td>
<td>Incorrect gas consumption rates at appliances</td>
</tr>
<tr>
<td>c.</td>
<td>Effects of meter pressure absorption under full load conditions</td>
</tr>
</tbody>
</table>
Learning Outcome 12
Know how to test gas appliance flue systems for effective operation

Assessment Criteria

12.1 Specify the key points to be checked in the visual inspection of a flue system prior to undertaking commissioning of the gas appliance/ flue system
   a. Open flue systems
   b. Room sealed flue systems – natural draught and fan assisted
   c. Vertex type appliances

12.2 State the factors that can affect flue system performance
   a. Downdraught conditions
   b. Wind effects at the appliance termination
   c. Passive stack ventilation
   d. Extraction fans sited in the vicinity of open flued appliances

12.3 Specify the testing procedures that should be performed to check the correct operation of an existing chimney flue/ gas appliance
   a. Flue flow test
   b. Spillage test
   c. Flue testing procedures with appliances sited in the vicinity of extraction fans
   d. Testing fanned draught open-flue systems and associated safety controls

12.4 Specify the testing procedures for room sealed fanned draught flue installations
   a. Checking case seals /case integrity
   b. Checking flue pipe/ air inlet connections for leakage
   c. Checking/testing of positive pressure case appliances

12.5 Specify the testing procedures for gas appliances that require commissioning by analysis of the flue combustion products
   a. Types of portable combustion gas analysers
   b. Flue gas samples to be taken during the commissioning process
   c. Sources of information required to determine correct flue gas products and ratios

Learning Outcome 13
Know how to identify and respond to unsafe gas situations

Assessment Criteria

13.1 Interpret the gas safety legislation that applies to situations relating to unsafe gas supplies
   or appliances
   a. Gas operative advice
   b. Gas user advice
   c. Responsibilities of the gas user
   d. Reporting gas escapes
   e. Actions that can be undertaken by the gas transporter
   f. Action of the LPG supplier
   g. Rights of entry to properties
   h. Turning off emergency controls
   i. Elimination of ignition sources
   j. Reduction of gas concentrations via ventilation
Learning Outcome 13  Continued

Know how to identify and respond to unsafe gas situations

Assessment Criteria

13.2 Identify the correct procedure for prioritising actions in the event of an unsafe situation
   a. Gas emergency priorities
      - Protect life
      - Protect property
      - Secure the escape
      - Leave the site safe

13.3 Clarify the types of unsafe situation that may be found with appliances and installations and how to respond to them
   a. Immediately Dangerous (ID) situations
      - Actions to take; ‘Do not use’ notices and labels; Warning notice forms; RIDDOR reportable Installations; RIDDOR reporting forms and information required
   b. At Risk (AR) situations
      - Actions to take; Concern for safety notices and labels
   c. Not to Current Standards (NCS) situations
      - Actions to take; Advice notices; Notification criteria for each category of NCS; Methods of notification

13.4 Identify the use of general notices and warning labels to avoid the occurrence of unsafe situations
   a. Meter labelling requirements
   b. Compartment labelling
   c. Appliance commissioning certificates
   d. Appliance service certificates
   e. Landlords safety certificates

Learning Outcome 14

Know the general requirements of LPG systems

Assessment Criteria

14.1 Interpret the gas safety legislation that applies to the installation of LPG pipework and appliances

14.2 Describe the additional characteristic and properties of LPG
   a. Origins of LPG
   b. Boiling point of LPG
   c. Types of gasses
   d. Vapour pressure curves
   e. Vaporisation and off takes
   f. Auto refrigeration and excessive off takes

14.3 Identify the methods of supplying LPG gases to permanent dwellings
   a. Bottled supplies
   b. Bulk storage

14.4 State the typical operating pressures within LPG systems for permanent dwellings
### Learning Outcome 14  Continued

Know the general requirements of LPG systems

#### Assessment Criteria

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 14.5 | Define the methods of entry and layout features of LPG service pipework to domestic dwellings fed from bulk storage and bottled supplies  
- a. Pipework materials, jointing, layout and routing  
- b. Regulator types and positioning requirements  
- c. Types of flexible connections and hoses  
- d. Operation and positioning of LPG emergency control valves and isolation valves |
| 14.6 | State the methods of checking and setting domestic LPG regulators |
| 14.7 | Interpret the gas safety legislation that applies to the tightness testing of LPG installations |
| 14.8 | Specify the tightness test procedure for LPG systems |
| 14.9 | Specify the purging requirements for LPG systems that have undergone tightness testing |
H/502/8487 – Specific Core Installation and Maintenance

This Practical and Knowledge unit enable learners to demonstrate occupational competence in demonstrating the use of tools, the safety of gas control operation and explain actions for unsafe procedures, how to carry out chimney performance checks, working safe with electrical systems and components, combustion and atmosphere sampling devices and calculate ventilation requirements. Upon completion of the unit the learners will:

- Demonstrate the use of common tools used in the gas utilisation industry.
- Demonstrate that gas safety controls are operating correctly and explain the actions required when unsafe or ineffective operation is found.
- Know the construction and operation of chimneys used for domestic gas appliances.
- Demonstrate how to carry out chimney performance checks.
- Identify and complete the correct notices, forms and labels used in domestic gas utilisation.
- Demonstrate how to work correctly and safely with electrical systems and components used in domestic gas utilisation.
- Demonstrate the correct use of combustion and atmosphere sampling analysers.
- Demonstrate safe lifting and handling techniques when moving equipment, materials and appliances associated with gas utilisation activities.
- Demonstrate the safe use of steps and ladders used in domestic gas utilisation activities.
- Demonstrate selection and use of correct Personal Protective Equipment (PPE) for domestic gas utilisation activities.
- Install and commission a small domestic gas installation.
- Calculate the requirements for permanent ventilation in domestic gas utilisation environments.

Learning Outcome 1

Demonstrate the use of common tools used in the gas utilisation industry

Assessment Criteria

1.1 Demonstrate the correct and safe use of tools for drilling, securing and cutting brick, concrete, block, studded, timber framed and dry lined walls:
   - a. Basic Hand Tools
   - b. Battery Operated Tools
   - c. RCD adaptors
   - d. Power Tools including visual inspection of drills, circular saws and jig saws
   - e. Visual Inspections of tools including checking the condition of flexes cables and plug

1.2 Checking that PAT Certificates are in date

1.3 Demonstrate the correct use of tools for measuring, cutting, securing and jointing pipework and other materials used in gas installation activities:
   - a. Measuring devices
   - b. Cutting devices and saws
   - c. Metallic and non-metallic pipes
   - d. Soldered Joints
   - e. Screwed Joints
   - f. Compression Joints
### Learning Outcome 1 Continued

**Demonstrate the use of common tools used in the gas utilisation industry**

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4 Demonstrate the correct and safe use of the following tools used to test systems</td>
</tr>
<tr>
<td>a. Pressure Gauges</td>
</tr>
<tr>
<td>b. Voltage Indicators</td>
</tr>
<tr>
<td>c. Continuity Testers</td>
</tr>
<tr>
<td>d. Electrical Multi-meters</td>
</tr>
<tr>
<td>e. Plug In Socket Testers</td>
</tr>
<tr>
<td>f. Electrical Proving Units</td>
</tr>
<tr>
<td>g. Thermometers</td>
</tr>
<tr>
<td>1.5 Make good materials and surfaces to include brick, concrete, block, studded, timber framed, tiled and dry lined</td>
</tr>
</tbody>
</table>

### Learning Outcome 2

**Demonstrate that gas safety controls are operating correctly and explain the actions required when unsafe or ineffective operation is found**

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Safely diagnose correct, unsafe or ineffective operation of:</td>
</tr>
<tr>
<td><strong>Flame Protection Devices, to include</strong></td>
</tr>
<tr>
<td>a. Vapour pressure</td>
</tr>
<tr>
<td>b. Thermoelectric</td>
</tr>
<tr>
<td>c. Flame rectification</td>
</tr>
<tr>
<td>d. Flame conduction</td>
</tr>
<tr>
<td><strong>Controls to include:</strong></td>
</tr>
<tr>
<td>a. Atmosphere Sensing Device</td>
</tr>
<tr>
<td>b. Spillage Detection Device</td>
</tr>
<tr>
<td>c. Pressure Regulators</td>
</tr>
<tr>
<td>d. Low Pressure Cut Off</td>
</tr>
<tr>
<td>e. Thermal Cut Off</td>
</tr>
<tr>
<td>f. Gas Cocks/Valves</td>
</tr>
<tr>
<td>g. Cooker Hotplate Lid Control</td>
</tr>
<tr>
<td>h. Electric Solenoid Valve</td>
</tr>
<tr>
<td>i. Excess Flow Valves</td>
</tr>
<tr>
<td>j. Thermoelectric Valve</td>
</tr>
<tr>
<td>k. Interrupter Devices</td>
</tr>
<tr>
<td>l. Multifunction Control</td>
</tr>
<tr>
<td><strong>Thermostats to include:</strong></td>
</tr>
<tr>
<td>a. Bi metallic</td>
</tr>
<tr>
<td>b. Liquid Expansion</td>
</tr>
<tr>
<td>c. Vapour Pressure</td>
</tr>
<tr>
<td>d. Electrical Thermostats</td>
</tr>
<tr>
<td>e. Thermistors</td>
</tr>
<tr>
<td>2.2 Demonstrate actions to be taken when defective or unsafe control operation is identified</td>
</tr>
</tbody>
</table>
### Learning Outcome 3

**Know the construction and operation of chimneys used for domestic gas appliances**

**Assessment Criteria**

<table>
<thead>
<tr>
<th>3.1</th>
<th>Classify gas appliances according to their Chimney types:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. Flueless</td>
</tr>
<tr>
<td></td>
<td>b. Open Chimney</td>
</tr>
<tr>
<td></td>
<td>c. Room Sealed Chimney</td>
</tr>
</tbody>
</table>

### Learning Outcome 4

**Demonstrate how to carry out chimney performance checks**

**Assessment Criteria**

<table>
<thead>
<tr>
<th>4.1</th>
<th>Carry out checks on open chimney systems:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. Visual checks throughout the length</td>
</tr>
<tr>
<td></td>
<td>b. Confirmation of correct type</td>
</tr>
<tr>
<td></td>
<td>c. Adequate cross sectional area</td>
</tr>
<tr>
<td></td>
<td>d. Catchment space measurement</td>
</tr>
<tr>
<td></td>
<td>e. Chimney flow test</td>
</tr>
<tr>
<td></td>
<td>f. Chimney Spillage test</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4.2</th>
<th>Carry out checks on room sealed chimney systems:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. Confirmation of correct type and installation</td>
</tr>
<tr>
<td></td>
<td>b. Correct terminal location and protection</td>
</tr>
</tbody>
</table>

| 4.3 | Testing operation to include case seal integrity for positive and negative appliance designs |

### Learning Outcome 5

**Identify and complete the correct notices, forms and labels used in domestic gas utilisation**

**Assessment criteria**

<table>
<thead>
<tr>
<th>5.1</th>
<th>Identify correct application and complete the following records, forms and labels:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. Landlord / Home Owner Gas Safety Record</td>
</tr>
<tr>
<td></td>
<td>b. Gas Safety Inspection Form</td>
</tr>
<tr>
<td></td>
<td>c. Benchmark Maintenance Report</td>
</tr>
<tr>
<td></td>
<td>d. Service / Maintenance Checklist(s)</td>
</tr>
<tr>
<td></td>
<td>e. Chimney / Hearth Notice Plate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5.2</th>
<th>Select and attach appropriate labels applicable to domestic gas work:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. Un-commissioned Appliance Label</td>
</tr>
</tbody>
</table>

| 5.3 | Balanced Compartment Label                                           |

### Learning Outcome 6

**Demonstrate how to work correctly and safely with electrical systems and components used in domestic gas utilisation**

**Assessment Criteria**

<table>
<thead>
<tr>
<th>6.1</th>
<th>Using Ohms Law, calculate:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. Current and Power</td>
</tr>
<tr>
<td></td>
<td>b. Voltage</td>
</tr>
<tr>
<td></td>
<td>c. Resistance</td>
</tr>
</tbody>
</table>

<p>| 6.2 | Assemble simple series and parallel circuits                           |</p>
<table>
<thead>
<tr>
<th>Learning Outcome 6  Continued</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrate how to work correctly and safely with electrical systems and components used in domestic gas utilisation</td>
</tr>
</tbody>
</table>

**Assessment Criteria**

6.3  Identify the type of electrical installation as:
   a. TT
   b. TN-S
   c. TN-C-S

6.4  Connect a domestic gas appliance to a fixed domestic electrical installation:
   a. Cable Type and Sizing calculation
   b. Fuse Rating calculation
   c. Fused Spur connection
   d. Wiring a Three Pin Plug

6.5  Safely carry out preliminary electrical safety checks:
   a. Earth Continuity
   b. Polarity
   c. Short Circuit
   d. Resistance to Earth
   e. RCD Operation Test

6.6  Demonstrate the safe isolation of electrical supplies connected to gas appliances or controls

6.7  Read and interpret appliance wiring diagrams to establish:
   a. Sequence of electrical operation
   b. Correct appliance and component wiring

6.8  Differentiate between main and supplementary electrical bonding connections

6.9  Demonstrate the procedure for safe electrical isolation:
   a. Use of locking devices
   b. Circuit protection device retention
   c. Voltage indicating device
   d. Use of proving unit

   Confirmation of safety – absence of electricity

6.10  Identify electrical faults and defects on domestic gas installations, initiating actions as required:
   a. Inadequate earthing provision
   b. Incorrect cable types and position
   c. Clearances from other services
   d. Failed components
   e. Incorrect polarity
   f. Inadequate circuit protection conductors
   g. Defective automatic disconnection device
   h. Appliance connections

6.11  Complete electrical installation certificate
Learning Outcome 7
Demonstrate the correct use of combustion and atmosphere sampling analysers

Assessment Criteria
7.1 Demonstrate the Correct use of a Combustion Performance Analysers and Atmosphere Sampling Analysers interpreting:
   a. CO, CO₂, O₂ readings, CO/CO₂ Ratios in a flueway
   b. CO, CO₂, O₂ readings in the atmosphere
   c. Visually and by the use of combustion performance analysis identify complete and incomplete combustion for Type ‘A’, ‘B’ and ‘C’ gas appliances
7.2 Complete the required checks using a combustion/atmosphere analyser in the event of “carbon monoxide detector” activation.

Learning Outcome 8
Demonstrate safe lifting and handling techniques when moving equipment, materials and appliances associated with gas utilisation activities

Assessment Criteria
8.1 Risk assess the work site and work activities to be undertaken
8.2 Assess loads to be handled and moved, to include:
   a. Size of Loads
   b. Weight of Loads
   c. Shape of Loads
   d. Configuration of Loads
   e. Need for assistance
8.3 Prepare to lift and handle loads, to include:
   a. Using correct PPE
   b. Communication to others
   Ensuring a clear path
8.4 Lift and move loads in accordance with best practice and safe systems of work
   a. Correct kinetic techniques
   b. Assisted lift needing two people
8.5 Simple mechanical lifting device

Learning Outcome 9
Demonstrate the safe use of steps and ladders used in domestic gas utilisation activities

Assessment Criteria
9.1 Risk assess the work site and work activities to be undertaken
9.2 Prepare the site location where steps and/or ladders need to be used
9.3 Inspect ladders and steps for defects
9.4 Position and erect steps and ladders in accordance with Regulations and safe working practice
9.5 Secure ladders by approved methods to ensure no slippage or movement may occur during use
9.6 Use steps and ladders for work activities in accordance with Regulations and safe working practice
## Learning Outcome 10
Demonstrate selection and use of correct Personal Protective Equipment (PPE) for domestic gas utilisation activities

### Assessment Criteria

10.1 Select PPE needed for specific activities:
   - Gloves
   - Protective footwear
   - Eye protectors
   - Ear protection
   - High visibility clothing
   - Knee protectors
   - Dust masks

10.2 Carry out gas installation or maintenance work wearing PPE as determined by each specific task

## Learning Outcome 11
Install and commission a small domestic gas installation

### Assessment Criteria

11.1 Install a domestic gas meter, pipework and domestic appliance:
   - Selecting correct materials and fittings
   - Demonstrate the correct method of jointing materials and fittings
   - Demonstrate the correct method of installing securing and supporting domestic meters and regulators
   - Demonstrate the correct method of installing a domestic appliance

11.2 Demonstrate tightness testing, purging and commissioning procedures including the procedure for resetting and sealing a regulator

11.3 Carry out a gas rate check and confirm it complies with manufacturer’s instructions

11.4 Demonstrate the correct method of removal of domestic meters and regulators:
   - Permanent removal
   - Temporary removal

11.5 Identify correct and incorrect methods of connecting the main equipotential bonding

11.6 Demonstrate action to meet the main equipotential bonding requirements for both permanent and temporary meter removal:
   - Method of bonding connection
   - Positioning of bond

11.7 Sizing of bond
Learning Outcome 12
Calculate the requirements for permanent ventilation in domestic gas utilisation environments

Assessment Criteria

12.1 Calculate the correct ventilation requirements for a range of domestic appliance installations in accordance with BS5440:
   a. Open chimney appliances
   b. Flueless appliances
   c. Appliances in compartments
   d. Multiple appliance installations
   e. Ventilation pathways via other rooms

12.2 Specify ventilation vents/grilles and methods

12.3 Measure existing vents and grilles to ensure that they are the correct type and provide the correct supply of air
T/502/8381 – Install, commission and de-commission gas pipework up to 35mm 1¼ diameter in domestic and small commercial premises

The practical and knowledge criteria detailed in this unit is in the installation of gas pipework up to 35 mm (1¼ inch) diameter (where the volume of the pipework does not exceed 0.035 cubic metre) from a meter outlet connection to gas appliance connection point, including ‘installation pipework and appliance connector pipework’ or in the case of non-metered installations from the Emergency Control Valve (EVC) located either inside or outside the property to the appliance connection point, supplied with 2nd or 3rd family gases. Upon completion of the unit the learners will:

- Design gas systems for installing gas pipework
- Plan and prepare work activities for installing domestic gas cookers, tumble dryers and leisure appliances
- De-commission domestic gas pipework to industry standards
- Install, exchange, and remove gas pipework to industry standards
- Pre-commission and Commission gas pipework to industry standards
- Use and communicate data and information to carry out de-commissioning, installation and commissioning work
- Resolve problems which could affect the de-commissioning, installation and commissioning process
- Install, commission and de-commission gas pipework up to 35mm (1¼) diameter in domestic and small commercial premises

<table>
<thead>
<tr>
<th>Learning Outcome 1</th>
<th>Design gas systems for installing gas pipework</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment Criteria</strong></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Identify and record the customer’s job requirements</td>
</tr>
<tr>
<td>1.2</td>
<td>Compare the customer’s job requirements with statutory and industry requirements and identify any conflicting issues</td>
</tr>
<tr>
<td>1.3</td>
<td>Survey the work site;</td>
</tr>
<tr>
<td></td>
<td>a. consult site diagrams for any key structural features that could affect the installation</td>
</tr>
<tr>
<td></td>
<td>b. record details of any features that may affect the installation</td>
</tr>
<tr>
<td>1.4</td>
<td>Check that the proposed positioning of the pipework meets the manufacturers’ and industry standards’ requirements for;</td>
</tr>
<tr>
<td></td>
<td>a. location</td>
</tr>
<tr>
<td></td>
<td>b. clearances</td>
</tr>
<tr>
<td>1.5</td>
<td>Check that the availability of input services;</td>
</tr>
<tr>
<td></td>
<td>a. gas</td>
</tr>
<tr>
<td></td>
<td>b. electricity</td>
</tr>
<tr>
<td></td>
<td>meet the appliance manufacturers’ and industry standards’ requirements for the pipework installation.</td>
</tr>
<tr>
<td>1.6</td>
<td>Check and ensure the design of the proposed installation is in compliance with industry standards</td>
</tr>
<tr>
<td>1.7</td>
<td>Prepare a range of design options to meet both customer and industry requirements</td>
</tr>
</tbody>
</table>
### Learning Outcome 1  Continued

**Design gas systems for installing gas pipework**

**Assessment Criteria**

<table>
<thead>
<tr>
<th>1.8</th>
<th>Present design options to the customer using variety of media;</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>written</td>
</tr>
<tr>
<td>b.</td>
<td>oral</td>
</tr>
<tr>
<td>c.</td>
<td>drawing</td>
</tr>
</tbody>
</table>

| 1.9 | Consult with the customer and obtain agreement to the design option that best meets all the requirements |

### Learning Outcome 2

**Plan and prepare work activities for installing domestic gas cookers, tumble dryers and leisure appliances**

**Assessment Criteria**

<table>
<thead>
<tr>
<th>2.1</th>
<th>Produce a risk assessment and method statement that incorporates;</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>safety provisions on the work site</td>
</tr>
<tr>
<td>b.</td>
<td>access to the work site</td>
</tr>
<tr>
<td>c.</td>
<td>movement of people on site</td>
</tr>
<tr>
<td>d.</td>
<td>the movement and safe storage of installation materials, tools and equipment for the job</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2.2</th>
<th>Survey the work site for</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>any pre-installation damage</td>
</tr>
<tr>
<td>b.</td>
<td>defects to existing building features</td>
</tr>
<tr>
<td>c.</td>
<td>record details of any features that may affect the installation</td>
</tr>
</tbody>
</table>

| 2.3 | Advise the property occupier of any defects found in the survey    |

<table>
<thead>
<tr>
<th>2.4</th>
<th>Protect the work site and the building fabric against possible damage being caused during;</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>de-commissioning</td>
</tr>
<tr>
<td>b.</td>
<td>installation</td>
</tr>
</tbody>
</table>

| 2.5 | Obtain confirmation from the customer before the job starts to ensure that they agree the planned work |

<table>
<thead>
<tr>
<th>2.6</th>
<th>Check and confirm that all materials, tools and equipment are available as required and are fit for purpose needed for</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>de-commissioning</td>
</tr>
<tr>
<td>b.</td>
<td>installation</td>
</tr>
<tr>
<td>c.</td>
<td>commissioning</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2.7</th>
<th>Check and confirm that the proposed siting of the gas supply meets the appliance manufacturers and industry standards requirements for;</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>location</td>
</tr>
<tr>
<td>b.</td>
<td>siting</td>
</tr>
<tr>
<td>c.</td>
<td>clearances</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2.8</th>
<th>Check and confirm that;</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>the gas supply,</td>
</tr>
<tr>
<td>b.</td>
<td>earthing supply</td>
</tr>
<tr>
<td>c.</td>
<td>provision of ventilation</td>
</tr>
</tbody>
</table>

meets industry standards’ requirements in relation to other services
<table>
<thead>
<tr>
<th>Learning Outcome 2</th>
<th>Continued</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan and prepare work activities for installing domestic gas cookers, tumble dryers and leisure appliances</td>
<td></td>
</tr>
<tr>
<td><strong>Assessment Criteria</strong></td>
<td></td>
</tr>
<tr>
<td>2.9 Confirm that the proposed siting of the gas supply meets industry standards’ requirements in relation to other services i.e. electricity supply</td>
<td></td>
</tr>
<tr>
<td>2.10 Carry out all necessary checks and tests to confirm;</td>
<td></td>
</tr>
<tr>
<td>a. the gas supply</td>
<td></td>
</tr>
<tr>
<td>b. electricity supply</td>
<td></td>
</tr>
<tr>
<td>meet the manufacturers’ and industry requirements for the installation</td>
<td></td>
</tr>
<tr>
<td>2.11 Calculate and confirm the correct sizing of pipework to ensure minimum pressure loss across installation</td>
<td></td>
</tr>
<tr>
<td>2.12 Check the existing installation for unsafe;</td>
<td></td>
</tr>
<tr>
<td>a. appliances</td>
<td></td>
</tr>
<tr>
<td>b. system components</td>
<td></td>
</tr>
<tr>
<td>apply the gas industry unsafe situations procedures to any identified</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Outcome 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>De-commission domestic gas pipework to industry standards</td>
</tr>
<tr>
<td><strong>Assessment Criteria</strong></td>
</tr>
<tr>
<td>3.1 Check that the;</td>
</tr>
<tr>
<td>a. gas supply</td>
</tr>
<tr>
<td>b. electricity supply</td>
</tr>
<tr>
<td>are in a condition that enables safe appliance de-commissioning</td>
</tr>
<tr>
<td>3.2 Use the correct tools and equipment for de-commissioning activities</td>
</tr>
<tr>
<td>3.3 Use designated safe;</td>
</tr>
<tr>
<td>a. isolation methods</td>
</tr>
<tr>
<td>b. tests</td>
</tr>
<tr>
<td>c. procedures</td>
</tr>
<tr>
<td>to de-commission gas and systems and components</td>
</tr>
<tr>
<td>3.4 Take precautionary actions to ensure that temporarily de-commissioned;</td>
</tr>
<tr>
<td>a. appliances</td>
</tr>
<tr>
<td>b. systems</td>
</tr>
<tr>
<td>c. components</td>
</tr>
<tr>
<td>do not present a safety hazard</td>
</tr>
<tr>
<td>3.5 Permanently remove and disconnect;</td>
</tr>
<tr>
<td>a. appliances</td>
</tr>
<tr>
<td>b. gas system components</td>
</tr>
<tr>
<td>c. earthing system components</td>
</tr>
<tr>
<td>3.6 After permanent removal of pipework mark any live gas pipes with a notice to indicate the pipe contains gas</td>
</tr>
</tbody>
</table>
# Learning Outcome 4
Install, exchange, and remove gas pipework to industry standards

## Assessment Criteria

<table>
<thead>
<tr>
<th>No.</th>
<th>Criteria Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Carry out preparatory work to meet the installation requirements</td>
</tr>
</tbody>
</table>
| 4.2 | Carry out the installation processes minimising damage to;  
|     | a. customer property  
|     | b. building features |
| 4.3 | Select and use the correct tools and equipment for installation activities |
| 4.4 | Remove existing gas and earthing system components as required by the installation plan |
| 4.5 | Fabricate gas system, fittings and components as required by the installation plan |
| 4.6 | Position the pipework and confirm it meets the;  
|     | a. location  
|     | b. siting  
|     | c. clearances  
|     | required by the appliance manufacturers’ and industry standards’ specification |
| 4.7 | Provide adequate ventilation for;  
|     | a. new  
|     | b. replacement  
|     | pipework installations and systems |
| 4.8 | Provide adequate support(s) for pipework installation to conform with industry standards’ specification |
| 4.9 | Position and protect pipework installation in and through walls to meet industry standards for sleeving and purpose designed channels |
| 4.10 | Position and protect pipework installation in multi-occupancy dwellings to meet industry standards’ requirements. Use of fire stops, sleeving, purposed designed shafts |
| 4.11 | Position and protect pipework installation in protected shafts containing;  
|     | a. stairs  
|     | b. lifts  
|     | c. other protected fire escape routes  
|     | to meet industry standards’ requirements |
| 4.12 | Position and protect external installations to meet industry standards and requirements |
| 4.13 | Ensure existing gas systems are clean and free of debris |
| 4.14 | Fix and connect gas pipework, valves, fittings and components to the supply |
| 4.15 | Mark any live gas pipes with a notice to indicate the pipe contains gas |
| 4.16 | Install additional emergency control valve (AECV) to the supply |
| 4.17 | Connect earthing system components to the gas supply |

# Learning Outcome 5
Pre-commission and Commission gas pipework to industry standards

## Assessment Criteria

<table>
<thead>
<tr>
<th>No.</th>
<th>Criteria Description</th>
</tr>
</thead>
</table>
| 5.1 | Confirm that the complete appliance installation complies with;  
|     | a. manufacturers’ specification  
|     | b. industry standards,  
|     | c. Gas Safety (Installation and Use) Regulations,  
|     | d. British Standards  
|     | e. Building Regulations |
| 5.2 | Check that conditions within the gas system will permit safe commissioning |
| 5.3 | Select and use the correct tools and equipment for commissioning activities |
### Learning Outcome 5  Continued

**Pre-commission and Commission gas pipework to industry standards**

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5.4</strong> Use tightness testing and purging procedures to confirm;</td>
</tr>
<tr>
<td>a. the integrity of the installed gas system</td>
</tr>
<tr>
<td>b. existing appliance(s)</td>
</tr>
<tr>
<td><strong>5.5</strong> Use purging procedures to confirm the safe supply of gas to the installed gas system</td>
</tr>
<tr>
<td><strong>5.6</strong> Use electrical testing procedures to confirm the integrity of the installed earthing system</td>
</tr>
<tr>
<td><strong>5.7</strong> Apply protective coating to pipework and to joints after gas tightness testing has been completed</td>
</tr>
<tr>
<td><strong>5.8</strong> Reconfirm that the ventilation requirements meet industry standards for the installation</td>
</tr>
<tr>
<td><strong>5.9</strong> Check and confirm the operation of the installed gas valves and components to ensure they function safely and operate in accordance with manufacturers’ instructions</td>
</tr>
<tr>
<td><strong>5.10</strong> Instruct the property occupier on the correct operation of the;</td>
</tr>
<tr>
<td>a. gas system</td>
</tr>
<tr>
<td>b. valves</td>
</tr>
<tr>
<td>c. components</td>
</tr>
<tr>
<td>providing them with a copy of any user instructions</td>
</tr>
<tr>
<td><strong>5.11</strong> Take precautionary actions to prevent the unauthorised use of;</td>
</tr>
<tr>
<td>a. uncommissioned gas appliances</td>
</tr>
<tr>
<td>b. gas systems</td>
</tr>
<tr>
<td>c. electrical systems</td>
</tr>
<tr>
<td>d. components</td>
</tr>
<tr>
<td>by isolation procedures and use of warning notices</td>
</tr>
</tbody>
</table>

### Learning Outcome 6

**Use and communicate data and information to carry out de-commissioning, installation and commissioning work**

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>6.1</strong> Liaise with the property occupier and other people who will be affected by the work during;</td>
</tr>
<tr>
<td>a. planning,</td>
</tr>
<tr>
<td>b. de-commissioning</td>
</tr>
<tr>
<td>c. installation</td>
</tr>
<tr>
<td>d. commissioning</td>
</tr>
<tr>
<td>to minimise disturbance to the job</td>
</tr>
<tr>
<td><strong>6.2</strong> Use;</td>
</tr>
<tr>
<td>a. normative documents</td>
</tr>
<tr>
<td>b. industry standards</td>
</tr>
<tr>
<td>c. British Standards</td>
</tr>
<tr>
<td>d. information from manufacturers’ instructions for the appliance to ensure the work is completed in accordance with the specification</td>
</tr>
<tr>
<td><strong>6.3</strong> Advise of any delays to the work to any persons who are affected by the delay</td>
</tr>
<tr>
<td><strong>6.4</strong> Report any delays in the work schedules to the line manager responsible for the job</td>
</tr>
<tr>
<td><strong>6.5</strong> Advise the designated persons of any unsafe situations and actions required to remedy those situations</td>
</tr>
</tbody>
</table>
### Learning Outcome 6  
**Continued**

Use and communicate data and information to carry out de-commissioning, installation and commissioning work

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.6 Complete documentation to confirm the safe commissioning of the gas system and components</td>
</tr>
<tr>
<td>6.7 Complete records and documentation confirming the safe commissioning of gas systems and components</td>
</tr>
<tr>
<td>6.8 Complete gas system de-commissioning records</td>
</tr>
</tbody>
</table>

### Learning Outcome 7

Resolve problems which could affect the de-commissioning, installation and commissioning process

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1 Rectify and report deficiencies in gas and earthing input services</td>
</tr>
<tr>
<td>7.2 Resolve problems in accordance with approved procedures where pre-commissioning checks and tests reveal gas system or component defects</td>
</tr>
<tr>
<td>7.3 Resolve problems in accordance with approved procedures when gas systems and components being commissioned do not meet design requirements</td>
</tr>
<tr>
<td>7.4 Resolve problems in accordance with approved procedures when the gas system and components cannot be restored to full performance</td>
</tr>
</tbody>
</table>

### Learning Outcome 8

Maintain water heating and wet central heating appliances

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.1 Describe the health, safety and environmental factors which need to be incorporated in risk assessment for the domestic installation process</td>
</tr>
<tr>
<td>8.2 Explain safe access and working at heights procedures</td>
</tr>
<tr>
<td>8.3 Specify the tools and equipment necessary to provide safe access to work at heights, or in confined spaces</td>
</tr>
<tr>
<td>8.4 Describe the methods of working which protect the building décor, customer property and existing systems and components</td>
</tr>
<tr>
<td>8.5 State the care and maintenance requirements of tools and equipment, and checks for safe condition</td>
</tr>
<tr>
<td>8.6 State the tools, equipment, materials and components required for the gas system de-commission, maintenance and commission – ordering, supplying, advising, checking and delivery procedures</td>
</tr>
<tr>
<td>8.7 Explain how to safely secure and store tools, equipment, materials and components to minimise loss or wastage</td>
</tr>
<tr>
<td>8.8 Describe the potential hazards that could arise from all de-commissioning, maintenance and commissioning activities and the checks to be carried out before work takes place</td>
</tr>
<tr>
<td>8.9 Explain the steps to take should materials, components, tools and equipment not be available at the site to commence the de-commissioning, maintenance and commissioning activity</td>
</tr>
<tr>
<td>8.10 Demonstrate how and where to access the required information, i.e. normative documents, industry standards guidance documents, British Standards and manufacturers’ instructions applicable to the gas system and appliance, to ensure the work is done to the specification and industry standards</td>
</tr>
</tbody>
</table>
## Learning Outcome 8 Continued

Maintain water heating and wet central heating appliances

### Assessment Criteria

8.11 Demonstrate how to read and interpret the information contained in normative documents, industry standards guidance documents, British Standards and manufacturers’ instructions

8.12 Describe how to measure and record installation and site details for prefabrication purposes

8.13 Explain how to confirm that the gas supply and earthing system requirements are adequate for the installation of the new gas system and components or, for extending the system or adding components

8.14 Explain how to confirm that the provision of ventilation meets the industry standards’ requirements for the installation i.e. in voids, shafts, ducts

8.15 Calculate correct sizing of pipework to ensure minimum pressure loss across installation

8.16 State checks and tests to confirm suitability of the gas supply

8.17 State checks and tests to confirm suitability of the earthing system, including the installation and positioning of the main equipotential bonding

8.18 State safe isolation methods, tests, and procedures for temporary and permanent de-commissioning of gas systems, earthing systems and components, including the use of temporary continuity bonds

8.19 Explain the precautions to ensure that de-commissioned gas and earthing systems do not prove a safety hazard

8.20 Describe measures to prevent de-commissioned gas systems being brought into operation utilising safety and warning notices

8.21 Describe the need to liaise with others whose procedures or routines may be affected by the suspension of the gas system operation

8.22 Summarise the points in the de-commissioning, installation and commissioning process where co-operation and liaison with other trades and property occupier may be required

8.23 State the industry practices and work standards for fabricating and installing gas pipework, valves, systems and components to comply with the manufacturers’ specification, industry standards, Gas Safety (Installation and Use) Regulations, British Standards and Building Regulations

8.24 Identify and describe the types of pipe materials suitable for carrying gas - steel, malleable iron, copper, corrugated stainless steel tube (CSST), polyethylene and lead

8.25 Identify and describe the types of pipe fittings suitable for carrying gas – capillary, compression, push-fit, union joints and screwed joints

8.26 State the industry practices and work standards for jointing materials and fittings suitable for carrying gas, including connecting to lead composition pipes

8.27 Describe the safety precautions to take when jointing materials and fittings - Including COSHH

8.28 Explain the industry practices and methods of bending pipe materials suitable for carrying gas i.e. bending methods of copper pipe, corrugated stainless steel tube (CSST) and stainless steel flexible pipe (anacondas)

8.29 Explain the industry practices and methods of bending copper pipework to set measured distances to include; double sets/offset bends, 90 degree bends, crank sets/passover bends

8.30 State the positioning and fixing requirements for gas pipework, valves, systems and components to comply with the manufacturers’ specification, industry standards, Gas Safety (Installation and Use) Regulations, British Standards and Building Regulations
**Learning Outcome 8 Continued**

Maintain water heating and wet central heating appliances

**Assessment Criteria**

<p>| 8.31 | Describe how Installation of gas pipework meets the industry standards’ requirements for; location, siting, clearance requirements and relationship to other services, i.e. electricity supply |
| 8.32 | State industry practices and work standards of providing adequate support(s) for pipework installation to conform with industry standards’ requirements |
| 8.33 | Produce a plan showing the positioning, protection and fixing methods for gas pipework, valves, systems and components in; floors, ducts, through walls, buried in walls, multi-occupancy buildings and protected shafts containing stairs, lifts or other protected fire escape routes, to comply with industry standards, Gas Safety (Installation and Use) Regulations, British Standards and Building Regulations i.e. sleeving, purposed designed channels, fire stops, purposed designed shafts |
| 8.34 | State the industry practices and work standards for pipe installation within suspended and joisted floors including methods of lifting and replacing floorboards and chipboard flooring |
| 8.35 | State the industry practices and work standards for pipe installation in concrete floors |
| 8.36 | Explain the installation and protection of external installations to meet industry standards requirements i.e. protection against mechanical damage, minimum depth below ground level |
| 8.37 | Describe the procedures and work methods for connecting to input services including; gas, earthing and ventilation systems |
| 8.38 | Describe the procedures and work methods of connecting pipework, valves and components to both new and existing gas systems and appliances |
| 8.39 | Describe the procedures and work methods to ensure correct gas pipe identification |
| 8.40 | Describe the process and procedures, equipment and legislative requirements for applying tightness testing and purging to gas appliances, systems and components |
| 8.41 | Describe the process and procedures, equipment and legislative requirements for applying electrical tests to earthing systems and components to ensure safe functioning i.e. earth continuity checks |
| 8.42 | State the procedures for checking the correct operation and performance of gas systems, valves and components and checking against the design specification to ensure safe functioning |
| 8.43 | Explain the routines and sequences for commissioning gas systems, valves and components |
| 8.44 | State how to complete all installation and commissioning documentation and records to be left with the property occupier including; Benchmark, Landlord/Home owner gas safety record |
| 8.45 | Explain system handover procedures and demonstrate the operation of gas systems, valves and components to end users |
| 8.46 | Summarise the steps to take when problems arise in the work activities |
| 8.47 | Describe Job management structures and methods of reporting and recording job progress or problems delaying progress |
| 8.48 | Describe how to safely collect and dispose of system contents that may be hazardous to health or the environments i.e. waste products including asbestos and insulation materials |
| 8.49 | Demonstrate how and where to access the required information, i.e. Industry regulations regarding the safe disposal of system contents that may be hazardous to health or the environment i.e. Special Waste Regulations, Hazardous Waste Regulations, Control of Asbestos at Work Regulations. |</p>
<table>
<thead>
<tr>
<th>Learning Outcome 8  Continued</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain water heating and wet central heating appliances</td>
</tr>
<tr>
<td><strong>Assessment Criteria</strong></td>
</tr>
<tr>
<td>8.50 Explain how to isolate unsafe gas appliances, gas systems and components and apply the gas industry unsafe situations procedure</td>
</tr>
</tbody>
</table>
D/503/8628 – Tightness test, purge, commission and de-commission gas pipework up to 35mm 1¼ diameter in small natural gas installations.

The practical and knowledge criteria detailed in this unit covers the work activities of planning, de-commissioning, commissioning and gas tightness testing and direct purging of small 2nd family gas (natural gas) installations downstream of an Emergency Control Valve (ECV). The unit is based on the Institution of Gas Engineers and Managers, normative standard IGE/UP/1B. Upon completion of the unit the learners will:

- Plan and prepare work activities for tightness testing and direct purging
- De-commission gas systems and components to industry standards
- Tightness testing and direct purging of gas systems and components
- Use and communicate data and information to carry out de-commissioning, tightness testing and direct purging
- Resolve problems which could affect de-commissioning, tightness testing and direct purging
- Understand how to tightness test, purge, commission and de-commission gas pipework up to 35mm 1¼ diameter in small natural gas installations

### Learning Outcome 1

Plan and prepare work activities for tightness testing and direct purging

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.1</strong> Carry out a risk assessment which incorporates;</td>
</tr>
<tr>
<td>a. safety provisions in the work site</td>
</tr>
<tr>
<td>b. access to the work site</td>
</tr>
<tr>
<td>c. movement of the workforce</td>
</tr>
<tr>
<td>d. members of the public</td>
</tr>
<tr>
<td>e. the movement and safe storage of materials, tools and equipment</td>
</tr>
<tr>
<td><strong>1.2</strong> Survey the work site for;</td>
</tr>
<tr>
<td>a. any damage or defects to existing building features</td>
</tr>
<tr>
<td>b. record details of any features that may affect the work</td>
</tr>
<tr>
<td><strong>1.3</strong> Advise the property occupier of any defects found</td>
</tr>
<tr>
<td><strong>1.4</strong> Protect the work site and the building fabric against possible damage being caused during the;</td>
</tr>
<tr>
<td>a. tightness testing process</td>
</tr>
<tr>
<td>b. direct purging process</td>
</tr>
<tr>
<td><strong>1.5</strong> Obtain confirmation from the property occupier before the job starts to ensure that they agree the planned work</td>
</tr>
<tr>
<td><strong>1.6</strong> Confirm the;</td>
</tr>
<tr>
<td>a. siting of the gas supply</td>
</tr>
<tr>
<td>b. provision of ventilation</td>
</tr>
<tr>
<td>b. meets the requirements for tightness testing and direct purging</td>
</tr>
<tr>
<td><strong>1.7</strong> Check and confirm all;</td>
</tr>
<tr>
<td>a. materials</td>
</tr>
<tr>
<td>b. tools</td>
</tr>
<tr>
<td>c. test equipment</td>
</tr>
<tr>
<td>necessary for the tightness testing and direct purging process are available as required and are fit for purpose</td>
</tr>
</tbody>
</table>
### Learning Outcome 1
Plan and prepare work activities for tightness testing and direct purging

**Assessment Criteria**

<table>
<thead>
<tr>
<th>1.8</th>
<th>Check and confirm that the;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. gas supply</td>
</tr>
<tr>
<td></td>
<td>b. earthing supply</td>
</tr>
<tr>
<td></td>
<td>c. provision of ventilation</td>
</tr>
<tr>
<td></td>
<td>meet the industry standards’ requirements for the installation</td>
</tr>
</tbody>
</table>

| 1.9 | Carry out all necessary checks and tests to confirm the gas supply meets the industry requirements for the installation |

<table>
<thead>
<tr>
<th>1.10</th>
<th>Check existing installation for;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. unsafe appliances and system components</td>
</tr>
<tr>
<td></td>
<td>and apply the gas industry unsafe situations procedures as necessary</td>
</tr>
</tbody>
</table>

### Learning Outcome 2
De-commission gas systems and components to industry standards

**Assessment Criteria**

<table>
<thead>
<tr>
<th>2.1</th>
<th>Check and confirm that conditions within the gas system will permit safe de-commissioning</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>2.2</th>
<th>Select and use the correct;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. tools</td>
</tr>
<tr>
<td></td>
<td>b. equipment</td>
</tr>
<tr>
<td></td>
<td>for de-commissioning activities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2.3</th>
<th>Use designated safe;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. isolation methods</td>
</tr>
<tr>
<td></td>
<td>b. tests</td>
</tr>
<tr>
<td></td>
<td>c. procedures</td>
</tr>
<tr>
<td></td>
<td>to de-commission gas systems and components</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2.4</th>
<th>Take precautionary actions to ensure that temporarily de-commissioned;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. appliances</td>
</tr>
<tr>
<td></td>
<td>b. gas systems</td>
</tr>
<tr>
<td></td>
<td>c. components</td>
</tr>
<tr>
<td></td>
<td>do not present a safety hazard</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2.5</th>
<th>Permanently remove and disconnect;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. appliances</td>
</tr>
<tr>
<td></td>
<td>b. gas system components</td>
</tr>
<tr>
<td></td>
<td>as necessary</td>
</tr>
</tbody>
</table>

### Learning Outcome 3
Tightness testing and direct purging of gas systems and components

**Assessment Criteria**

<table>
<thead>
<tr>
<th>3.1</th>
<th>Confirm the complete pipework installation complies with the;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. manufacturers’ specification</td>
</tr>
<tr>
<td></td>
<td>industry standards</td>
</tr>
</tbody>
</table>

| 3.2 | Carry out preparatory work for tightness testing and direct purging to meet industry standards |

| 3.3 | Check that conditions within the gas system will permit safe tightness testing and direct purging |
Learning Outcome 3  Continued

Tightness testing and direct purging of gas systems and components

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.4  Select and use the correct tools and equipment for tightness testing and direct purging activities</td>
</tr>
<tr>
<td>3.5  Measure, calculate and record gas system installation volumes for tightness testing and direct purging activities</td>
</tr>
<tr>
<td>3.6  Ensure ventilation for tightness testing and direct purging activities meets industry standards’ requirements</td>
</tr>
<tr>
<td>3.7  Remove existing gas components as necessary</td>
</tr>
<tr>
<td>3.8  Carry out the tightness testing and direct purging process, minimising damage to;</td>
</tr>
<tr>
<td>a. customer property</td>
</tr>
<tr>
<td>b. building features</td>
</tr>
<tr>
<td>3.9  Use tightness testing procedures to confirm the integrity of the newly installed</td>
</tr>
<tr>
<td>a. gas system</td>
</tr>
<tr>
<td>b. new and or existing appliances</td>
</tr>
<tr>
<td>3.10 Use tightness testing procedures to confirm the integrity of the existing;</td>
</tr>
<tr>
<td>a. gas system</td>
</tr>
<tr>
<td>b. new and existing appliances</td>
</tr>
<tr>
<td>3.11 Use tightness testing procedures to confirm the integrity of the gas system where the;</td>
</tr>
<tr>
<td>a. maximum operating pressure (MOP) at the outlet of the emergency control valve</td>
</tr>
<tr>
<td>(ECV) is above 75mbar but not exceeding 2 bar</td>
</tr>
<tr>
<td>b. no meter inlet valve is fitted</td>
</tr>
<tr>
<td>3.12 Where the installation fails the tightness test, either;</td>
</tr>
<tr>
<td>a. trace and repair the escape and retest installation</td>
</tr>
<tr>
<td>b. isolate unsafe gas appliances</td>
</tr>
<tr>
<td>c. gas system</td>
</tr>
<tr>
<td>d. components</td>
</tr>
<tr>
<td>and apply the gas industry unsafe situations procedure</td>
</tr>
<tr>
<td>3.13 Use purging procedures to confirm the safe supply of gas to the installed;</td>
</tr>
<tr>
<td>a. gas system</td>
</tr>
<tr>
<td>b. appliances</td>
</tr>
<tr>
<td>3.14 Instruct the property occupier on the correct operation of the gas</td>
</tr>
<tr>
<td>a. system</td>
</tr>
<tr>
<td>b. valves</td>
</tr>
<tr>
<td>c. components</td>
</tr>
<tr>
<td>3.15 Take precautionary actions to prevent the unauthorised use of uncommissioned gas</td>
</tr>
<tr>
<td>a. appliances</td>
</tr>
<tr>
<td>b. systems</td>
</tr>
<tr>
<td>c. components</td>
</tr>
<tr>
<td>by isolation procedures and use of warning notices</td>
</tr>
<tr>
<td>Learning Outcome 4</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td><strong>Assessment Criteria</strong></td>
</tr>
<tr>
<td>4.1 Liaise with the property occupier and other people who will be affected by the work during the tightness testing and direct purging processes to minimise disturbance to the job</td>
</tr>
<tr>
<td>4.2 Use;</td>
</tr>
<tr>
<td>a. normative documents</td>
</tr>
<tr>
<td>b. industry standards</td>
</tr>
<tr>
<td>c. British Standards</td>
</tr>
<tr>
<td>d. information from manufacturers’ instructions to ensure the work is carried out to the specification</td>
</tr>
<tr>
<td>4.3 Advise of any delays to the work to any persons who are affected by the delay</td>
</tr>
<tr>
<td>4.4 Report any delays in the work schedules to the job supervisor</td>
</tr>
<tr>
<td>4.5 Advise the designated person in the property of any unsafe situations and actions required to remedy those situations</td>
</tr>
<tr>
<td>4.6 Check that the customer is satisfied with the finished job</td>
</tr>
<tr>
<td>4.7 Complete records and documentation confirming the safe tightness testing and direct purging of gas systems and components</td>
</tr>
<tr>
<td>4.8 Complete gas system de-commissioning records</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Outcome 5</th>
<th>Resolve problems which could affect de-commissioning, tightness testing and direct purging</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment Criteria</strong></td>
<td></td>
</tr>
<tr>
<td>5.1 Rectify and report deficiencies in gas and earthing input services</td>
<td></td>
</tr>
<tr>
<td>5.2 Resolve problems in accordance with approved procedures where pre-tightness testing and direct purging checks and tests reveal gas system or component defects</td>
<td></td>
</tr>
<tr>
<td>5.3 Resolve problems in accordance with approved procedures when gas systems and components being tightened and purged do not meet design requirements</td>
<td></td>
</tr>
<tr>
<td>5.4 Resolve problems in accordance with approved procedures when the gas system and components cannot be restored to full performance</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Outcome 6</th>
<th>Understand how to tightness test, purge, commission and de-commission gas pipework up to 35mm 1¼ diameter in small natural gas installations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment Criteria</strong></td>
<td></td>
</tr>
<tr>
<td>6.1 Describe the health, safety and environmental factors which need to be incorporated in risk assessment for the domestic tightness testing and direct purging process</td>
<td></td>
</tr>
<tr>
<td>6.2 Explain safe access and working at heights procedures</td>
<td></td>
</tr>
<tr>
<td>6.3 Specify the tools and equipment necessary to provide safe access to work at heights, or in confined spaces</td>
<td></td>
</tr>
<tr>
<td>6.4 Describe the methods of working which protect the building décor, customer property and existing systems and components</td>
<td></td>
</tr>
<tr>
<td>6.5 Explain the tools, equipment, materials and components required for de-commissioning, tightness testing and direct purging processes – ordering, supplying, advising, checking and delivery procedures</td>
<td></td>
</tr>
</tbody>
</table>
## Learning Outcome 6 Continued

Understand how to tightness test, purge, commission and de-commission gas pipework up to 35mm 1¼ diameter in small natural gas installations

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
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<tbody>
<tr>
<td>6.6</td>
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<td>6.20</td>
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<td>6.21</td>
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<tr>
<td>6.22</td>
</tr>
</tbody>
</table>
### Learning Outcome 6 Continued

Understand how to tightness test, purge, commission and de-commission gas pipework up to 35mm 1¼ diameter in small natural gas installations

### Assessment Criteria

- **6.23** State the procedures and work methods for connecting to input services including; gas, earthing systems and ventilation
- **6.24** State the procedures and work methods of connecting pipework, valves and components to both new and existing gas systems and appliances
- **6.25** Demonstrate how to confirm that the gas supply and ventilation are adequate for de-commissioning, tightness testing and direct purging of the gas system, appliance(s) and components – IGE/UP/1B
- **6.26** Describe how to measure, calculate and record gas system installation volumes for tightness testing and direct purging activities – IGE/UP/1B
- **6.27** State the test equipment and legislative requirements for applying tightness testing to gas systems, appliances and components – IGE/UP/1B
- **6.28** Explain tightness testing procedures – IGE/UP/1B to confirm the integrity of newly installed gas system and, where applicable, new and existing appliances
- **6.29** Explain tightness testing procedures – IGE/UP/1B to confirm the integrity of the existing installed gas system and, where applicable, new and existing appliances to ensure the installation doesn’t exceed the maximum permissible pressure drop
- **6.30** Explain recognition of medium pressure regulator sets – IGE/UP/1B where the maximum operating pressure (MOP) at the outlet of the emergency control valve (ECV) is above 75mbar but not exceeding 2bar and, whether a meter inlet valve (MIV) is fitted
- **6.31** Explain tightness testing procedures – IGE/UP/1B to confirm the integrity of gas systems where the maximum operating pressure (MOP) at the outlet of the emergency control valve (ECV) is above 75mbar but not exceeding 2bar and, where a meter inlet valve (MIV) is fitted or, no meter inlet valve is fitted
- **6.32** State the industry practices and procedures for tracing and repairing gas escapes
- **6.33** Explain the process and procedures, equipment and legislative requirements for applying direct purging of gas systems, appliances and components – IGE/UP/1B
- **6.34** State the routines and sequences for direct purging of gas systems, appliances and components – IGE/UP/1B
- **6.35** State the routines and sequences for commissioning gas systems, valves and components to industry standards
- **6.36** Describe measures to prevent uncommissioned gas systems being brought into operation utilising safety and warning notices
- **6.37** Explain how to complete all tightness testing and direct purging documentation and records to be left with the property occupier – IGE/UP/1B i.e., Gas testing and purging – domestic (NG) certificate, benchmarks, landlord/home owner gas safety record, etc
- **6.38** Describe the system handover procedures and demonstrating the operation of gas systems and components to end users
- **6.39** Explain the steps to take when problems arise in the work activities
- **6.40** Describe job management structures and methods of reporting and recording job progress or problems delaying progress
- **6.41** Describe how to safely collect and dispose of system contents that may be hazardous to health or the environments e.g., waste products such as asbestos, insulation, etc
### Learning Outcome 6  Continued

Understand how to tightness test, purge, commission and de-commission gas pipework up to 35mm 1¼ diameter in small natural gas installations

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.42 Demonstrate how and where to access the required information, i.e. Industry regulations regarding the safe disposal of system contents that may be hazardous to health or the environment e.g., Special Waste Regulations, Hazardous Waste Regulations, Control of Asbestos at Work Regulations, etc.</td>
</tr>
<tr>
<td>6.43 Explain how to isolate unsafe gas appliances, gas systems and components and application of the gas industry unsafe situations procedure</td>
</tr>
</tbody>
</table>
Y/502/8454 – Install Domestic Gas Water Heaters and Wet Central Heating Appliances

The practical and knowledge criteria detailed in this unit is from the appliance shut-off valve to and including the appliance, locating and fixing the appliance to the wall, connecting and assembling the chimney components to the appliance, drilling the wall to accommodate the chimney assembly and connecting the appliance to water supplies. Electrical connection will be made either to an existing 13 amp 240 volt plug socket, fused socket outlet or to a suitable connection point on the central heating wiring system. Upon completion of the unit the learners will:

- Designing gas systems for installing domestic gas water heaters and wet central heating appliances
- Plan and prepare work activities for installing domestic gas water heaters and wet central heating appliances
- De-commissioning domestic gas water heaters and wet central heating appliances
- Install, exchange, and remove domestic gas water heaters and wet central heating appliances
- Pre-commission and Commission domestic gas water heaters and wet central heating appliances
- Use and communicate data and information to carry out de-commissioning, installation and commissioning work
- Resolve problems which could affect the de-commissioning, installation and commissioning process
- Installing, commissioning and de-commissioning domestic gas water heaters and wet central heating appliances

### Learning Outcome 1

Design gas systems for installing domestic gas water heaters and wet central heating appliances

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Identify and record the customer’s job requirements</td>
</tr>
<tr>
<td>1.2 Compare the customer’s job requirements with statutory and industry requirements and identify any conflicting issues</td>
</tr>
<tr>
<td>1.3 Survey the work site;</td>
</tr>
<tr>
<td>a. consult site diagrams for any key structural features that could affect the installation</td>
</tr>
<tr>
<td>b. record details of any features that may affect the installation</td>
</tr>
<tr>
<td>1.4 Check that the proposed positioning of the appliance meets the manufacturers’ and industry standards’ requirements for;</td>
</tr>
<tr>
<td>a. location</td>
</tr>
<tr>
<td>b. clearances</td>
</tr>
<tr>
<td>1.5 Check that the availability of input services meet the appliance manufacturers’ and industry standards’ requirements for the appliance installation</td>
</tr>
</tbody>
</table>
Learning Outcome 1  Continued
Design gas systems for installing domestic gas water heaters and wet central heating appliances

Assessment Criteria

1.6 Check;
   a. size
   b. location
   c. availability
   of input services meet the;
      a. appliance manufacturer’s
      b. industry standards
   requirements for the installation of;
      a. gas supply
      b. electricity supply
      c. chimney suitability
      d. the provision of ventilation

1.7 Check proposed location of condensate disposal is in compliance with;
   a. appliance manufacturer’s instructions
   b. industry standards

1.8 Check and ensure the design of the proposed installation is in compliance with industry
   standards

1.9 Prepare a range of design options to meet both;
   a. customer
   b. industry requirements

1.10 Present design options to the customer using a variety of media:
   a. written
   b. oral
   c. drawings

1.11 Consult with the customer and obtain agreement to the design option that best meets all
   the requirements

Learning Outcome 2
Plan and prepare work activities for installing domestic gas water heaters and wet central heating
appliances

Assessment Criteria

2.1 Carry out a risk assessment that incorporates;
   a. safety provisions
   b. access at the work site,
   c. movement of people on site
   movement and safe storage of installation materials, tools and equipment

2.2 Survey the work site for;
   a. any pre-installation damage
   b. defects to existing building features
   c. record details of any features that may affect the installation

2.3 Advise the property occupier of any defects found

2.4 Protect the work site and the building fabric against possible damage being caused during;
   a. de-commissioning
   installation

2.5 Obtain confirmation from the customer before the job starts to ensure that they agree the
   planned work
Learning Outcome 2  Continued

Plan and prepare work activities for installing domestic gas water heaters and wet central heating appliances

Assessment Criteria

2.6  Check and confirm that all materials, tools and equipment are available as required and are fit for purpose needed for;
   a.  de-commissioning
   b.  installation
   c.  commissioning

2.7  Carry out checks and tests to confirm the;
   a.  gas supply
   b.  electricity supply
   c.  the provision of ventilation
      meet the industry standards’ requirements for the installation

2.8  Check existing installation for any unsafe appliances and system components apply the gas industry unsafe situations procedures as required

2.9  Confirm that the proposed siting of the gas supply meets industry standards’ requirements in relation to other services, i.e. electricity supply

2.10 Confirm the suitability of the proposed location of condensate disposal as required

Learning Outcome 3

De-commission domestic gas water heaters and wet central heating appliances

Assessment Criteria

3.1  Check that the;
   a.  gas supply
   b.  electricity supply
      is in a condition that enables safe appliance de-commissioning

3.2  Use the correct tools and equipment for de-commissioning activities

3.3  Use designated safe;
   a.  isolation methods
   b.  tests
   c.  procedures
      to de-commission gas and systems and component

3.4  Take precautionary actions to ensure that temporarily de-commissioned;
   a.  appliances
   b.  systems
   c.  components
      do not present a safety hazard

3.5  Permanently remove and disconnect;
   a.  appliances
   b.  gas system components
      electricity system component
## Learning Outcome 4

Install, exchange, and remove domestic gas water heaters and wet central heating appliances

### Assessment Criteria

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Carry out preparatory work to meet the manufacturer’s installation requirements</td>
</tr>
</tbody>
</table>
| 4.2    | Install the appliance minimising damage to;  
|        | a. customer property  
|        | b. building features |
| 4.3    | Select and use the correct tools and equipment for the installation |
| 4.4    | Remove any existing gas and electricity system components required for the installation |
| 4.5    | Fabricate gas and electricity system components required by the installation |
| 4.6    | Position the appliance and confirm it meets the;  
|        | a. location  
|        | b. siting  
|        | c. clearances  
|        | required by the manufacturers’ and industry standards’ specification |
| 4.7    | Provide the required ventilation for the appliance installation in accordance manufacturer’s instructions |
| 4.8    | Ensure existing gas systems are clean and free from debris |
| 4.9    | Fix and connect the;  
|        | a. gas supply  
|        | b. electricity supply components to the appliance |
| 4.10   | Fix and connect the condensate disposal system as required |
| 4.11   | Use tightness testing and purging procedures to confirm the integrity of the installed gas system and appliance |
| 4.12   | Use electrical testing procedures to confirm the integrity of the installed electrical system and appliance |
| 4.13   | Use industry;  
|        | a. standard checks  
|        | b. testing procedures  
|        | to confirm the integrity of the newly installed or existing chimney system and appliance flue seals |
| 4.14   | Carry out precautionary actions to prevent the unauthorised use of;  
|        | a. uncommissioned gas appliances  
|        | b. gas systems  
|        | c. electrical systems  
|        | d. components  
|        | by following isolation procedures and use of warning notices |

## Learning Outcome 5

Pre-commission and Commission domestic gas water heaters and wet central heating appliances

### Assessment Criteria

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
</table>
| 5.1    | Confirm that the complete appliance installation complies with the;  
|        | a. manufacturers’ specification  
|        | b. industry standards  
|        | c. Gas Safety (Installation and Use) Regulations  
|        | d. British Standards  
|        | e. Building Regulations |
### Learning Outcome 6

Use and communicate data and information to carry out de-commissioning, installation and commissioning work

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1 Liaise with the property occupier and other people who will be affected by the work during the;</td>
</tr>
<tr>
<td>a. planning</td>
</tr>
<tr>
<td>b. de-commissioning</td>
</tr>
<tr>
<td>c. installation</td>
</tr>
<tr>
<td>d. commissioning</td>
</tr>
<tr>
<td>processes to minimise disturbance to the job</td>
</tr>
<tr>
<td>6.2 Use;</td>
</tr>
<tr>
<td>a. normative documents</td>
</tr>
<tr>
<td>b. industry standards</td>
</tr>
<tr>
<td>c. British Standards</td>
</tr>
<tr>
<td>d. information from manufacturers’ instructions</td>
</tr>
<tr>
<td>for the appliance to ensure the work is completed in accordance with the specification</td>
</tr>
<tr>
<td>6.3 Advise of any delays to the work to any persons who are affected by the delay</td>
</tr>
<tr>
<td>6.4 Report any delays in the work schedules to the line manager responsible for the job</td>
</tr>
<tr>
<td>6.5 Identify and advise persons that need to be informed of any unsafe situations and actions required to remedy those situations</td>
</tr>
<tr>
<td>6.6 Complete documentation to confirm the safe commissioning of the gas appliance and components</td>
</tr>
</tbody>
</table>
### Learning Outcome 6  Continued

Use and communicate data and information to carry out de-commissioning, installation and commissioning work

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.7 Complete gas appliance and system de-commissioning Records</td>
</tr>
<tr>
<td>6.8 Submit details of installation and exchange appliance(s) to a Gas Work Notification Scheme</td>
</tr>
</tbody>
</table>

### Learning Outcome 7

Resolve problems which could affect the de-commissioning, installation and commissioning process

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1 Report deficiencies in;</td>
</tr>
<tr>
<td>a. gas supply services</td>
</tr>
<tr>
<td>b. electricity supply services</td>
</tr>
<tr>
<td>7.2 Resolve problems in accordance with approved procedures where pre-commissioning checks and tests reveal;</td>
</tr>
<tr>
<td>a. gas appliance</td>
</tr>
<tr>
<td>b. gas supply</td>
</tr>
<tr>
<td>c. component defects</td>
</tr>
<tr>
<td>7.3 Resolve problems in accordance with approved procedures when;</td>
</tr>
<tr>
<td>a. gas appliances</td>
</tr>
<tr>
<td>b. gas systems</td>
</tr>
<tr>
<td>c. components</td>
</tr>
<tr>
<td>being commissioned do not meet design requirements</td>
</tr>
<tr>
<td>7.4 Report problems in accordance with approved procedures when the;</td>
</tr>
<tr>
<td>a. gas appliances</td>
</tr>
<tr>
<td>b. gas systems</td>
</tr>
<tr>
<td>c. components</td>
</tr>
<tr>
<td>cannot be restored to full performance</td>
</tr>
</tbody>
</table>

### Learning Outcome 8

Installing, commissioning and de-commissioning domestic gas water heaters and wet central heating appliances

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.1 Legislative and Safety Knowledge</td>
</tr>
<tr>
<td>a. Interpret regulations and guidance governing health and safety in the workplace, environmental protection and the use of risk assessments</td>
</tr>
<tr>
<td>b. Interpret legislation covering the general responsibilities of the installer for their own safety and that of others</td>
</tr>
<tr>
<td>The Gas Safety (Installation and Use) Regulations 1998 and associated Approved Code of Practice Guidance</td>
</tr>
<tr>
<td>Regulation 26 – Gas appliances</td>
</tr>
<tr>
<td>Regulation 28 – Access</td>
</tr>
<tr>
<td>Regulation 29 – Manufacturer’s instructions</td>
</tr>
<tr>
<td>Regulation 33 – Testing of appliances</td>
</tr>
<tr>
<td>Regulation 34 – Use of appliances</td>
</tr>
</tbody>
</table>
### Learning Outcome 8

Installing, commissioning and de-commissioning domestic gas water heaters and wet central heating appliances

### Assessment Criteria

#### 8.2 Installing, commissioning and de-commissioning domestic gas water heaters and wet central heating appliances knowledge

- a. Describe the health, safety and environmental factors which need to be incorporated in risk assessment for the domestic installation process
- b. Explain safe access and working at heights
- c. Specify the tools and equipment necessary to provide safe access to work at heights, or in confined spaces
- d. Describe the methods of working which protect the building décor, customer property and existing systems and components

#### 8.3

- a. State the care and maintenance requirements of tools and equipment, and checks for safe condition
- b. State the tools, equipment, materials and components required for the gas appliance and gas system de-commission, installation and commission – ordering, supplying, advising, checking and delivery procedures
- c. Explain how to safely secure and store tools, equipment, materials and components to minimise loss or wastage
- d. Describe the potential hazards that could arise from all de-commissioning, installation and commissioning activities and the checks to be carried out before work takes place

#### 8.4

- a. Explain the steps to take should materials, components, tools and equipment not be available at the site to commence the de-commissioning, installation and commissioning activity
- b. Demonstrate how and where to access the required information, i.e. normative documents, industry standards guidance documents, British Standards and manufacturers’ instructions applicable to the appliance, to ensure the work is done to the specification and industry standards
- c. Demonstrate how to read and interpret the information contained in normative documents, industry standards guidance documents, British Standards and manufacturers’ instructions
  
  Explain how to measure and record installation and site details for prefabrication purposes

#### 8.5

- a. Explain how to confirm that the gas supply, electric supply, chimney system and ventilation requirements are adequate for installation of the new gas appliance, gas system and components
- b. Explain how to confirm that the gas supply, electric supply, chimney system and ventilation requirements are adequate for extending the system
- c. Describe isolation methods, tests, and procedures to de-commission gas and electricity systems or components
- d. State procedures for temporary and permanent de-commissioning of appliances and systems including use of temporary continuity bonds
- e. Explain the precautions to ensure that de-commissioned appliances or systems do not prove a safety hazard
### Learning Outcome 8 Continued

#### Installing, commissioning and de-commissioning domestic gas water heaters and wet central heating appliances

**Assessment Criteria**

8.6  
- a. Describe measures to prevent de-commissioned appliances or systems being brought into operation utilising safety and warning notices  
- b. Describe the need to liaise with others whose procedures or routines may be affected by the suspension of the gas appliance and gas system operation  
- c. Summarise the points in the de-commissioning, installation and commissioning process where co-operation and liaison with other trades and property occupier may be required  
- d. Explain the industry practices and work standards for fabricating and installing domestic gas cookers, tumble dryers, leisure appliances, gas systems and components to comply with the manufacturers’ specification, industry standards, Gas Safety (Installation and Use) Regulations, British Standards and Building Regulations

8.7  
- a. State the procedures and work methods for connecting to input services including; gas, electric, ventilation and chimney systems  
- b. State the procedures and work methods of connecting domestic gas cookers, tumble dryers, leisure appliances and components to both new and existing gas, electric, ventilation and chimney systems  
- c. State the process and procedures, equipment and legislative requirements for applying tightness testing and purging to appliances, gas systems and components  
- d. State the process and procedures, equipment and legislative requirements for applying electrical tests to appliances, systems and components to ensure safe functioning i.e. preliminary electrical safety checks

8.8  
- a. Explain the routines and sequences for commissioning domestic gas cookers, tumble dryers, leisure appliances, gas systems and components in accordance with manufacturers’ specification and industry standards  
- b. State the procedures for checking the correct operation and performance of domestic gas cookers, tumble dryers, leisure appliances, gas systems and components and checking against the design specification  
- c. State the procedures for checking the correct operation and performance of domestic gas cookers, tumble dryers, leisure appliances, gas systems and components to ensure safe functioning

8.9  
- a. State the procedures for checking and confirming the gas system operating pressures  
- b. State the procedures for checking and confirming the appliance operating pressure and the heat input  
- c. Describe the tests, checks and use of flue gas analysers which confirm the suitability of the gas combustion performance  
- d. Describe the tests and checks to confirm the integrity, suitability and performance of the chimney system  
- e. Describe the tests and checks to confirm the suitability and performance of the ventilation system
## Learning Outcome 8 Continued

Installing, commissioning and de-commissioning domestic gas water heaters and wet central heating appliances

### Assessment Criteria

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
</table>
| 8.10 | a. Explain how to complete all installation and commissioning documentation and records to be left with the property occupier i.e., Benchmarks, Landlord/Home owner gas safety record, Chimney/Hearth notice plate,  
     b. Describe measures to prevent un-commissioned gas appliances and gas systems being brought into operation utilising safety and warning notices  
     c. Explain the system handover procedures and demonstrating the operation of domestic gas cookers, tumble dryers, leisure appliances, gas systems and components to end users  
     d. Summarise the steps to take when problems arise in the work activities  
     e. Describe job management structures and methods of reporting and recording job progress or problems delaying progress |
| 8.11 | a. Describe how to safely collect and dispose of system contents that may be hazardous to health or the environment i.e. waste products such as asbestos, insulation, electrical/electronic items and those containing fluorinated gases as in gas refrigeration appliances.  
     b. Demonstrate how and where to access the required information, i.e. Industry Regulations regarding the safe disposal of system contents that may be hazardous to health or the environment i.e. Special Waste Regulations, Hazardous Waste Regulations, Fluorinated Greenhouse Gases Regulations (F gas), Control of Asbestos at Work Regulations |
| 8.12 | Explain how to isolate unsafe gas appliances, gas systems and components and application of the gas industry unsafe situations procedure |
T/502/8459 – Maintain Gas Water Heaters and Wet Central Heating Appliances

The practical and knowledge criteria detailed in this unit is in the maintenance, commission and decommissions of water heating and wet central heating domestic gas appliances up to and including the appliance isolation (service) point supplied with 2nd or 3rd family gases. This unit will provide evidence of competence to enable an individual to apply for a ‘licence to practice’ from the gas industry registrar, currently Gas Safe Register. Upon completion of the unit the learners will:

- Plan and prepare work activities for maintaining water heating and wet central heating appliances
- De-commission water heating and wet central heating appliances to industry standard
- Maintain domestic water heating and wet central heating appliances to industry standards
- Pre-commission and Commission water heating and wet central heating appliances to industry standards
- Use and communicate data and information to carry out de-commissioning, maintenance and commissioning work
- Resolve problems which could affect the de-commissioning, maintenance and commissioning process
- Maintain water heating and wet central heating appliances

### Learning Outcome 1

Plan and prepare work activities for maintaining water heating and wet central heating appliances

#### Assessment Criteria

1.1 Produce a risk assessment and method statement which incorporates
   a. safety provisions on the work site
   b. access to the work site,
   c. movement of people on the site
   d. movement and safe storage of materials, tools and equipment for the job

1.2 Survey the work site for
   a. any pre-maintenance damage
   b. defects to existing building features
   and record it

1.3 Advise the property occupier of any defects found

1.4 Protect the work site and the building fabric against possible damage being caused during the de-commissioning and maintenance process

1.5 Obtain confirmation from the property occupier before the job starts to ensure that they agree the planned work

1.6 Check and confirm all materials, tools and equipment necessary for the de commissioning, maintenance and commissioning process are available as required and are fit for purpose

1.7 Check and confirm that the siting of the appliance meets the manufacturers’ and industry standards’ requirements for
   a. location
   b. siting and clearances
## Learning Outcome 1  Continued

Plan and prepare work activities for maintaining water heating and wet central heating appliances

### Assessment Criteria

1.8 Confirm that the
   a. gas supply,
   b. electricity supply,
   c. ventilation and where required,
   d. chimney / flue suitability where necessary)
meet the appliance manufacturers’ and industry standards’ requirements for the installation

1.9 Carry out all necessary checks and tests to confirm the
   a. gas supply
   b. electricity supply
   c. chimney / flue system(where required)
meet the manufacturers’ and industry requirements for the installation

1.10 Check location of condensate disposal is in compliance with appliance manufacturers and industry standards requirements as necessary

1.11 Check existing installation for any unsafe appliances and system components and apply the gas industry unsafe situations procedures as required

## Learning Outcome 2

De-commission water heating and wet central heating appliances to industry standards

### Assessment Criteria

2.1 Check that conditions within the
   a. gas
   b. electricity

2.2 Use the correct tools and equipment for de-commissioning activities

2.3 Use designated
   a. safe isolation methods,
   b. tests,
   c. procedures
to de-commission gas and electricity systems and components

2.4 Take precautionary actions to ensure that temporarily de-commissioned
   a. appliances
   b. systems,
   c. components
do not present a safety hazard

2.5 Permanently remove and disconnect
   a. appliances
   b. gas system components
   c. electricity system components
as required
### Learning Outcome 3

**Maintain domestic water heating and wet central heating appliances to industry standards**

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Carry out preparatory work to meet the maintenance requirements</td>
</tr>
<tr>
<td>3.2 Remove existing gas and electricity system components as required by the maintenance activities</td>
</tr>
<tr>
<td>3.3 Carry out the maintenance process in accordance with</td>
</tr>
<tr>
<td>a. manufacturers’ specification</td>
</tr>
<tr>
<td>b. industry standards</td>
</tr>
<tr>
<td>3.4 Carry out the maintenance process, minimising damage to</td>
</tr>
<tr>
<td>a. customer property</td>
</tr>
<tr>
<td>b. building features</td>
</tr>
<tr>
<td>3.5 Use the correct tools and equipment for maintenance work activities</td>
</tr>
<tr>
<td>3.6 Re-position the appliance and confirm it meets the</td>
</tr>
<tr>
<td>a. location,</td>
</tr>
<tr>
<td>b. siting</td>
</tr>
<tr>
<td>c. clearances</td>
</tr>
<tr>
<td>required by the manufacturers’ and industry standards’ specification</td>
</tr>
<tr>
<td>3.7 Check existing ventilation for appliances and system meets industry requirements for the installation</td>
</tr>
<tr>
<td>3.8 Ensure existing gas systems are clean and free of debris</td>
</tr>
<tr>
<td>3.9 Re-connect</td>
</tr>
<tr>
<td>a. gas</td>
</tr>
<tr>
<td>b. electricity</td>
</tr>
<tr>
<td>system components to the appliance</td>
</tr>
<tr>
<td>3.10 Use tightness testing and purging procedures to confirm the integrity of the re-connected gas system and appliance</td>
</tr>
<tr>
<td>3.11 Use electrical testing procedures to confirm the integrity of the re-installed electrical system and appliance</td>
</tr>
<tr>
<td>3.12 Use industry standard checks and testing procedures to confirm the integrity of the existing chimney system and appliance flue seals where required</td>
</tr>
</tbody>
</table>

### Learning Outcome 4

**Pre-commission and Commission water heating and wet central heating appliances to industry standards**

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1 Confirm the complete appliance installation complies with</td>
</tr>
<tr>
<td>a. the manufacturers’ specification</td>
</tr>
<tr>
<td>b. industry standards</td>
</tr>
<tr>
<td>c. Gas Safety (Installation and Use) Regulations,</td>
</tr>
<tr>
<td>d. British Standards and Building Regulations</td>
</tr>
<tr>
<td>4.2 Check that conditions within the</td>
</tr>
<tr>
<td>a. gas</td>
</tr>
<tr>
<td>b. electricity</td>
</tr>
<tr>
<td>systems will permit safe commissioning</td>
</tr>
<tr>
<td>4.3 Use the correct tools and equipment for commissioning activities</td>
</tr>
<tr>
<td>4.4 Check that the gas system operating pressures meet industry standards</td>
</tr>
</tbody>
</table>
### Learning Outcome 4  Continued

**Pre-commission and Commission water heating and wet central heating appliances to industry standards**

**Assessment Criteria**

4.5 Check the appliance in accordance with industry standards’ and manufacturers’ requirements for
   a. operating pressure
   b. heat input

4.6 Check the combustion performance as required
   a. visually
   b. by flue gas analysis

4.7 Test chimney performance and reconfirm it performs according to (where required)
   a. manufacturers’ instructions
   b. industry standards’

4.8 Check that the ventilation requirements meet current industry standards for the installation

4.9 Check the operation of the
   a. gas appliance,
   b. gas system
   c. gas components
   to ensure they function safely and operate in accordance with manufacturers’ instructions

4.10 Check the
   a. electrical system
   b. electrical components
   function safely and operate in accordance with the manufacturers’ instructions

4.11 Explain to the property occupier the correct operation of the
   a. appliance
   b. gas system
   and provide them with their copy of the appliance literature

4.12 Take precautionary actions by isolation procedures and use of warning notices to prevent the unauthorised use of uncommissioned
   a. gas appliances
   b. gas systems
electrical systems and components

### Learning Outcome 5

**Use and communicate data and information to carry out de-commissioning, maintenance and commissioning work**

**Assessment Criteria**

5.1 Liaise with the property occupier and other people who will be affected by the work in order to minimise disturbance to the job during
   a. the planning
   b. de-commissioning
   c. installation commissioning processes

5.2 Use normative documents, such as
   a. industry standards
   b. British Standards
   c. manufacturers’ instructions for the appliance
to ensure the work is done to specification
### Learning Outcome 5  Continued

Use and communicate data and information to carry out de-commissioning, maintenance and commissioning work

**Assessment Criteria**

<table>
<thead>
<tr>
<th>No.</th>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.3</td>
<td>Advise of any delays to the work to any persons who are affected by the delay</td>
</tr>
<tr>
<td>5.4</td>
<td>Report any delays in the work schedules to the job supervisor</td>
</tr>
<tr>
<td>5.5</td>
<td>Advise the designated persons of any unsafe situations and actions required to remedy those situations</td>
</tr>
<tr>
<td>5.6</td>
<td>Check that the customer is satisfied with the finished job</td>
</tr>
</tbody>
</table>
| 5.7 | Complete records and documentation confirming the safe maintenance of  
|     | a. gas appliances  
|     | b. systems  
|     | c. components |
| 5.8 | Complete commissioning and de-commissioning records for  
|     | a. gas appliance  
|     | b. gas system as required  
|     | and ensure they are stored securely |

### Learning Outcome 6

Resolve problems which could affect the de-commissioning, maintenance and commissioning process

**Assessment Criteria**

<table>
<thead>
<tr>
<th>No.</th>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1</td>
<td>Rectify and report deficiencies in gas and electric input services</td>
</tr>
<tr>
<td>6.2</td>
<td>Resolve problems in accordance with approved procedures where pre-maintenance checks and tests reveal gas appliance, gas system or component defects</td>
</tr>
<tr>
<td>6.3</td>
<td>Resolve problems in accordance with approved procedures when gas appliances, gas system and components being commissioned do not meet design requirements</td>
</tr>
<tr>
<td>6.4</td>
<td>Resolve problems in accordance with approved procedures when the gas appliance, the gas system or component cannot be restored to full performance</td>
</tr>
</tbody>
</table>

### Learning Outcome 7

Maintain water heating and wet central heating appliances

**Assessment criteria**

<table>
<thead>
<tr>
<th>No.</th>
<th>Assessment criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1.</td>
<td>Describe the health, safety and environmental factors which need to be incorporated in risk assessment for the domestic maintenance process</td>
</tr>
<tr>
<td>7.2</td>
<td>Explain safe access and working at heights procedures</td>
</tr>
<tr>
<td>7.3</td>
<td>Specify the tools and equipment necessary to provide safe access to work at heights, or in confined spaces</td>
</tr>
<tr>
<td>7.4</td>
<td>Describe the methods of working which protect the building décor, customer property and existing systems and components</td>
</tr>
<tr>
<td>7.5</td>
<td>State the care and maintenance requirements of tools and equipment, and checks for safe condition</td>
</tr>
<tr>
<td>7.6</td>
<td>State the tools, equipment, materials and components required for the gas system de-commission, maintenance and commission – ordering, supplying, advising, checking and delivery procedures</td>
</tr>
<tr>
<td>7.7</td>
<td>Explain how to safely secure and store tools, equipment, materials and components to minimise loss or wastage</td>
</tr>
</tbody>
</table>
## Learning Outcome 7  Continued

Maintain water heating and wet central heating appliances

### Assessment criteria

| 7.8 | Describe the potential hazards that could arise from all de-commissioning, maintenance and commissioning activities and the checks to be carried out before work takes place |
| 7.9 | Explain the steps to take should materials, components, tools and equipment not be available at the site to commence the de-commissioning, maintenance and commissioning activity |
| 7.10 | Demonstrate how and where to access the required information, i.e. normative documents, industry standards guidance documents, British Standards and manufacturers’ instructions applicable to the gas system and appliance, to ensure the work is done to the specification and industry standards |
| 7.11 | Demonstrate how to read and interpret the information contained in normative documents, industry standards guidance documents, British Standards and manufacturers’ instructions |
| 7.12 | Describe how to confirm that the gas supply, electric supply, chimney system and ventilation requirements are adequate for existing gas appliances, systems, or components |
| 7.13 | State safe isolation methods, tests, and procedures to de-commission gas and electricity systems or components |
| 7.14 | State safe isolation methods, tests, and procedures for temporary and permanent de commissioning of gas systems, earthing systems and components, including the use of temporary continuity bonds |
| 7.15 | Explain the precautions to ensure that de commissioned gas and earthing systems do not prove a safety hazard |
| 7.16 | Describe measures to prevent de-commissioned appliances or systems being brought into operation utilising safety and warning notices |
| 7.27 | Describe the routines and sequences of the maintenance process of water heating and wet central heating domestic gas appliances, gas systems and components in accordance with manufacturers’ specification and industry standards |
| 7.28 | Describe the routines and sequences for recommissioning water heating and wet central heating domestic gas appliances, gas systems and components in accordance with manufacturers’ specification and industry standards |
| 7.29 | Explain the procedures for checking the correct operation and performance of water heating and wet central heating gas appliances, gas systems and components and checking against the design specification |
| 7.30 | Explain the procedures for checking the correct operation and performance of water heating and wet central heating gas appliances, gas systems and components to ensure safe functioning |
| 7.31 | Explain the procedures for checking that the hot water performance of water heating gas appliances and combination boilers complies with the manufacturers’ specification i.e., there is sufficient pressure and flow rate and correct temperatures are achieved |
| 7.32 | State the procedures for checking and confirming the gas system operating pressures |
| 7.33 | Describe the procedures for checking and confirming the appliance operating pressure and the heat input |
| 7.34 | Describe the tests, checks and use of flue gas analysers which confirm the suitability of the gas combustion performance |
| 7.35 | Describe the tests and checks to confirm the integrity, suitability and performance of the chimney system |
### Learning Outcome 7  Continued

Maintain water heating and wet central heating appliances

<table>
<thead>
<tr>
<th>Assessment criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.36  Describe the tests and checks to confirm the suitability and performance of the ventilation system</td>
</tr>
<tr>
<td>7.37  Explain how to complete all maintenance documentation and records to be left with the property occupier i.e., Benchmarks, Landlord/Home owner gas safety record, maintenance report form, etc</td>
</tr>
<tr>
<td>7.38  Describe the measures to prevent un commissioned gas systems being brought into operation utilising safety and warning notices</td>
</tr>
<tr>
<td>7.39  Explain the system handover procedures and demonstrating the operation of replacement systems and components to end users</td>
</tr>
<tr>
<td>7.40  Explain the steps to take when problems arise in the work activities</td>
</tr>
<tr>
<td>7.41  Describe job management structures and methods of reporting and recording job progress or problems delaying progress</td>
</tr>
<tr>
<td>7.42  Describe how to safely collect and dispose of system contents that may be hazardous to health or the environment e.g. waste products such as asbestos, insulation, etc.</td>
</tr>
<tr>
<td>7.43  Demonstrate how and where to access the required information, i.e. Industry regulations regarding the safe disposal of system contents that may be hazardous to health or the environment e.g. Special Waste Regulations, Hazardous Waste Regulations, Control of Asbestos at Work Regulations, etc.</td>
</tr>
<tr>
<td>7.44  Explain how to isolate unsafe gas appliances, gas systems and components and application of the gas industry unsafe situations procedure</td>
</tr>
</tbody>
</table>
K/602/3138 - Understand the Fundamental Principles and Requirements of Environmental Technology Systems

To allow learners to develop the knowledge and understanding required to be able to communicate with others in relation to the fundamental working principles, potential to install and regulatory requirements for micro-renewable energy and water conservation technologies
To prepare learners to progress to the specialist units for the installation, commissioning, handover, inspection, service and maintenance of micro-renewable energy and water conservation technologies. Upon completion of the unit the learners will:

- Know the fundamental working principles of micro-renewable energy and water conservation technologies
- Know the fundamental requirements of building location/building features for the potential to install micro-renewable energy and water conservation systems to exist
- Know the fundamental regulatory requirements relating to micro-renewable energy and water conservation technologies
- Know the typical advantages and disadvantages associated with micro-renewable energy and water conservation technologies

Learning Outcome 1

Know the fundamental working principles of micro-renewable energy and water conservation technologies

Assessment Criteria

1.1 Identify the fundamental working principles for each of the following heat producing micro-renewable energy technologies:
   - a. solar thermal (hot water)
   - b. ground source heat pump
   - c. air source heat pump
   - d. biomass

1.2 Identify the fundamental working principles for each of the following electricity producing micro-renewable energy technologies:
   - a. solar photovoltaic
   - b. micro-wind
   - c. micro-hydro

1.3 Identify the fundamental working principles of the following co-generation technologies:
   - a. micro-combined heat and power (heat-led)

1.4 Identify the fundamental working principles for each of the following water conservation technologies:
   - a. rainwater harvesting
   - b. greywater re-use

Learning Outcome 2

Know the fundamental requirements of building location/building features for the potential to install micro-renewable energy and water conservation systems to exist

Assessment Criteria

2.1 Clarify the fundamental requirements for the potential to install a solar water heating system to exist

2.2 Clarify the fundamental requirements for the potential to install a solar photovoltaic system to exist
### Learning Outcome 2  Continued

Know the fundamental requirements of building location/building features for the potential to install micro-renewable energy and water conservation systems to exist

#### Assessment Criteria

2.3 Clarify the fundamental requirements for the potential to install a ground source heat pump system to exist

2.4 Clarify the fundamental requirements for the potential to install an air source heat pump system to exist

2.5 Clarify the fundamental requirements for the potential to install a biomass system to exist

2.6 Clarify the fundamental requirements for the potential to install a micro wind system to exist

2.7 Clarify the fundamental requirements for the potential to install a micro hydro system to exist

2.8 Clarify the fundamental requirements for the potential to install a micro-combined heat and power (heat led) system to exist

2.9 Clarify the fundamental requirements for the potential to install a rainwater harvesting/greywater re-use system to exist

### Learning Outcome 3

Know the fundamental regulatory requirements relating to micro-renewable energy and water conservation technologies

#### Assessment Criteria

3.1 Confirm what would be typically classified as ‘permitted development’ under town and country planning regulations in relation to the deployment of the following technologies:

   a. Solar thermal (hot water)
   b. Solar photovoltaic
   c. Ground source heat pump
   d. Air source heat pump
   e. Micro-wind
   f. Biomass
   g. Micro-hydro
   h. Micro-combined heat and power (heat-led)
   i. Rainwater harvesting
   j. Greywater re-use

3.2 Confirm which sections of the current building regulations/building standards apply in relation to the deployment of the following technologies:

   a. Solar thermal (hot water)
   b. Solar photovoltaic
   c. Ground source heat pump
   d. Air source heat pump
   e. Micro-wind
   f. Biomass
   g. Micro-hydro
   h. Micro-combined heat and power (heat-led)
   i. Rainwater harvesting
   j. Greywater re-use
Learning Outcome 4

Know the typical advantages and disadvantages associated with micro-renewable energy and water conservation technologies:

Assessment Criteria

4.1 Identify typical advantages associated with each of the following technologies:
   a. Solar thermal (hot water)
   b. Solar photovoltaic
   c. Ground source heat pump
   d. Air source heat pump
   e. Micro-wind
   f. Biomass
   g. Micro-hydro
   h. Micro-combined heat and power (heat-led)
   i. Rainwater harvesting
   j. Greywater re-use

4.2 Identify typical disadvantages associated with each of the following technologies:
   a. Solar thermal (hot water)
   b. Solar photovoltaic
   c. Ground source heat pump
   d. Air source heat pump
   e. Micro-wind
   f. Biomass
   g. Micro-hydro
   h. Micro-combined heat and power (heat-led)
   i. Rainwater harvesting
   j. Greywater re-use
F/602/3100 - Know the requirements to install, commission and handover solar thermal hot water systems

The unit focuses upon the knowledge required to plan and prepare for, install (including testing and commissioning) and handover of fully-filled and drainback solar thermal hot water systems. The emphasis is upon ‘active’ systems but the unit also includes some content relating to ‘passive’ systems. The unit also covers fundamental design techniques but does not cover detailed design. The unit covers systems for domestic hot water production only. The unit focuses upon systems with up to 20m² of solar collector area. Upon completion of the unit the learner will:

- Know the health and safety risks and safe systems of work associated with solar thermal hot water system installation work
- Know the requirements of relevant regulations/standards relating to practical installation, testing and commissioning activities for solar thermal hot water system installation work
- Know the types and layouts of solar thermal hot water system
- Know the purpose of components used within solar thermal hot water system installations
- Know the types and key operating principles of solar collectors
- Know the information requirements to enable system component selection and sizing
- Know the fundamental techniques used to select, size and position components for solar thermal hot water systems
- Know how the performance of solar hot water systems is measured
- Know the preparatory work required for solar thermal hot water system installation work
- Know the requirements for connecting solar thermal hot water system collector circuits to combination boiler domestic hot water circuits
- Know the requirements for installing solar collector arrays
- Know the requirements for installing for solar thermal hot water system pipework
- Know the requirements to test and commission solar thermal hot water system installations
- Know the requirements to handover solar thermal hot water systems

### Learning Outcome 1

Know the health and safety risks and safe systems of work associated with solar thermal hot water system installation work

### Assessment Criteria

1.1 Confirm which aspects of solar thermal hot water system installation work pose risk of:
   - a. electrocution/electric shock
   - b. burns
   - c. toxic poisoning
   - d. injury through flash to steam of system heat transfer fluid
   - e. a fall from height
   - f. personal injury though component / equipment handling

1.2 Confirm safe systems of work for solar thermal hot water system installation work in relation to prevention of:
   - a. electrocution/electric shock
   - b. burns
   - c. toxic poisoning
   - d. injury through flash to steam of system heat transfer fluid
   - e. a fall from height
   - f. personal injury though component/equipment handling
Learning Outcome 2
Know the requirements of relevant regulations/standards relating to practical installation, testing and commissioning activities for solar thermal hot water system installation work

Assessment Criteria
2.1 Interpret building regulation/building standards guidance documentation as relevant to solar thermal hot water system installation work to identify the requirements in relation to:
   a. maintaining the structural integrity of the building
   b. mandating the fire resistant integrity of the building
   c. the prevention of moisture ingress (building water tightness)
   d. notification of work requirements
   e. control of temperature in primary and secondary circuits including primary circuits connected to unvented hot water storage systems
   f. energy conservation
   g. testing and commissioning requirements
   h. compliance certification
2.2 Interpret industry recognised water regulation/byelaw guidance documentation as relevant to solar thermal hot water system installation work to identify the requirements in relation to:
   a. prevention of contamination of the wholesome water supply
   b. energy conservation
   c. safe operation
   d. testing and commissioning requirements

Learning Outcome 3
Know the types and layouts of solar thermal hot water system

Assessment Criteria
3.1 Identify the following solar thermal hot water systems types:
   a. Fully filled (active)
   b. Drainback (active)
   c. Passive (thermo-siphon)
3.2 Identify the following solar thermal hot water system storage vessel types and collector circuit arrangements:
   a. direct (fully filled) DHW storage cylinder only
   b. indirect, sealed collector circuit, DHW storage cylinder only (solar primary coil only)
   c. indirect, sealed collector circuit, DHW storage cylinder only (dual coil)
   d. indirect, sealed collector circuit, pre-heat cylinder and DHW storage cylinder
   e. indirect, sealed collector circuit, thermal store
### Learning Outcome 4
**Know the purpose of components used within solar thermal hot water system installations**

**Assessment Criteria**

4.1 Confirm the purpose of the following solar thermal hot water system components:
   a. differential temperature controller
   b. cylinder sensor(s)
   c. solar collector sensor
   d. drain back vessel
   e. flow meter
   f. flow regulator (mechanical)
   g. expansion vessel

### Learning Outcome 5
**Know the types and key operating principles of solar collectors**

**Assessment Criteria**

5.1 Identify the following types of solar collector
   a. unglazed collector
   b. flat plate glazed collector
   c. roof integrated glazed collector
   d. evacuated tube collector – direct flow
   e. evacuated tube collector – heat pipe

5.2 Confirm the key operating principles for:
   a. flat plate collectors
   b. evacuated tube collector – direct flow
   c. evacuated tube collector – heat pipe

5.3 Identify the effect that the temperature difference between the solar primary circuit/collector temperature and the ambient temperature has on the relative efficiency of the following types of solar collector:
   a. unglazed collector
   b. flat plate glazed collector
   c. evacuated tube collector

### Learning Outcome 6
**Know the information requirements to enable system component selection and sizing**

**Assessment Criteria**

6.1 Confirm the information requirements in relation to:
   a. building design
   b. building dimensions/angles
   c. building location and orientation
   d. building fabric/material details
   e. existing input services
   f. existing hot water/heating systems

6.2 Confirm the information requirements in relation to:
   a. building occupancy
   b. required hot water usage pattern
### Learning Outcome 7

**Know the fundamental techniques used to select, size and position components for solar thermal hot water systems**

#### Assessment Criteria

<table>
<thead>
<tr>
<th>7.1</th>
<th>Confirm how to determine typical domestic hot water system storage vessel requirements in relation to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>daily demand (Vd) (litres/day per person or litres/day per m² of floor area)</td>
</tr>
<tr>
<td>b.</td>
<td>boiler volume (Vb)</td>
</tr>
<tr>
<td>c.</td>
<td>dedicated solar volume (Vs) (litres per m² of collector area or as a % or Vd)</td>
</tr>
<tr>
<td>d.</td>
<td>total cylinder volume (Vt)</td>
</tr>
<tr>
<td>e.</td>
<td>solar heat exchange coli surface area (m² of surface area in relation to collector flow rate and collector surface area)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7.2</th>
<th>Confirm how to determine typical domestic hot water system collector area requirements in relation to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>building occupancy</td>
</tr>
<tr>
<td>b.</td>
<td>proposed angle of collector installation</td>
</tr>
<tr>
<td>c.</td>
<td>proposed orientation of collector installation</td>
</tr>
<tr>
<td>d.</td>
<td>Shading that may affect collector performance</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7.3</th>
<th>Confirm how to determine the annual irradiation yield as a % of optimum in relation to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>collector orientation</td>
</tr>
<tr>
<td>b.</td>
<td>collector angle</td>
</tr>
<tr>
<td>c.</td>
<td>collector over shading</td>
</tr>
</tbody>
</table>

| 7.4 | State typical recommended solar primary circuit circulation rates |

<table>
<thead>
<tr>
<th>7.5</th>
<th>Confirm how to determine solar primary circuit pipe size requirements in relation to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>primary circuit circulation rates</td>
</tr>
<tr>
<td>b.</td>
<td>collector area</td>
</tr>
<tr>
<td>c.</td>
<td>primary circuit pipework length</td>
</tr>
</tbody>
</table>

| 7.6 | Confirm how to determine total solar primary circuit water content volume |

<table>
<thead>
<tr>
<th>7.8</th>
<th>Confirm how to determine total solar primary circuit expansion vessel size requirements in relation to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>primary circuit water content volume</td>
</tr>
<tr>
<td>b.</td>
<td>collector height above cylinder</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7.8</th>
<th>Identify typical sizing requirements for drainback vessels in relation to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>net collector area</td>
</tr>
<tr>
<td>b.</td>
<td>total volume of the system</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7.9</th>
<th>Confirm how to determine solar primary circuit dynamic pressure drop and circulating pump size requirements for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>fully filled systems</td>
</tr>
<tr>
<td>b.</td>
<td>drainback systems</td>
</tr>
</tbody>
</table>

### Learning Outcome 8

**Know how the performance of solar hot water systems is measured**

#### Assessment Criteria

<table>
<thead>
<tr>
<th>8.1</th>
<th>Define the meaning of the term ‘solar fraction’</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.2</td>
<td>Identify factors that affect the solar fraction</td>
</tr>
</tbody>
</table>
### Learning Outcome 9

Know the preparatory work required for solar thermal hot water system installation work

**Assessment Criteria**

<table>
<thead>
<tr>
<th>9.1</th>
<th>State the requirements in relation to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>authorisation for the work to proceed</td>
</tr>
<tr>
<td>b.</td>
<td>the availability of appropriate access to all required work areas</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>9.2</th>
<th>Confirm the requirements of pre-installation checks in relation to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>the suitability of the building structure and the building fabric in relation to the installation of system components</td>
</tr>
<tr>
<td>b.</td>
<td>verification that the generation capacity of the proposed solar hot water system installation is appropriate to the hot water system energy load and usage</td>
</tr>
<tr>
<td>c.</td>
<td>the inspection of existing hot water/heating system installations</td>
</tr>
<tr>
<td>d.</td>
<td>water quality</td>
</tr>
<tr>
<td>e.</td>
<td>the availability of a suitable electrical input service</td>
</tr>
<tr>
<td>f.</td>
<td>the proposed siting of key internal system components</td>
</tr>
</tbody>
</table>

### Learning Outcome 10

Know the requirements for connecting solar thermal hot water system collector circuits to combination boiler domestic hot water circuits

**Assessment Criteria**

<table>
<thead>
<tr>
<th>10.1</th>
<th>Confirm how to determine the suitability of combination boilers to receive preheated water</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>10.2</th>
<th>Confirm the pipework layout and components required for connecting a solar thermal hot water system to a combination boiler to include the:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>arrangements for prevention of backflow</td>
</tr>
<tr>
<td>b.</td>
<td>arrangements for ensuring that the combination boiler cold inlet supply water is provided at an appropriate temperature</td>
</tr>
<tr>
<td>c.</td>
<td>arrangements for allowing stored hot water to be used directly from the store when the temperature of the stored water is appropriate</td>
</tr>
</tbody>
</table>

### Learning Outcome 11

Know the requirements for installing solar collector arrays

**Assessment Criteria**

<table>
<thead>
<tr>
<th>11.1</th>
<th>Confirm the positioning and fixing requirements and where appropriate the weathering requirements for the following solar collector types:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>flat plate, surface mounted, inclined roof with single lap roof covering</td>
</tr>
<tr>
<td>b.</td>
<td>flat plate, surface mounted, inclined roof with double lap roof covering</td>
</tr>
<tr>
<td>c.</td>
<td>flat plate, integrated, inclined single lap roof covering</td>
</tr>
<tr>
<td>d.</td>
<td>flat plate, integrated, inclined double lap roof covering</td>
</tr>
<tr>
<td>e.</td>
<td>evacuated tube, inclined single lap roof covering</td>
</tr>
<tr>
<td>f.</td>
<td>evacuated tube, inclined double lap roof covering</td>
</tr>
<tr>
<td>g.</td>
<td>frame mounted, horizontal (roof or ground)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>11.2</th>
<th>Confirm the pipework layout, component requirements and component positioning requirements for the following system types and collector array connection arrangements:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>fully filled system, collector array connected in series</td>
</tr>
<tr>
<td>b.</td>
<td>fully filled system, collector array connected in parallel</td>
</tr>
<tr>
<td>c.</td>
<td>fully filled system, collector array connected with east/west split</td>
</tr>
<tr>
<td>d.</td>
<td>drainback system, single collector array</td>
</tr>
</tbody>
</table>
**Learning Outcome 11** Continued
Know the requirements for installing solar collector arrays

**Assessment Criteria**

11.3 Confirm the requirements to achieve durable weather-tightness of buildings where collector array connection pipework passes through the building fabric

11.4 State when specialist equipment is required in relation to preventing irradiation reaching collector absorbers during installation

---

**Learning Outcome 12**

Know the requirements for installing for solar thermal hot water system pipework

**Assessment Criteria**

12.1 Propose suitable pipework materials in relation to:
   a. system operating temperatures
   b. system operating pressures
   c. system chemicals

12.2 Confirm the requirements for pipework supports in relation to:
   a. suitable materials
   b. spacing of pipework supports

12.3 State suitable pipework jointing methods in relation to:
   a. system operating temperatures
   b. system operating pressures
   c. system chemicals

12.4 Confirm the requirements for pipework insulation for solar thermal hot water system installation work in relation to:
   a. system operating temperatures
   b. system efficiency and performance
   c. potential exposure of the insulation to ultra-violet rays/light
   d. potential exposure of the insulation
   e. to adverse weather
   f. the sections of installations that must be insulated
   g. the sections of installations that must not be insulated
   h. resistance to vermin attack

12.5 Confirm the requirements for installing pressure relief valve discharge pipework in relation to:
   a. routing of pipework
   b. termination of pipework
### Learning Outcome 13

**Know the requirements to test and commission solar thermal hot water system installations**

**Assessment Criteria**

<table>
<thead>
<tr>
<th>13.1</th>
<th>Confirm the requirements to prepare for testing and commissioning in relation to:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. compliance with the system design and specification</td>
</tr>
<tr>
<td></td>
<td>b. compliance with system/component manufacturer requirements</td>
</tr>
<tr>
<td></td>
<td>c. suitability of electrical supply circuit arrangements</td>
</tr>
<tr>
<td></td>
<td>d. flushing the system of installation debris</td>
</tr>
<tr>
<td></td>
<td>e. selection of suitable heat transfer fluid</td>
</tr>
<tr>
<td></td>
<td>f. filling and venting the hydraulic circuits</td>
</tr>
<tr>
<td></td>
<td>g. checking system water quality</td>
</tr>
<tr>
<td></td>
<td>h. protection against freezing</td>
</tr>
<tr>
<td></td>
<td>i. provision of system labelling</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>13.2</th>
<th>State what specialist equipment is required in relation to:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. the introduction and checking of system freeze protection fluids</td>
</tr>
<tr>
<td></td>
<td>b. setting system pressure</td>
</tr>
<tr>
<td></td>
<td>c. checking the corrosion protection of the system</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>13.3</th>
<th>Confirm the testing requirements for hydraulic circuits within solar thermal hot water system installations in relation to:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. hydraulic test pressure</td>
</tr>
<tr>
<td></td>
<td>b. hydraulic test duration</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>13.4</th>
<th>Confirm the commissioning requirements for a fully-filled indirect sealed collector circuit installation in relation to:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. setting of the expansion vessel charge pressure</td>
</tr>
<tr>
<td></td>
<td>b. setting of the system fluid level</td>
</tr>
<tr>
<td></td>
<td>c. setting of mechanical controls</td>
</tr>
<tr>
<td></td>
<td>d. setting of electrical controls and temperature sensors</td>
</tr>
<tr>
<td></td>
<td>e. system functional tests</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>13.5</th>
<th>Confirm the commissioning requirements for a fully-filled drainback installation in relation to:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. setting of the system fluid level</td>
</tr>
<tr>
<td></td>
<td>b. setting of mechanical controls</td>
</tr>
<tr>
<td></td>
<td>c. setting of electrical controls and temperature sensors</td>
</tr>
<tr>
<td></td>
<td>d. system functional tests</td>
</tr>
</tbody>
</table>

| 13.6 | Confirm the commissioning requirements for multiple collector arrays connected in series                           |

| 13.7 | State the recording requirements for the commissioning of solar thermal hot water system installations               |

### Learning Outcome 14

**Know the requirements to handover solar thermal hot water systems**

**Assessment Criteria**

<table>
<thead>
<tr>
<th>14.1</th>
<th>Confirm the pre-handover checks that need to be carried out</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.2</td>
<td>Confirm industry handover procedures in relation to the:</td>
</tr>
<tr>
<td></td>
<td>a. provision of written information</td>
</tr>
<tr>
<td></td>
<td>b. provision of diagrammatic information</td>
</tr>
<tr>
<td></td>
<td>c. provision of verbal information/demonstration relating to system operation and use</td>
</tr>
</tbody>
</table>
L/602/3102 - Install, commission and handover ‘active’ solar thermal hot water systems

The unit focuses upon the occupational competence required to plan and prepare for, install (including testing and commissioning) and handover of ‘active’ fully-filled and drainback solar thermal hot water systems. The unit covers systems for domestic hot water production only. The unit focuses upon systems with up to 20m² of solar collector area. Upon completion of the unit the learner will:

- Plan and prepare for the installation of ‘active’ solar thermal hot water system
- Install solar thermal hot water system components
- Test and commission an ‘active’ solar thermal hot water system
- Handover an ‘active’ solar thermal hot water system

### Learning Outcome 1

**Plan and prepare for the installation of ‘active’ solar thermal hot water system**

**Assessment Criteria**

1.1 Undertake pre-installation checks for a solar hot water system installation to include checks relating to:

   a. authorisation for the work to proceed
   b. verification that the generation capacity of the proposed solar hot water system installation is appropriate to the hot water system load
   c. the availability of appropriate access to all required work areas
   d. the inspection of existing domestic hot water/heat heating system installations
   e. the availability of a suitable electrical input service
   f. the proposed siting of key internal system components
   g. the suitability of the building structure in relation to the proposed installation
   h. the suitability of the proposed location and position of the solar collector panel(s).

1.2 ... for optimum collection capacity

   a. the suitability of the building fabric in relation to the installation of the solar collector panel(s)

1.3 Confirm that the tools, materials and equipment required for the installation work are available and are in a safe, usable condition

### Learning Outcome 2

**Install solar thermal hot water system components**

**Assessment Criteria**

2.1 Install in accordance with manufacturer’s guidance, regulatory requirements and industry recognised procedures, key system components on either a fully-filled or drainback, ‘active’ solar thermal hot water system to include as a minimum the positioning, fixing and connection of the following components:

   **Fully-filled systems:**
   a. solar collector
   b. expansion vessel
   c. solar circulating pump

   **Drainback systems:**
   a. solar collector
   b. drainback vessel
   c. solar circulating pump
### Learning Outcome 3

Test and commission an ‘active’ solar thermal hot water system

**Assessment Criteria**

<table>
<thead>
<tr>
<th>3.1</th>
<th>Prepare a fully-filled or drainback solar thermal hot water system for testing and commissioning to include checks/actions to confirm:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>compliance with the system design and specification</td>
</tr>
<tr>
<td>b.</td>
<td>compliance with system/component manufacturer requirements</td>
</tr>
<tr>
<td>c.</td>
<td>the suitability of electrical supply circuit arrangements</td>
</tr>
<tr>
<td>d.</td>
<td>correct flushing the system of installation debris</td>
</tr>
<tr>
<td>e.</td>
<td>correct filling and venting the hydraulic circuits</td>
</tr>
<tr>
<td>f.</td>
<td>protection of the system against freezing</td>
</tr>
<tr>
<td>g.</td>
<td>adequate provision of system labelling</td>
</tr>
</tbody>
</table>

| 3.2 | Test the system for hydraulic soundness using appropriate test equipment in accordance with manufacturer’s guidance, regulatory requirements and industry recognised procedures |

<table>
<thead>
<tr>
<th>3.3</th>
<th>Identify the commissioning requirements for the installation in relation to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>the system/component manufacturer(s) requirements</td>
</tr>
<tr>
<td>b.</td>
<td>system design/specification requirements</td>
</tr>
<tr>
<td>c.</td>
<td>the client/end user requirements</td>
</tr>
<tr>
<td>d.</td>
<td>statutory regulations and/or industry recognised procedures</td>
</tr>
</tbody>
</table>

| 3.4 | Commission a fully-filled or drainback system in accordance with manufacturer’s guidance, design requirements, client’s requirements and statutory requirements and/or industry recognised procedures |

| 3.5 | Complete relevant documentation to record the commissioning activities |

### Learning Outcome 4

Handover an ‘active’ solar thermal hot water system

**Assessment Criteria**

| 4.1 | Undertake relevant checks to ensure that the system is ready for handover and compliant with manufacturer’s guidance, the system design/specification, client’s requirements, regulatory requirements and/or industry recognised requirements |

| 4.2 | Explain and demonstrate to the end user the operation and use of the system using manufacturer’s guidance and industry agreed handover procedures |

| 4.3 | Identify and explain to the end user any aspects of the system that varies from the agreed specifications and requirements |

| 4.4 | Obtain acceptance by the end user of the system according to the industry agreed handover procedures |

| 4.5 | Ensure that all relevant handover documentation is correctly completed and recorded in the appropriate information systems and passed to the end user in accordance with manufacturer’s guidance and industry recognised procedures |
Y/602/3104 - Know the requirements to inspect, service and maintain ‘active’ solar thermal hot water systems

The unit focuses upon the knowledge required to inspect, service and maintain fully-filled and drainback ‘active’ solar thermal hot water systems. The unit covers systems for domestic hot water production only. The unit focuses upon systems with up to 20m² of solar collector area. Upon completion of the unit the learner will:

- Know the requirements for the routine service and maintenance of ‘active’ solar thermal hot water systems
- Know how to diagnose faults in ‘active’ solar thermal hot water system installations
- Know how to rectify faults in ‘active’ solar thermal hot water systems

**Learning Outcome 1**

Know the requirements for the routine service and maintenance of ‘active’ solar thermal hot water systems

**Assessment Criteria**

1.1 Confirm which documentation needs to be available to enable routine service and maintenance work on ‘active’ solar thermal hot water systems

1.2 Confirm the typical routine service and maintenance requirements for fully filled systems in relation to:
   a. visual inspection requirements
   b. cleaning of components
   c. checking of system water content
   d. functional tests

1.3 Confirm the typical routine service and maintenance requirements for drainback systems in relation to:
   a. visual inspection requirements
   b. cleaning of components
   c. checking of system water content
   d. functional tests

1.4 Confirm the industry requirements for the recording and reporting of routine service and maintenance work on solar thermal hot water systems

**Learning Outcome 2**

Know how to diagnose faults in ‘active’ solar thermal hot water system installations

**Assessment Criteria**

2.1 Confirm the information that needs to be available to enable fault diagnosis

2.2 Confirm the work action and sequences required to diagnose the following faults:
   a. loss of system pressure without evidence of discharge
   b. discharge from pressure relief valve on the solar primary circuit
   c. insulation melting on solar collector circuit pipework
   d. overheating of solar collector circuit
   e. lack of circulation within the solar collector circuit
   f. poor or no system performance
   g. system noise and/or vibration
<table>
<thead>
<tr>
<th>Learning Outcome 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Know how to rectify faults in ‘active’ solar thermal hot water systems</td>
</tr>
<tr>
<td><strong>Assessment Criteria</strong></td>
</tr>
<tr>
<td>3.1 Confirm the work action and sequences required to rectify the following faults:</td>
</tr>
<tr>
<td>a. loss of system pressure without evidence of discharge</td>
</tr>
<tr>
<td>b. evidence of discharge valve on the solar primary circuit</td>
</tr>
<tr>
<td>c. insulation melting on solar collector circuit pipework</td>
</tr>
<tr>
<td>d. overheating of solar collector circuit</td>
</tr>
<tr>
<td>e. lack of circulation within the solar collector circuit</td>
</tr>
<tr>
<td>f. poor or no system performance</td>
</tr>
<tr>
<td>g. system noise and/or vibration</td>
</tr>
</tbody>
</table>
K/602/3107 - Inspect, service and maintain ‘active’ solar thermal hot water systems

The unit focuses upon the occupational competence required to inspect, service and maintain ‘active’ fully-filled and drainback solar thermal hot water systems. The unit covers systems for domestic hot water production only. The unit focuses upon systems with up to 20m² of solar collector area. On completion of the unit the learner will:

- Undertake the routine service and maintenance of an ‘active’ solar thermal hot water system
- Undertake fault diagnosis work on ‘active’ solar thermal hot water system installations
- Undertake fault rectification work on ‘active’ solar thermal hot water system installations

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### Learning Outcome 1

**Undertake the routine service and maintenance of an ‘active’ solar thermal hot water system**

#### Assessment Criteria

1.1 Obtain the relevant information required to enable the work

1.2 Undertake a visual service and maintenance inspection of a fully-filled or drainback, ‘active’ solar thermal hot water system installation to include checks in relation to:
   
   a. compliance with manufacturer’s installation instructions
   
   b. compliance with statutory regulations
   
   c. condition of system components including cleanliness
   
   d. correct positioning of system components
   
   e. security of fixing of system components

1.3 Undertake routine servicing of relevant components on a fully-filled or drainback, ‘active’ solar thermal hot water system to include:
   
   a. checking the system water levels
   
   b. checking provision for the expansion of system water
   
   c. checking for protection of the system water against freezing
   
   d. cleaning of system components
   
   e. adjustment of system controls

1.4 Undertake routine service and maintenance functional tests on a fully-filled or drainback solar thermal hot water system to confirm:
   
   a. safe operation
   
   b. efficient operation
   
   c. the correct functioning of system components/controls

1.5 Complete the relevant service and maintenance records in accordance with industry recognised procedures
### Learning Outcome 2

**Undertake fault diagnosis work on ‘active’ so thermal hot water system installations**

#### Assessment Criteria

1. **Obtain the relevant information required to enable the fault diagnosis work**
2. **Identify the cause of a minimum of FOUR separate faults from the following list:**
   a. loss of system pressure without evidence of discharge
   b. discharge from pressure relief valve on the solar primary circuit
   c. insulation melting on solar collector circuit pipework
   d. overheating of solar collector circuit
   e. lack of circulation within the solar collector circuit
   f. poor or no system performance
   g. system noise and/or vibration
3. **Agree with the relevant person(s) fault rectification procedures for the faults identified**

### Learning Outcome 3

**Undertake fault rectification work on ‘active’ solar thermal hot water system installations**

#### Assessment Criteria

1. **Obtain the relevant information required to enable the fault rectification work**
2. **Take relevant precautionary actions to prevent unauthorised use of the system prior to or during the fault rectification work**
3. **Take relevant precautionary actions to minimise the risk of injury to self or others during the fault rectification work**
4. **Rectify a minimum of TWO separate faults from the following list:**
   a. loss of system pressure without evidence of discharge
   b. discharge from pressure relief valve on the solar primary circuit
   c. insulation melting on solar collector circuit pipework
   d. overheating of solar collector circuit
   e. lack of circulation within the solar collector circuit
   f. poor or no system performance
   g. system noise and/or vibration
5. **Undertake post-rectification functional tests in accordance with manufacturer’s guidance, regulatory requirements and industry recognised procedures to confirm that the system is in a safe, functional and efficient condition**
Y/602/3054 - Know the requirements to install, commission and handover heat pump systems non-refrigerant circuits

The unit focuses upon the underpinning knowledge required to plan and prepare for, install (including testing and commissioning) and handover heat pump system installations. The unit focuses upon systems up to 45kW load and include air source, water source and ground source systems. The unit covers fundamental heat pump system design awareness and component selection but does not include detailed system design.

The unit covers connection to collector loops and the fundamental requirements of collector loop design and installation; however, the unit does not cover collector loop design or installation in detail. The unit covers the requirements for appropriate personnel competence as required by The Fluorinated Greenhouse Gases Regulations 2008, in relation to heat pump work but the unit does not cover aspects of heat pump work that involves handling fluorinated greenhouse gases or working on the heat pump refrigerant circuit. On completion of the unit the learner will:

- Know the health and safety risks and safe systems of work associated with heat pump system installation work (non-refrigerant circuits)
- Know the requirements of relevant regulations/standards relating to practical installation, testing and commissioning activities for heat pump installation work
- Know the purpose and operational characteristics of heat pump unit and heat pump system components
- Know the different types of heat pump units and system arrangements for hydraulic emitter circuits
- Know the fundamental principles of heat pump selection and system design that are common to both air and ground source heat pumps
- Know the fundamental design principles for ground source ‘closed loop’ heat pump collector circuit design, component sizing and installation
- Know the layouts of ‘open loop’ water filled heat pump collector circuits
- Know the fundamental design considerations and principles that are specific to air source heat pumps
- Know the preparatory work required for heat pump installation work
- Know the requirements to install and test heat pump systems (non-refrigerant circuits)
- Understand the requirements to commission heat pump system installations
- Understand the requirements to handover heat pump system installations

<table>
<thead>
<tr>
<th>Learning Outcome 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Know the health and safety risks and safe systems of work associated with heat pump system installation work (non-refrigerant circuits)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Confirm which aspects of heat pump installation work pose risk of:</td>
</tr>
<tr>
<td>a. electrocution/electric shock</td>
</tr>
<tr>
<td>b. burns</td>
</tr>
<tr>
<td>c. toxic poisoning personal injury though component/equipment handling</td>
</tr>
<tr>
<td>1.2 Confirm safe systems of work for heat pump installation work in relation to prevention of:</td>
</tr>
<tr>
<td>a. electrocution/electric shock</td>
</tr>
<tr>
<td>b. burns</td>
</tr>
<tr>
<td>c. toxic poisoning</td>
</tr>
<tr>
<td>d. personal injury though component/equipment handling</td>
</tr>
</tbody>
</table>
## Learning Outcome 2

Know the requirements of relevant regulations/standards relating to practical installation, testing and commissioning activities for heat pump installation work

### Assessment Criteria

2.1 Interpret building regulation/building standards guidance documentation as relevant to heat pump installation work to identify the requirements in relation to:

   a. maintaining the structural integrity of the building
   b. maintaining the fire resistant integrity of the building
   c. the prevention of moisture ingress (building water tightness)
   d. notification of work requirements
   e. physical installation requirements
   f. energy conservation
   g. testing and commissioning requirements
   h. compliance certification

2.2 Interpret industry recognised water regulation/byelaw guidance documentation as relevant to heat pump installation work to identify the requirements in relation to:

   a. the physical installation of the system
   b. energy conservation
   c. safe operation
   d. testing and commissioning requirements

2.3 State the requirements of the current fluorinated greenhouse gases regulations in relation to:

   a. the competence of personnel installing heat pumps where the refrigerant circuit has been assembled and tested by the product manufacturer
   b. the competence of personnel installing heat pumps where the refrigerant circuit is to be assembled and tested in the location where the heat pump is to be installed and operated
   c. the competence of personnel undertaking leakage checking on heat pump refrigerant circuits
   d. the competence of personnel undertaking recovery of fluorinated greenhouse gases from heat pump refrigerant circuits
Learning Outcome 3

Know the purpose and operational characteristics of heat pump unit and heat pump system components

Assessment Criteria

3.1 Confirm the purpose and operational characteristics of the following components:
   a. evaporator
   b. low pressure switch
   c. compressor
   d. high pressure switch
   e. condenser
   f. dryer/receiver
   g. sight glass
   h. expansion valve
   i. expansion valve phial
   j. refrigerant four way valve
   k. brine pump
   l. emitter circuit electro-mechanical valves
   m. fan coil
   n. integrated buffer tank
   o. ground loop heat exchanger

3.2 Confirm how the vapour compression refrigerant circuit within a heat pump unit operates

Learning Outcome 4

Know the different types of heat pump units and system arrangements for hydraulic emitter circuits

Assessment Criteria

4.1 Recognise the following heat source/heat sink heat pump packages that can be deployed with a hydraulic ‘heat sink’ emitter circuit:
   a. outside air/water
   b. exhaust air/water
   c. brine (closed loop)/water
   d. water (open loop)/water
   e. DX (closed loop)/water

4.2 Identify the different types of heat pump unit within the categories:
   a. ground source – packaged (indoor)
   b. ground source – packaged (outdoor)
   c. air source - external air, packaged (indoor)
   d. air source - external air, packaged (outdoor)
   e. air source - external air, internal heat pump unit with brine circuit between fan coil unit and heat pump unit

4.3 Confirm the meaning of the terms:
   a. monovalent system
   b. bivalent system

4.4 Identify the following monovalent hydraulic emitter circuits:
   a. heating only
   b. heating with buffer tank
   c. heating with buffer tank and indirect stored domestic hot water
   d. heating with buffer tank and indirect stored domestic hot water with solar coil
   e. heating with thermal store
Learning Outcome 4  Continued

Know the different types of heat pump units and system arrangements for hydraulic emitter circuits

Assessment Criteria

4.5 Identify the following parallel bivalent hydraulic emitter circuits that incorporate a secondary heat source other than an immersion heater:
   a. heating with buffer tank
   b. heating with buffer tank and indirect stored domestic hot water
   c. heating with buffer tank and indirect stored domestic hot water with solar coil
   d. heating with buffer tank and thermal store

4.6 Confirm the arrangements for connecting buffer tanks:
   a. in series
   b. in parallel

Learning Outcome 5

Know the fundamental principles of heat pump selection and system design that are common to both air and ground source heat pumps

Assessment Criteria

5.1 Confirm the meaning of the term ‘Coefficient of Performance’

5.2 Confirm the relationship between Coefficient of Performance and the:
   a. heat pump input temperature
   b. heat pump emitter temperature

5.3 Confirm the effect that ambient temperature can have on:
   a. monovalent system
   b. bivalent system

5.4 Confirm the meaning of the term ‘Seasonal Performance Factor’

5.5 Identify the factors that can affect the Seasonal Performance Factor

5.6 Confirm the meaning of the term ‘System Efficiency’

5.7 Identify the factors that can affect the ‘System Efficiency’

5.8 Confirm why achieving minimum heat loss from the building is particularly important when designing a heat pump system

5.9 State the effect that oversizing of a heat pump has on:
   a. system performance/efficiency
   b. heat pump operation

5.10 State the effect that undersizing of a heat pump has on:
   a. system performance/efficiency
   b. heat pump operation

5.11 Confirm how to identify heat pump hydraulic flow rate requirements

5.12 Confirm how to use manufacturer’s data to select heat pump units:
   a. output charts
   b. other data

5.13 Confirm the meaning of the term ‘bivalent points’ in relation to heat pump output charts

5.14 Confirm how ‘bivalent points’ are used to determine auxiliary heat requirements

5.15 Confirm how heat pump output capacity is affected by:
   a. heat pump input temperature
   b. heat pump output temperature
Learning Outcome 5  Continued

Know the fundamental principles of heat pump selection and system design that are common to both air and ground source heat pumps (Cont.)

Assessment Criteria

5.16 Identify the suitability of the following types of hydraulic heating system emitter for suitability with heat pump systems:
   a. underfloor heating
   b. fan assisted convector heaters
   c. standard panel radiators

5.17 State the typical mean water temperature recommended when designing a hydraulic emitter circuit that incorporates:
   a. underfloor heating
   b. fan assisted convector heaters
   c. standard panel radiators

5.18 Confirm how correction factors are used to determine panel radiator output requirements in relation to mean water temperature and room temperature difference (degrees centigrade)

5.19 Confirm the potential benefits of including a buffer tank in the system design

5.20 Identify the potential disadvantages of including a buffer tank in the system design

5.21 Confirm the typical allowance in litres (l) per kilowatt (kW) of heat pump output that would be allowed for sizing a buffer tank when there is no requirement for heat during compressor ‘off’ periods

5.22 Confirm using available external temperature, heat load and system flow temperature data, the required size (heat output in kW) of a heat pump to be connected to a hydraulic heat emitter circuit using a monovalent system design

5.23 State the typical annual operating hours for a heat pump that is being used for:
   a. heating only
   b. heating and domestic hot water

5.24 State how heat pump annual operating hours may vary in relation to the:
   a. type of building
   b. geographical location of the installation

Learning Outcome 6

Know the fundamental design principles for ground source ‘closed loop’ heat pump collector circuit design, component sizing and installation

Assessment Criteria

6.1 Identify the following brine filled heat pump collector circuit configurations:
   a. ground ‘closed’ loop horizontal
   b. ground ‘closed’ loop compact collector
   c. ground ‘closed’ loop slinky
   d. ground ‘closed’ loop vertical borehole
   e. lake ‘closed’ loop
   f. vertical borehole closed’ loop
Learning Outcome 6  Continued

Know the fundamental design principles for ground source ‘closed loop’ heat pump collector circuit design, component sizing and installation

**Assessment Criteria**

6.2 Confirm the requirements of horizontal ‘closed’ loop brine filled hydraulic heat pump collector circuits in relation to:
   - a. suitable pipework materials
   - b. below ground jointing
   - c. protection against frost damage
   - d. protection against mechanical damage
   - e. separation distances to avoid thermal interference
   - f. separation distances from other services and adjacent buildings
   - g. achieving balanced loop/collector circuits

6.3 Confirm the typical requirements of vertical borehole ‘closed’ loop brine filled hydraulic heat pump collector circuits in relation to:
   - a. suitable pipework materials
   - b. below ground jointing
   - c. protection against frost damage
   - d. protection against mechanical damage
   - e. separation distances to avoid thermal interference
   - f. separation distances from other services and adjacent buildings
   - g. achieving balanced loop/collector circuits

6.4 Identify the typical components required in relation to:
   - a. single circuit ‘closed’ loop collector circuits
   - b. multi-circuit ‘closed’ loop collector circuits
   - c. brine circuits between outside air source units and internal heat pump units

6.5 Confirm the typical layout of components in relation to:
   - a. single circuit collector circuits
   - b. multi-circuit collector circuits
   - c. brine circuits between outside air source units and internal heat pump units

6.6 Confirm which factors determine the year round energy available in Watts (W) per m2 of ground area

6.7 Confirm how to determine the energy requirement (refrigeration capacity) from the ground loop (kW) using the total heat pump capacity (kW) and the electrical energy input rating (kW)

6.8 Confirm how the specific heat extraction capacity (in W/m2 for horizontal/vertical trench collectors and W/m for vertical borehole collectors) of the ground collector circuit can be affected by the:
   - a. ground conditions/soil types
   - b. type of backfill material
   - c. geographical location – ground rest temperature
   - d. ground loop configuration
   - e. annual heat pump operating hours

6.9 Confirm how the total ground area (m2) requirements for horizontal collector loops is determined using the following data:
   - a. refrigeration capacity (kW)
   - b. specific extraction output (W/m2)
<table>
<thead>
<tr>
<th>Learning Outcome 6</th>
<th>Continued</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Know the fundamental design principles for ground source ‘closed loop’ heat pump collector circuit design, component sizing and installation</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Assessment Criteria</strong></td>
<td></td>
</tr>
<tr>
<td>6.10 Confirm how the pipe length (m) requirement for a horizontal ‘loop’ collector circuit is determined using the following data:</td>
<td></td>
</tr>
<tr>
<td>a. total ground area (m²)</td>
<td></td>
</tr>
<tr>
<td>b. collector loop pipe spacing (m)</td>
<td></td>
</tr>
<tr>
<td>6.11 Confirm how the pipe length (m) requirement for a ‘slinky’ collector circuit is determined using the following data:</td>
<td></td>
</tr>
<tr>
<td>a. total ground area (m²)</td>
<td></td>
</tr>
<tr>
<td>b. centre to centre spacing of the slinky collector (m)</td>
<td></td>
</tr>
<tr>
<td>6.11 Confirm how the typical collector length (m) requirement for a vertical borehole collector circuit is determined using the following data:</td>
<td></td>
</tr>
<tr>
<td>a. heat pump refrigeration capacity (kW)</td>
<td></td>
</tr>
<tr>
<td>b. ground condition</td>
<td></td>
</tr>
<tr>
<td>c. annual heat pump operating hours</td>
<td></td>
</tr>
<tr>
<td>Confirm how a collector circuit brine pump size (Kg/h) is determined using the following data:</td>
<td></td>
</tr>
<tr>
<td>a. design flow rate</td>
<td></td>
</tr>
<tr>
<td>b. brine viscosity</td>
<td></td>
</tr>
<tr>
<td>c. heat pump refrigeration capacity (kW)</td>
<td></td>
</tr>
<tr>
<td>d. specific thermal capacity of brine (kJ/kg)</td>
<td></td>
</tr>
<tr>
<td>e. temperature difference between brine circuit flow and return pipework (degrees centigrade)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Outcome 7</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Know the layouts of ‘open loop’ water filled heat pump collector circuits</strong></td>
</tr>
<tr>
<td><strong>Assessment Criteria</strong></td>
</tr>
<tr>
<td>7.1 Identify the following ‘open loop’ water filled heat pump collector circuit configurations:</td>
</tr>
<tr>
<td>a. ground ‘open’ loop vertical borehole</td>
</tr>
<tr>
<td>b. lake ‘open’ loop</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Outcome 8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Know the fundamental design considerations and principles that are specific to air source heat pumps</strong></td>
</tr>
<tr>
<td><strong>Assessment Criteria</strong></td>
</tr>
<tr>
<td>8.1 Identify the factors that need to be considered when selecting and positioning air source heat pump fan coil units in relation to:</td>
</tr>
<tr>
<td>a. operating noise (including the potential effect on neighbouring properties)</td>
</tr>
<tr>
<td>b. air turbulence during operation</td>
</tr>
<tr>
<td>8.2 Identify the design options to provide for the defrost cycle for an air source heat pump</td>
</tr>
<tr>
<td>8.3 Confirm how to size a buffer tank to provide for an air source heat pump defrost cycle</td>
</tr>
</tbody>
</table>
## Learning Outcome 9

**Know the preparatory work required for heat pump installation work**

### Assessment Criteria

9.1 Confirm the common requirements of pre-installation checks for air or ground source heat pump unit installations connected to hydraulic emitters circuits in relation to:
   - a. authorisation for the work to proceed
   - b. the availability and collation of all relevant information
   - c. verification of the suitability of the hydraulic emitter circuit for connection to the heat pump unit
   - d. verification that the heat output capacity of the heat pump unit is matched to the required proportional contribution of the total building heat load
   - e. verification that the buffer tank sizing is correct
   - f. the availability of appropriate access to all required work areas
   - g. the availability and condition of a suitable electrical input service
   - h. adequate provision for the siting of key internal system components
   - i. the suitability of the building structure in relation to the ... proposed installation

9.2 Confirm the pre-installation checks that are specific to the positioning of fan coil units

## Learning Outcome 10

**Know the requirements to install and test heat pump systems (non-refrigerant circuits)**

### Assessment Criteria

10.1 Confirm the requirements for moving and handling heat pump units to avoid damage to the unit

10.2 Confirm the requirements to avoid undue noise and/or vibration transmission from the heat pump unit to the building structure during the operation of the heat pump

10.3 Identify the requirements where brine circuit pipework passes through the external building fabric in relation to:
   - a. provision for movement
   - b. protection against freezing
   - c. prevention of water ingress

10.4 Confirm the charging and flushing requirements for closed loop collector circuits in relation to:
   - a. purging of air and installation debris
   - b. addition of antifreeze protection and suitable biocides
   - c. checking flow rates

10.5 State what equipment is needed for system charging and flushing

10.6 Confirm the hydraulic test requirements for:
   - a. closed loop collector circuits
   - b. hydraulic emitter circuits
## Learning Outcome 11
Understand the requirements to commission heat pump system installations

### Assessment Criteria

11.1 Confirm the conditions that are required to implement commissioning activities for ground source heat pump systems

11.2 Confirm the commissioning requirements for ground source heat pump systems in relation to:
   a. setting of mechanical controls
   b. setting of electrical controls and temperature sensors
   c. functional tests

11.3 Confirm the conditions that are required to implement commissioning activities for air source heat pump systems

11.4 Confirm the commissioning requirements for air source heat pump systems in relation to:
   a. setting of mechanical controls
   b. setting of electrical controls and temperature sensors
   c. functional tests

## Learning Outcome 12
Understand the requirements to handover heat pump system installations

### Assessment Criteria

12.1 Confirm the pre-handover checks that need to be carried out for a ground source heat pump system installation

12.2 Confirm the industry handover procedures for a ground source heat pump system installation in relation to the:
   a. provision of written information
   b. provision of diagrammatic information
   c. provision of verbal information/demonstration relating to system operation and use

12.3 Confirm the pre-handover checks that need to be carried out for an air source heat pump system installation

12.4 Confirm the industry handover procedures for an air source heat pump system installation in relation to the:
   a. provision of written information
   b. provision of diagrammatic information
   c. provision of verbal information/demonstration relating to system operation and use
D/602/3072 - Install commission and handover heat pumps non-refrigerant circuits

The unit focuses upon the occupational competence required to plan and prepare for, install (including testing and commissioning) and handover of heat pump systems up to 45kW load and include air source, water source and ground source systems. The unit covers connection to collector loops and the fundamental requirements of collector loop design and installation; however, the unit does not cover collector loop design or installation in detail. Upon completion of the unit the learner will be able to:

- Plan and prepare for the installation of heat pumps (non-refrigerant circuits)
- Install air and ground source heat pump units (non-refrigerant circuits)
- Test and commission a ground source heat pump installation (non-refrigerant circuits)
- Test and commission an air source heat pump installation (non-refrigerant circuits)
- Handover an air or ground source heat pump installation

**Learning Outcome 1**

Plan and prepare for the installation of heat pumps (non-refrigerant circuits)

**Assessment Criteria**

1.1 Undertake pre-installation checks for a heat pump installation to include checks relating to:
   a. authorisation for the work to proceed
   b. the availability of appropriate access to all required work areas
   c. the availability and collation of all relevant information
   d. verification of the suitability of the proposed location of the fan coil unit (air source heat pumps only)
   e. verification that the emitter circuit design or existing installation is compatible with the proposed heat pump installation
   f. verification that the buffer tank size (where relevant) is appropriate
   g. verification that the collector circuit is appropriate to the heat pump rating (ground source heat pumps only)
   h. verification that the heat pump rating is suitable for the emitter circuit load (heating and/or heating and hot water)
   i. verification of the suitability of the proposed location of the heat pump unit
   j. verification of the suitability of the availability of a suitable electrical input service
   k. the proposed siting of key internal system components
   l. the suitability of the building structure in relation to the proposed installation

1.2 Confirm that the tools, materials and equipment required for the installation work are available and are in a safe usable condition

**Learning Outcome 2**

Install air and ground source heat pump units (non-refrigerant circuits)

**Assessment Criteria**

2.1 Install in accordance with manufacturer’s guidance, regulatory requirements and industry recognised procedures an air source heat pump to include as a minimum the connection of the heat pump unit to the hydraulic emitter circuit

2.2 Install in accordance with manufacturer’s guidance, regulatory requirements and industry recognised procedures a ground source heat pump to include as a minimum the connection of the heat pump unit to the collector circuit
## Learning Outcome 3

**Test and commission a ground source heat pump installation (non-refrigerant circuits)**

### Assessment Criteria

#### 3.1
Prepare a ground source heat pump system for testing and commissioning to include checks/actions to confirm:

- a. compliance with the system design and specification
- b. compliance with system/component manufacturer requirements
- c. the suitability of electrical supply circuit arrangements
- d. correct flushing the system of installation debris
- e. correct filling and venting the hydraulic circuits
- f. protection of the system against freezing

#### 3.2
Test the collector circuit for hydraulic soundness using appropriate test equipment in accordance with manufacturer’s guidance, regulatory requirements and industry recognised procedures

#### 3.3
Identify the commissioning requirements for the installation in relation to:

- a. the system/component manufacturer(s) requirements
- b. system design/specification requirements
- c. the client/end user requirements
- d. statutory regulations and/or industry recognised procedures

#### 3.4
Commission the installation in accordance with manufacturer’s guidance, design requirements, client’s requirements and statutory requirements and/or industry recognised procedures

#### 3.5
Complete relevant documentation to record the commissioning activities

## Learning Outcome 4

**Test and commission an air source heat pump installation (non-refrigerant circuits)**

### Assessment Criteria

#### 4.1
Prepare an air source heat pump system for testing and commissioning to include checks/actions to confirm:

- a. compliance with the system design and specification
- b. compliance with system/component manufacturer requirements
- c. the suitability of electrical supply circuit arrangements
- d. correct flushing the system of installation debris
- e. correct filling and venting the hydraulic circuits
- f. protection of the system against freezing

#### 4.2
Identify the commissioning requirements for the installation in relation to:

- a. the system/component manufacturer(s) requirements
- b. system design/specification requirements
- c. the client/end user requirements
- d. statutory regulations and/or industry recognised procedures

#### 4.3
Commission the installation in accordance with manufacturer’s guidance, design requirements, client’s requirements and statutory requirements and/or industry recognised procedures
<table>
<thead>
<tr>
<th>Learning Outcome 5</th>
<th>Handover an air or ground source heat pump installation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment Criteria</strong></td>
<td></td>
</tr>
<tr>
<td>5.1 Undertake relevant checks to ensure that the system is ready for handover and compliant with manufacturer’s guidance, the system design/specification, client’s requirements, regulatory requirements and/or industry recognised requirements</td>
<td></td>
</tr>
<tr>
<td>5.2 Explain and demonstrate to the end user the operation and use of the system using manufacturer’s guidance and industry agreed handover procedures</td>
<td></td>
</tr>
<tr>
<td>5.3 Identify and explain to the end user any aspects of the system that varies from the agreed specifications and requirements</td>
<td></td>
</tr>
<tr>
<td>5.4 Obtain acceptance by the end user of the system according to the industry agreed handover procedures</td>
<td></td>
</tr>
<tr>
<td>5.5 Ensure that all relevant handover documentation is correctly completed and recorded in the appropriate information systems and passed to the end user in accordance with manufacturer’s guidance and industry recognised procedures</td>
<td></td>
</tr>
</tbody>
</table>
F/602/3078 - Know the requirements to inspect, service and maintain heat pump system installations non-refrigerant circuits

The unit focuses upon the underpinning knowledge required to inspect, service and maintain heat pump system installations. The unit focuses upon systems up to 45kW load and include air source and ground source systems. The unit does not cover aspects of heat pump service and maintenance work that involves handling fluorinated greenhouse gases or working on the heat pump refrigerant circuit. Upon completion of the unit the learner will:

- Know the requirements for the non-refrigerant circuit routine service and maintenance of heat pump system installations
- Know how to diagnose faults in heat pump system installations
- Know how to rectify non-refrigerant circuit faults in heat pump system installations

### Learning Outcome 1

Know the requirements for the non-refrigerant circuit routine service and maintenance of heat pump system installations

### Assessment Criteria

1.1 Confirm which documentation needs to be available to enable routine service and maintenance work on heat pump system installations

1.2 Confirm typical routine service and maintenance requirements for an air source heat pump installation in relation to:
   a. visual inspection requirements
   b. cleaning of components
   c. checking of system water content
   d. functional tests

1.3 Confirm typical routine service and maintenance requirements for a ground source heat pump installation in relation to:
   a. visual inspection requirements
   b. cleaning of components
   c. checking of system water content
   d. functional tests

1.4 Confirm the industry requirements for the recording and reporting of routine service and maintenance work on heat pump system installations

1.5 State the action(s) to take in the event of a failure or suspected failure of the refrigerant circuit and/or a suspected refrigerant circuit defect

### Learning Outcome 2

Know how to diagnose faults in heat pump system installations

### Assessment Criteria

2.1 Confirm the information that needs to be available to enable fault diagnosis

2.2 Confirm the work action and sequences required to diagnose the following faults:
   a. heat pump low pressure trip/alarm activated by a collector circuit malfunction
   b. heat pump high pressure trip/alarm activated by an emitter circuit malfunction
   c. poor or no collector circuit performance
   d. Insufficient heat output to emitter circuit
   e. domestic hot water heat up is satisfactory but space heating is not operating
   f. system noise and/or vibration
<table>
<thead>
<tr>
<th>Learning Outcome 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Know how to rectify non-refrigerant circuit faults in heat pump system installations</td>
</tr>
</tbody>
</table>

**Assessment Criteria**

3.1 Confirm the work action and sequences required to rectify the following faults:
   a. heat pump low pressure trip/alarm activated by a collector circuit malfunction
   b. heat pump high pressure trip/alarm activated by an emitter circuit malfunction
   c. poor or no collector circuit performance
   d. insufficient heat output to emitter circuit
   e. domestic hot water heat up is satisfactory but space heating is not operating
   f. system noise and/or vibration
L/602/3083 - Inspect, service and maintain heat pump installations non-refrigerant circuits

The unit focuses upon the occupational competence required to inspect, service and maintain heat pump system installations. The unit focuses upon systems up to 45kW load and include air source and ground source systems. The unit does not cover aspects of heat pump service and maintenance work that involves handling fluorinated greenhouse gases or working on the heat pump refrigerant circuit. Upon completion of the unit the learner will be able to:

- Undertake the non-refrigerant circuit routine service and maintenance of an air source heat pump system installation
- Undertake the non-refrigerant circuit routine service and maintenance of an ground source heat pump system installation
- Undertake non-refrigerant circuit fault diagnosis work on an air or ground source heat pump system installation
- Undertake non-refrigerant circuit fault rectification work on an air or ground source heat pump system installation

**Learning Outcome 1**

Undertake the non-refrigerant circuit routine service and maintenance of an air source heat pump system installation

**Assessment Criteria**

1.1 Obtain the relevant information required to enable the work

1.2 Undertake a visual service and maintenance inspection of an air source heat pump installation to include checks in relation to:
   a. compliance with manufacturer’s installation instructions
   b. compliance with statutory regulations
   c. condition of system components including cleanliness
   d. checking the system fluid levels
   e. checking the system pressure levels
   f. checks to ensure that electrical controls and temperature sensors are set correctly
   g. leakage and/or dampness
   h. correct positioning of system components
   i. pipework insulation is of the correct grade, in good condition and is firmly in place
   j. provision of information and safety labels
   k. security of fixing of system components

1.3 Undertake routine servicing of relevant components an air source heat pump installation to include checks in relation to:
   a. checking for protection of the system water against freezing
   b. cleaning and lubrication of system components
   c. adjustment of system controls

1.4 Undertake routine service and maintenance functional tests on a air source heat pump installation to confirm:
   a. safe operation
   b. efficient operation
   c. the correct functioning of system components/controls
   d. no undue noise or vibration

1.5 Complete the relevant service and maintenance records in accordance with industry recognised procedures
### Learning Outcome 2

Undertake the non-refrigerant circuit routine service and maintenance of an ground source heat pump system installation

#### Assessment Criteria

2.1 Obtain the relevant information required to enable the work

2.2 Undertake a visual service and maintenance inspection of an ground source heat pump installation to include checks in relation to:
   - compliance with manufacturer’s installation instructions
   - compliance with statutory regulations
   - condition of system components including cleanliness
   - checking the system fluid levels
   - checking the system pressure levels
   - checks to ensure that electrical controls and temperature sensors are set correctly
   - leakage and/or dampness
   - correct positioning of system components
   - pipework insulation is of the correct grade, in good condition and is firmly in place
   - provision of information and safety labels
   - security of fixing of system components

2.3 Undertake routine servicing of relevant components a ground source heat pump installation to include checks in relation to:
   - checking for protection of the system water against freezing
   - cleaning and lubrication of system components
   - adjustment of system controls

2.4 Undertake routine service and maintenance functional tests on a ground source heat pump installation to confirm:
   - safe operation
   - efficient operation
   - the correct functioning of system components/controls
   - no undue noise or vibration

2.5 Complete the relevant service and maintenance records in accordance with industry recognised procedures

### Learning Outcome 3

3. Undertake non-refrigerant circuit fault diagnosis work on an air or ground source heat pump system installation

#### Assessment Criteria

3.1 Obtain the relevant information required to enable the fault diagnosis work

3.2 Identify the cause of a minimum of FOUR separate faults from the following list:
   - heat pump low pressure trip/alarm activated by a collector circuit malfunction
   - heat pump high pressure trip/alarm activated by an emitter circuit malfunction
   - poor or no collector circuit performance
   - insufficient heat output to emitter circuit
   - domestic hot water heat up is satisfactory but space heating is not operating
   - system noise and/or vibration

3.3 Agree with the relevant person(s) fault rectification procedures for the faults identified
**Learning Outcome 4**

Undertake non-refrigerant circuit fault rectification work on an air or ground source heat pump system installation

**Assessment Criteria**

<table>
<thead>
<tr>
<th>4.1</th>
<th>Obtain the relevant information required to enable the fault rectification work</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2</td>
<td>Take relevant precautionary actions to prevent unauthorised use of the system prior to or during the fault rectification work</td>
</tr>
<tr>
<td>4.3</td>
<td>Take relevant precautionary actions to minimize the risk of injury to self or others during the fault rectification work</td>
</tr>
<tr>
<td>4.4</td>
<td>Rectify a minimum of TWO separate faults from the following list:</td>
</tr>
<tr>
<td></td>
<td>a. heat pump low pressure trip/alarm activated by a collector circuit malfunction</td>
</tr>
<tr>
<td></td>
<td>b. heat pump high pressure trip/alarm activated by an emitter circuit malfunction</td>
</tr>
<tr>
<td></td>
<td>c. poor or no collector circuit performance</td>
</tr>
<tr>
<td></td>
<td>d. insufficient heat output to emitter circuit</td>
</tr>
<tr>
<td></td>
<td>e. domestic hot water heat up is satisfactory but space heating is not operating</td>
</tr>
<tr>
<td></td>
<td>f. system noise and/or vibration</td>
</tr>
<tr>
<td>4.5</td>
<td>Undertake post-rectification functional tests in accordance with manufacturer’s guidance, regulatory requirements and industry recognised procedures to confirm that the system is in a safe, functional and efficient condition</td>
</tr>
</tbody>
</table>
T/602/3109 - Know the requirements to install, commission and handover rainwater harvesting and grey water reuse systems

This unit provides learning in health and safety risks and safe systems of work associated with heat pumps, regulations and standards relating to the installation, testing and commissioning, the purpose and characteristics, different types, fundamental principles of selection, design layouts, and the preparation of work needed. On completion of the unit the learner will:

- Know the health and safety risks and safe systems of work associated with rainwater harvesting and greywater reuse system installation work
- Know the requirements of relevant regulations/standards relating to practical installation, testing and commissioning activities for solar thermal hot water system installation work
- Know the types and layouts of rainwater harvesting and greywater reuse system used for single premises installations
- Know the purpose of components used within rainwater harvesting and greywater reuse systems
- Know the information requirements to enable rainwater harvesting and greywater reuse system component selection and sizing
- Know the fundamental techniques used to select, size and position components for rainwater harvesting and greywater reuse systems
- Know options and requirements for the treatment of water in biological, physical, biomechanical and hybrid rainwater harvesting/greywater recycling systems
- Know the preparatory work required for rainwater harvesting and greywater recycling system installation work
- Know the requirements for installing rainwater harvesting and greywater reuse storage tanks
- Know the requirements for installing rainwater harvesting and greywater recycling system pipework
- Know the requirements to test and commission rainwater harvesting and greywater re-use system installations
- Know the requirements to handover rainwater harvesting and greywater recycling systems.

**Learning Outcome 1**

Know the health and safety risks and safe systems of work associated with rainwater harvesting and greywater reuse system installation work

**Assessment Criteria**

1.1 Confirm which aspects of rainwater harvesting and greywater reuse system installation work pose risk of: electrocution/electric shock
   - electrocution/electric shock
   - infection
   - toxic poisoning
   - asphyxiation
   - personal injury though component/equipment handling
### Learning Outcome 1  Continued

**Know the health and safety risks and safe systems of work associated with rainwater harvesting and greywater reuse system installation work**

#### Assessment Criteria

1.2 Confirm safe systems of work for rainwater harvesting and greywater reuse system installation work in relation to prevention of: electrocution/electric shock
   - a. electrocution/electric shock
   - b. infection
   - c. toxic poisoning
   - d. asphyxiation
   - e. personal injury though component/equipment handling

### Learning Outcome 2

**Know the requirements of relevant regulations/standards relating to practical installation, testing and commissioning activities for rainwater harvesting and greywater reuse system installation work**

#### Assessment Criteria

2.1 Interpret building regulation/building standards guidance documentation as relevant to rainwater harvesting and greywater reuse system installation work to identify the requirements in relation to: maintaining the structural integrity of the building
   - a. maintaining the fire resistant integrity of the building
   - b. the prevention of moisture ingress (building water tightness)
   - c. notification of work requirements
   - d. energy conservation
   - e. roof drainage system installation
   - f. rainwater and greywater storage tank installation
   - g. cold water supply requirements
     - water quality
     - water efficiency
   - h. compliance certification

2.2 Interpret industry recognised water regulation/byelaw guidance documentation as relevant to rainwater harvesting and greywater reuse system installation work to identify the requirements in relation to: the physical installation of the system
   - a. notification of the work
   - b. backflow and contamination prevention requirements
   - c. marking and labelling requirements
   - d. use of the harvested/reused water
## Learning Outcome 3
Know the types and layouts of rainwater harvesting and greywater reuse system used for single premises installations

### Assessment Criteria

3.1 Identify the following rainwater harvesting systems types:
   a. gravity supply
   b. direct pumped
   c. pumped to storage cistern
   d. gravity distribution

3.2 Identify the following greywater reuse systems types:
   a. direct reuse
   b. short retention
   c. basic physical/chemical
   d. biological
   e. bio-mechanical
   f. hybrid

3.3 Confirm where in system layouts the following backflow prevention arrangements for wholesome back up water supply are required:
   a. type AA air gap
   b. type AB air gap

## Learning Outcome 4
Know the purpose of components used within rainwater harvesting and greywater reuse systems

### Assessment Criteria

4.1 Confirm the purpose of the following rainwater harvesting and greywater reuse system components: outside air/water
   a. anti-surge valve
   b. calmed inlet
   c. inlet filter
   d. level sensor/float switch
   e. module (including pump and air gap)
   f. pump control unit
   g. system control unit
   h. expansion vessel (direct systems)
   i. water level gauge.

## Learning Outcome 5
Know the information requirements to enable rainwater harvesting and greywater reuse system component selection and sizing

### Assessment Criteria

5.1 Confirm the information requirements in relation to:
   a. building design
   b. building dimensions
   c. building location and orientation
   d. building fabric/material details
   e. existing wholesome water supply systems
   f. existing rainwater and waste water systems
   g. proposed use of the harvested rainwater/greywater
Learning Outcome 5  Continued
Know the information requirements to enable rainwater harvesting and greywater reuse system component selection and sizing

Assessment Criteria

5.2  Confirm the information requirements in relation to:
   a. building occupancy
   b. demand/usage
   c. any special features

Learning Outcome 6
Know the fundamental techniques used to select, size and position components for rainwater harvesting and greywater reuse systems

Assessment Criteria

6.1  Confirm how to determine the storage capacity (litres) of a greywater reuse system within a single premises using the simplified approach in relation to: ground ‘closed’ loop horizontal
   a. occupancy
   b. greywater yield
   c. greywater demand/usage

6.2  Confirm how to determine the storage capacity (litres) of a rainwater harvesting system within a single premises using the simplified approach in relation to: suitable pipework materials
   a. roof plan area (tiled pitched roofs)
   b. average annual rainfall depth for the location
   c. building occupancy

6.3  Confirm which materials are typically suitable for the manufacture of rainwater harvesting and greywater reuse tanks and cisterns suitable pipework materials

6.4  Confirm the requirements for durability in relation to the materials selected for rainwater harvesting and greywater reuse system tanks and components single circuit ‘closed’ loop collector circuits

6.5  Confirm the design requirements for rainwater harvesting and greywater reuse storage tank/cistern installation in relation to: single circuit collector circuits
   a. prevention of stagnation of the stored water
   b. provision of covers and vents
   c. prevention of contamination/microbial growth
   d. keeping the stored water dark and cold
   e. provision and sizing of an overflow
   f. prevention of surcharging via overflow pipework
   g. termination of overflows from rainwater harvesting storage tanks
   h. termination of overflows from greywater reuse storage tanks
   i. proximity to trees
   j. contaminated ground
   k. groundwater levels
   l. ground strength and stability
   m. proximity to utilities and foundations

6.6  Confirm the options for providing a back-up water supply within a rainwater harvesting or greywater reuse system
Learning Outcome 6  Continued

Know the fundamental techniques used to select, size and position components for rainwater harvesting and greywater reuse systems

Assessment Criteria

6.7 Confirm the requirements of pump installation within a rainwater harvesting or greywater reuse system in relation to:
   a. prevention of dry-running
   b. prevention of sound and vibration transfer
   c. prevention of overheating
   d. provision of non-return valves
   e. provision of isolating valves
   f. provision of a pump failure alarm
   g. provision of controls
   h. provision of monitoring

6.8 Confirm which materials are suitable for rainwater harvesting and greywater reuse system collection and distribution pipework and fittings

6.9 State typical collection and distribution system pipe sizes for rainwater harvesting and greywater reuse systems for pipework between the storage tank and the system control unit.

Learning Outcome 7

Know options and requirements for the treatment of water in biological, physical, biomechanical and hybrid rainwater harvesting/greywater recycling systems

Assessment Criteria

7.1 State when the inclusion of a water treatment arrangement in rainwater harvesting and greywater recycling systems: ground ‘open’ loop vertical borehole
   a. is a regulatory requirement
   b. may be beneficial or good practice

7.2 Confirm the working principles of a UV disinfection system

7.3 Confirm the typical installation arrangements for a UV disinfection system in relation to:
   a. water sample points
   b. filters
   c. flow restrictors
   d. isolation valves

7.4 Confirm the options for the chemical treatment of water in rainwater harvesting and greywater recycling systems.

Learning Outcome 8

Know the preparatory work required for rainwater harvesting and greywater recycling system installation work

Assessment Criteria

8.1 State the requirements in relation to: operating noise (including the potential effect on neighbouring properties)
   a. authorisation for the work to proceed
   b. the availability of appropriate access to all required work areas
### Learning Outcome 8  Continued

Know the preparatory work required for rainwater harvesting and greywater recycling system installation work

**Assessment Criteria**

8.2 Confirm the requirements of pre-installation checks in relation to the:
   a. suitability of the proposed installation in relation to:
      - yield
      - usage
   b. suitability of the building structure and the building fabric in relation to the installation of system components
   c. inspection of the existing water supply installation
   d. inspection of the existing rainwater and/or greywater installation
   e. availability of a suitable electrical input service
   f. proposed siting of key internal system components.

### Learning Outcome 9

Know the requirements for installing rainwater harvesting and greywater reuse storage tanks

**Assessment Criteria**

9.1 Confirm the requirements to maintain the structural integrity of the tank if holes need to be cut within a storage tank during the installation process

9.2 Confirm the requirements for mounting and supporting above ground tanks and cisterns.

### Learning Outcome 10

Know the requirements for installing rainwater harvesting and greywater recycling system pipework

**Assessment Criteria**

10.1 Confirm the requirement of the connection arrangement where rainwater and greywater overflow and drainage pipework connects to the underground drainage system

10.2 Confirm which jointing methods are acceptable for rainwater and greywater pipework collection pipework

10.3 Confirm which jointing methods are acceptable for rainwater and greywater pipework distribution pipework.

### Learning Outcome 11

Know the requirements to test and commission rainwater harvesting and greywater re-use system installations

**Assessment Criteria**

11.1 Confirm the requirements to prepare for testing and commissioning in relation to:
   a. compliance with the system design and specification
   b. compliance with system/component manufacturer requirements
   c. suitability of electrical supply circuit arrangements
   d. flushing the system of installation debris
   e. filling the storage tank
   f. provision of marking and labelling to system pipework and components
### Learning Outcome 11  Continued

<table>
<thead>
<tr>
<th>Knowledge Requirement</th>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Know the requirements to test and commission rainwater harvesting and greywater re-use system installations</td>
<td>11.2 Confirm the testing requirements for hydraulic testing of the distribution system in relation to:</td>
</tr>
<tr>
<td></td>
<td>b. test duration</td>
</tr>
<tr>
<td></td>
<td>c. permitted leakage</td>
</tr>
<tr>
<td></td>
<td>d. pass criteria</td>
</tr>
<tr>
<td></td>
<td>11.3 Confirm the test procedure to check that cross-connections have not been introduced</td>
</tr>
<tr>
<td></td>
<td>11.4 Confirm the typical commissioning requirements for a rainwater harvesting system installation in relation to:</td>
</tr>
<tr>
<td></td>
<td>b. setting of mechanical controls</td>
</tr>
<tr>
<td></td>
<td>c. setting of electrical controls</td>
</tr>
<tr>
<td></td>
<td>d. system functional tests</td>
</tr>
<tr>
<td></td>
<td>e. water quality checks</td>
</tr>
<tr>
<td></td>
<td>11.5 Confirm the commissioning requirements for a greywater re-use system installation in relation to:</td>
</tr>
<tr>
<td></td>
<td>b. setting of mechanical controls</td>
</tr>
<tr>
<td></td>
<td>c. setting of electrical controls</td>
</tr>
<tr>
<td></td>
<td>d. system functional tests</td>
</tr>
<tr>
<td></td>
<td>e. water quality checks</td>
</tr>
<tr>
<td></td>
<td>11.6 State the recording requirements for the commissioning of rainwater harvesting and greywater re-use system installations.</td>
</tr>
</tbody>
</table>

### Learning Outcome 12

<table>
<thead>
<tr>
<th>Knowledge Requirement</th>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Know the requirements to handover rainwater harvesting and greywater recycling systems</td>
<td>12.1 Confirm the pre-handover checks that need to be carried out</td>
</tr>
<tr>
<td></td>
<td>12.2 Confirm industry handover procedures in relation to the: provision of written information</td>
</tr>
<tr>
<td></td>
<td>b. provision of diagrammatic information</td>
</tr>
<tr>
<td></td>
<td>c. provision of verbal information/demonstration relating to system operation and use.</td>
</tr>
</tbody>
</table>
K/602/3110 - Install, commission and hand over rainwater harvesting and greywater reuse systems

The unit focuses upon the occupational competence required to demonstrate occupational competence in how to plan and prepare for installation. To install, test, commission, and hand over rainwater harvesting and greywater systems. On completion of the unit the learner will:

- Be able to plan and prepare for the installation of rainwater harvesting and greywater reuse systems
- Be able to install rainwater harvesting and greywater reuse system components
- Be able to test and commission rainwater harvesting and greywater reuse systems
- Be able to handover rainwater harvesting and greywater reuse systems.

<table>
<thead>
<tr>
<th>Learning Outcome 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be able to plan and prepare for the installation of rainwater harvesting and greywater reuse systems.</td>
</tr>
</tbody>
</table>

**Assessment Criteria**

1.1 Undertake pre-installation checks for a rainwater harvesting or greywater reuse system installation to include checks relating to: yield
   a. the suitability of the proposed installation in relation to:
      - yield
      - usage
      - any special features
   b. the suitability of the building structure and the building fabric in relation to the installation of
   c. system components
   d. the inspection of the existing water supply installation
   e. the inspection of the existing rainwater and/or greywater installation
   f. the availability of a suitable electrical input service
   g. the proposed siting of key internal system components

1.2 Confirm that the tools, materials and equipment required for the installation work are available and are in a safe usable condition.

<table>
<thead>
<tr>
<th>Learning Outcome 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be able to install rainwater harvesting and greywater reuse system components.</td>
</tr>
</tbody>
</table>

**Assessment Criteria**

2.1 Install in accordance with manufacturer’s guidance, regulatory requirements and industry recognised procedures, key system components on either a rainwater harvesting or greywater reuse system to include as a minimum the positioning, fixing and connection of the following components: the suitability of the proposed installation in relation to:
   a. storage tank (connection to tank only)
   b. system control unit (water connections only)
   c. pump
### Learning Outcome 3

Be able to test and commission rainwater harvesting and greywater reuse systems.

#### Assessment Criteria

3.1 Prepare a rainwater harvesting or greywater reuse system for testing and commissioning to include checks/actions to:
   - a. confirm compliance with the system design and specification
   - b. confirm compliance with system/component manufacturer requirements
   - c. confirm the suitability of electrical supply circuit arrangements
   - d. flushing the system of installation debris
   - e. filling the storage tank
   - f. confirm the provision of appropriate marking and labelling to system pipework and components

3.2 Test a rainwater harvesting or greywater reuse distribution system for hydraulic soundness using appropriate test equipment in accordance with manufacturer’s guidance, regulatory requirements and industry recognised procedures.

3.3 Undertake the relevant test procedure to check that cross-connections have not been introduced.

3.4 Identify the commissioning requirements for a rainwater harvesting or greywater reuse installation in relation to:
   - a. the system/component manufacturer(s) requirements
   - b. system design/specification requirements
   - c. the client/end user requirements
   - d. statutory regulations and/or industry recognised procedures

3.5 Commission a rainwater harvesting and greywater reuse system in accordance with manufacturer’s guidance, design requirements, client’s requirements and statutory requirements and/or industry recognised procedures.

3.6 Complete relevant documentation to record the rainwater harvesting or greywater reuse system commissioning activities.

### Learning Outcome 4

Be able to handover rainwater harvesting and greywater reuse systems.

#### Assessment Criteria

4.1 Undertake relevant checks on either a rainwater harvesting or greywater reuse system to ensure that the system is ready for handover and compliant with manufacturer’s guidance, the system design/specification, client’s requirements, regulatory requirements and/or industry recognised requirements.

4.2 Explain and demonstrate to the end user the operation and use of either a rainwater harvesting or greywater reuse system using manufacturer’s guidance and industry agreed handover procedures.

4.3 Identify and explain to the end user any aspects of the rainwater harvesting or greywater reuse system that varies from the agreed specifications and requirements.

4.4 Obtain acceptance by the end user of the rainwater harvesting or greywater reuse system according to the industry agreed handover procedures.

4.5 Ensure that all relevant handover documentation is correctly completed and recorded in the appropriate information systems and passed to the end user in accordance with manufacturer’s guidance and industry recognised procedures.
M/602/3111 - Know the requirements to inspect, service and maintain rainwater harvesting and greywater reuse systems

The unit focuses upon the underpinning knowledge required to enable learners to demonstrate occupational competence in inspection, servicing and maintenance, diagnostic and rectification of faults.

- Know the requirements for the routine service and maintenance of rainwater harvesting and reuse systems
- Know how to diagnose faults in rainwater harvesting and greywater reuse systems
- Know how to rectify faults in rainwater harvesting and greywater reuse systems

<table>
<thead>
<tr>
<th>Learning Outcome 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Know the requirements for the routine service and maintenance of rainwater harvesting and reuse systems.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Confirm which documentation needs to be available to enable routine service and maintenance work on rainwater harvesting and greywater reuse systems.</td>
</tr>
<tr>
<td>1.2 Confirm the typical routine service and maintenance requirements for a rainwater harvesting system in relation to:</td>
</tr>
<tr>
<td>a. visual inspection requirements</td>
</tr>
<tr>
<td>b. cleaning of components</td>
</tr>
<tr>
<td>c. functional tests</td>
</tr>
<tr>
<td>1.3 Confirm the typical routine service and maintenance requirements for greywater reuse systems in relation to:</td>
</tr>
<tr>
<td>a. visual inspection requirements</td>
</tr>
<tr>
<td>b. cleaning of components</td>
</tr>
<tr>
<td>c. functional tests</td>
</tr>
<tr>
<td>1.4 Confirm the relevant guideline values for the general monitoring of water quality in rainwater harvesting and greywater reuse systems in relation to:</td>
</tr>
<tr>
<td>a. dissolved oxygen (stored rainwater)</td>
</tr>
<tr>
<td>b. suspended solids</td>
</tr>
<tr>
<td>c. colour</td>
</tr>
<tr>
<td>d. turbidity</td>
</tr>
<tr>
<td>e. pH</td>
</tr>
<tr>
<td>f. residual chlorine</td>
</tr>
<tr>
<td>g. residual bromine</td>
</tr>
<tr>
<td>1.5 State what equipment is required to monitor water quality in rainwater harvesting and greywater reuse systems.</td>
</tr>
<tr>
<td>1.6 Confirm the industry requirements for the recording and reporting of routine service and maintenance work on rainwater harvesting and greywater reuse systems.</td>
</tr>
</tbody>
</table>
### Learning Outcome 2
Know the requirements for the routine service and maintenance of rainwater harvesting and reuse systems.

**Assessment Criteria**

2.1 Confirm the information that needs to be available to enable fault diagnosis.

2.2 Confirm the work action and sequences required to diagnose the following faults: visual inspection requirements:
   - a. poor or no flow into storage tank
   - b. system pump fails to operate
   - c. back-up water supply fails to operate
   - d. water quality is unacceptable
   - e. undue system noise or vibration.

### Learning Outcome 3
Know how to rectify faults in rainwater harvesting and greywater reuse systems.

**Assessment Criteria**

3.1 Confirm the work action and sequences required to rectify the following faults:
   - a. poor or no flow into storage tank
   - b. system pump fails to operate
   - c. back-up water supply fails to operate
   - d. water quality is unacceptable
   - e. undue system noise or vibration
A/602/3130 - Inspect, service and maintain rainwater harvesting and grey water reuse systems

This unit focuses upon the occupational competence required to enable learners to demonstrate inspection, servicing and maintenance, diagnostic and rectification of faults

- Be able to undertake the routine service and maintenance of rainwater harvesting and greywater reuse systems
- Be able to undertake fault diagnosis work on rainwater harvesting and greywater reuse systems installations
- Be able to undertake fault rectification work on rainwater harvesting and greywater reuse systems installations.

### Learning Outcome 1

Be able to undertake the routine service and maintenance of rainwater harvesting and greywater reuse systems

### Assessment Criteria

1.1 Obtain the relevant information required to enable the work poor or no flow into storage tank

1.2 Undertake a visual service and maintenance inspection of a rainwater harvesting or greywater reuse system installation to include checks in relation to:
   a. compliance with manufacturer’s installation instructions
   b. compliance with statutory regulations
   c. condition of system components including cleanliness
   d. correct positioning of system components
   e. security of fixing of system components

1.3 Undertake routine servicing of relevant components on a rainwater harvesting or greywater reuse system to include:
   a. checking the system water levels
   b. checking the system water quality
   c. cleaning of system components
   d. adjustment of system controls

1.4 Undertake routine service and maintenance functional tests on a rainwater harvesting or greywater reuse system to confirm:
   a. safe operation
   b. efficient operation
   c. the correct functioning of system components/controls

1.5 Complete the relevant service and maintenance records in accordance with industry recognised procedures
### Learning Outcome 2

Be able to undertake fault diagnosis work on rainwater harvesting and greywater reuse systems installations

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2.1</strong> Obtain the relevant information required to enable the fault diagnosis work.</td>
</tr>
<tr>
<td><strong>2.2</strong> Diagnose the cause of a minimum of four separate faults on a rainwater harvesting and/or greywater reuse system from the following list:</td>
</tr>
<tr>
<td>a. Poor or no flow into storage tank</td>
</tr>
<tr>
<td>b. System pump fails to operate</td>
</tr>
<tr>
<td>c. Back-up water supply fails to operate</td>
</tr>
<tr>
<td>d. Water quality is unacceptable</td>
</tr>
<tr>
<td>e. Undue system noise or vibration</td>
</tr>
<tr>
<td><strong>2.3</strong> Agree with the relevant person(s) fault rectification procedures for the faults identified</td>
</tr>
</tbody>
</table>

### Learning Outcome 3

Be able to undertake fault rectification work on rainwater harvesting and greywater reuse systems installations

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3.1</strong> Obtain the relevant information required to enable the fault rectification work</td>
</tr>
<tr>
<td><strong>3.2</strong> Take relevant precautionary actions to prevent unauthorised use of the system prior to or during the fault rectification work</td>
</tr>
<tr>
<td><strong>3.3</strong> Take relevant precautionary actions to minimise the risk of injury to self or others during the fault rectification work</td>
</tr>
<tr>
<td><strong>3.4</strong> Rectify a minimum of two separate faults on a rainwater harvesting and/or greywater reuse system from the following list:</td>
</tr>
<tr>
<td>a. Poor or no flow into storage tank</td>
</tr>
<tr>
<td>b. System pump fails to operate</td>
</tr>
<tr>
<td>c. Back-up water supply fails to operate</td>
</tr>
<tr>
<td>d. Water quality is unacceptable</td>
</tr>
<tr>
<td>e. Undue system noise or vibration</td>
</tr>
<tr>
<td><strong>3.5</strong> Undertake post-rectification functional tests in accordance with manufacturer’s guidance, regulatory requirements and industry recognised procedures to confirm that the system is in a safe, functional and efficient condition</td>
</tr>
</tbody>
</table>
Assessment of Requirements for Individual Units

L1 Generic Units

Unit Ref: Y/502/8180 – Understand fundamental scientific principles within building services engineering

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.

Unit Ref: K/505/9403 – Understand and carry out copper pipe fabrication work for domestic plumbing systems

To achieve the completion of this combination unit, you must satisfactorily complete the applicable knowledge assessment for the knowledge learning outcomes within the unit. You must also complete the appropriate practical performance activities in simulated conditions as per the requirements for the unit as specified in the BPEC Qualification manual.

Unit Ref: K/505/9417 – Understand and carry out low carbon steel pipe fabrication work for domestic plumbing systems

To achieve the completion of this combination unit, you must satisfactorily complete the applicable knowledge assessment for the knowledge learning outcomes within the unit. You must also complete the appropriate practical performance activities in simulated conditions as per the requirements for the unit as specified in the BPEC Qualification manual.

Unit Ref: M/505/9418 – Understand and carry out plastic pipe fabrication work for domestic plumbing systems

To achieve the completion of this combination unit, you must satisfactorily complete the applicable knowledge assessment for the knowledge learning outcomes within the unit. You must also complete the appropriate practical performance activities in simulated conditions as per the requirements for the unit as specified in the BPEC Qualification manual.

Unit Ref: K/505/9420 – Understand the key features of domestic plumbing systems

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.

Unit Ref: T/505/9419 – Understand and demonstrate techniques for installing and securing plumbing pipework

To achieve the completion of this combination unit, you must satisfactorily complete the applicable knowledge assessment for the knowledge learning outcomes within the unit. You must also complete the appropriate practical performance activities in simulated conditions as per the requirements for the unit as specified in the BPEC Qualification manual.
L2 Generic Units

Unit Ref: J/602/2479 – Understand and carry out safe working practices in building services engineering

To achieve the completion of this combination unit, you must satisfactorily complete the applicable knowledge assessment for the knowledge learning outcomes within the unit. You must also complete the appropriate practical performance activities in simulated conditions as per the requirements for the unit as specified in the BPEC Qualification manual.

Unit Ref: J/602/2482 – Understand how to communicate with others within Building Services Engineering

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.

Unit Ref: D/602/2486 – Understand how to apply environmental protection measures within Building Services Engineering

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.

Unit Ref: J/602/2496 – Understand how to apply scientific principles within MES

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.

Unit Ref: D/602/2682 – Understand and carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems

To achieve the completion of this combination unit, you must satisfactorily complete the applicable knowledge assessment for the knowledge learning outcomes within the unit. You must also complete the appropriate practical performance activities in simulated conditions as per the requirements for the unit as specified in the BPEC Qualification manual.

Unit Ref: H/602/2697 – Understand and apply domestic cold water system installation 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. You must also complete the appropriate practical performance activities in simulated conditions as per the requirements for the unit as specified in the BPEC Qualification manual.

Unit Ref: F/602/2884 – Understand and apply domestic hot water system installation 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. You must also complete the appropriate practical performance activities in simulated conditions as per the requirements for the unit as specified in the BPEC Qualification manual.
Unit Ref: Y/602/2888 – Understand and apply domestic central heating system installation 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. You must also complete the appropriate practical performance activities in simulated conditions as per the requirements for the unit as specified in the BPEC Qualification manual.

Unit Ref: F/602/2917 – Understand and apply domestic rainwater system installation 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. You must also complete the appropriate practical performance activities in simulated conditions as per the requirements for the unit as specified in the BPEC Qualification manual.

Unit Ref: J/602/2921 – Understand and apply domestic above ground drainage system installation 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. You must also complete the appropriate practical performance activities in simulated conditions as per the requirements for the unit as specified in the BPEC Qualification manual.

Unit Ref: T/602/2493 – Apply safe working practices in building services engineering working environment

To achieve the completion of this performance unit, you must provide satisfactory evidence of having met the requirements of the Learning Outcomes and Assessment Criteria from a real working environment.

Unit Ref: D/602/2939 – Install and Maintain domestic plumbing and heating systems

To achieve the completion of this performance unit, you must provide satisfactory evidence of having met the requirements of the Learning Outcomes and Assessment Criteria from a real working environment. The performance based learning outcomes for this unit will be assessed by utilising practical activities in a real working environment, for at least 3 of the following 5 types of plumbing system (cold water, hot water, central heating, rainwater and above ground drainage) at a minimum of two separate work locations and on a minimum of two occasions.

Unit Ref: R/602/2971 – Install and Maintain domestic heating systems

To achieve the completion of this performance unit, you must provide satisfactory evidence of having met the requirements of the Learning Outcomes and Assessment Criteria from a real working environment. The performance based learning outcomes for this unit will be assessed by utilising practical activities in a real working environment, for at least 2 of the following 3 types of heating system (open vented heating system, sealed heating system, open vented hot water system) at a minimum of two separate work locations and on a minimum of two occasions.
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.
Unit Ref: K/502/9298 – Install, commission, service and maintain domestic plumbing and heating systems

To achieve the completion of this performance unit, you must provide satisfactory evidence of having met the requirements of the Learning Outcomes and Assessment Criteria from a real working environment. The performance based learning outcomes for this unit will be assessed by utilising practical activities in a real working environment, for at least 2 of the following 5 types of plumbing system (cold water, hot water, central heating, rainwater and above ground drainage) at a minimum of two separate work locations and on a minimum of two occasions.

Unit Ref: A/502/8933 - Install, commission, service and maintain domestic heating systems

To achieve the completion of this performance unit, you must provide satisfactory evidence of having met the requirements of the Learning Outcomes and Assessment Criteria from a real working environment. The performance based learning outcomes for this unit will be assessed by utilising practical activities in a real working environment for at least 2 domestic central heating and hot water systems in at least 2 separate work locations.
L3 Gas units

Unit Ref: J/502/9390 – Understand core gas safety principles for natural gas within domestic building services engineering

To achieve the completion of this knowledge unit, you must satisfactorily complete the applicable knowledge assessments for the knowledge learning outcomes within the unit.

Unit Ref: H/502/8487 – Specific Core Installation and Maintenance

To achieve the completion of this combination unit, you must satisfactorily complete the applicable knowledge assessments for the knowledge learning outcomes within the unit. You must also complete the appropriate practical performance activities under simulated conditions as per the requirements for the unit as specified in the BPEC Qualification manual. Any additional criteria not assessed during practical performance activities under simulated conditions must be assessed in the real working environment.

Unit Ref: T/502/8381 – Install, commission and de-commission gas pipework up to 35mm 1¼ diameter in domestic and small commercial premises

A minimum of one assessment conducted in the workplace is required for this unit and one ‘in-centre’ performance assessment provided by BPEC Certification Ltd. The remaining assessment of experience should be carried out in the workplace (See below for the Gas Utilisation Specific Assessment Strategy (Appendix F) for full assessment requirements).

<table>
<thead>
<tr>
<th>UNIT ASSESSMENT REQUIREMENTS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Assessments must be carried out as documented in this table</td>
</tr>
<tr>
<td>• Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RANGE</th>
<th>RWE ASSESSMENT</th>
<th>ASSESSMENT OF EXPERIENCE</th>
<th>WORKPLACE ASSESSMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Range:</strong></td>
<td></td>
<td>Evidence of experience undertaking the satisfactory tightness testing and purging is required across the documented ranges.</td>
<td></td>
</tr>
<tr>
<td>Copper Tube</td>
<td></td>
<td></td>
<td>At least 5 (^1) separate installation occasions must occur with the Learner demonstrating experience across the Assessment Criteria on each occasion.</td>
</tr>
<tr>
<td>Steel Tube</td>
<td></td>
<td></td>
<td>At least 3 (^1) of the installation occasions must be from the workplace.</td>
</tr>
<tr>
<td>Corrugated Stainless Steel Tube (CSST)</td>
<td></td>
<td></td>
<td>One Successful Assessment</td>
</tr>
<tr>
<td>Polyethylene Tube (PE)</td>
<td></td>
<td></td>
<td>One Successful Assessment</td>
</tr>
<tr>
<td><strong>Secondary Range:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Through Walls</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under Wooden Floors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface Mounted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capillary Joints</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compression Joints</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSST Joints</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screwed Joints</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formed Bends</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table Notes:

\(^1\) The documented numbers required to be evidenced do include the assessment occasions.
**Unit Ref: D/503/8628 – Tightness test, purge, commission and de-commission gas pipework up to 35mm 1¼ diameter in small natural gas installations.**

A minimum of one assessment conducted in the workplace is required for this unit and one ‘in-centre’ performance assessment provided by BPEC Certification Ltd. The remaining assessment of experience should be carried out in the workplace (See below for the Gas Utilisation Specific Assessment Strategy (Appendix F) for full assessment requirements).

### Unit Assessment Requirements:
- Assessments must be carried out as documented in this table.
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements.

<table>
<thead>
<tr>
<th>Range</th>
<th>RWE Assessment</th>
<th>Assessment of Experience</th>
<th>Workplace Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Range:</strong></td>
<td></td>
<td>Evidence of experience undertaking the satisfactory tightness testing and purging is required across the documented ranges.</td>
<td></td>
</tr>
<tr>
<td>Natural Gas Installations</td>
<td>One Successful Assessment</td>
<td>At least 5(^1) separate installation occasions must occur with the Learner demonstrating experience across the Assessment Criteria on each occasion.</td>
<td>One Successful Assessment (^2)</td>
</tr>
<tr>
<td>LPG Installations</td>
<td></td>
<td>At least 3(^{1}) of the installation occasions must be from the workplace.</td>
<td></td>
</tr>
<tr>
<td><strong>Secondary Range:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purge Natural Gas Installation with Volume ≤ 0.02 m(^3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purge Natural Gas Installation with Volume &gt; 0.02 m(^3) ≤ 0.035 m(^3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Including a Meter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Installation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existing Installation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table Notes:**

1. The documented numbers required to be evidenced do include the assessment occasions.
2. The assessment must be of a different ‘Primary Range’ type than the one utilised as part of the RWE Assessment.
Unit Ref: Y/502/8454– Install domestic gas water heaters and wet central heating appliances

A minimum of one assessment conducted in the workplace is required for this unit and one ‘in-centre’ performance assessment provided by BPEC Certification Ltd. The remaining assessment of experience should be carried out in the workplace (See below for the Gas Utilisation Specific Assessment Strategy (Appendix F) for full assessment requirements).

(Successful completion of the Y/502/8454 knowledge assessments is also required for this unit).

**UNIT ASSESSMENT REQUIREMENTS:**

- Assessments must be carried out as documented in this table
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements

<table>
<thead>
<tr>
<th>RANGE</th>
<th>RWE ASSESSMENT</th>
<th>ASSESSMENT OF EXPERIENCE</th>
<th>WORKPLACE ASSESSMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Range:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Traditional Boiler ¹</td>
<td></td>
<td>Evidence of experience undertaking the satisfactory installation of gas fired boilers is required across the documented ranges.</td>
<td></td>
</tr>
<tr>
<td>- System Boiler ²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Combination Boiler ³</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary Range:</td>
<td>One Successful Assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Room Sealed Fanned Draught Appliance (Horizontal Chimney) <em>(Appliance Type C₁₂ or C₁₃)</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Room Sealed Fanned Draught Appliance (Vertical Chimney) <em>(Appliance Type C₁₂ or C₁₃)</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Condensing Appliance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- New Installation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Installation Exchange</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

One Successful Assessment

Table Notes:

¹ A ‘Traditional Boiler’ for the purpose of this document is deemed to be a boiler where the central heating system controls such as the pump, zone valves and other auxiliary controls are external to the appliance casing as supplied by the manufacturer.

² A ‘System Boiler’ for the purpose of this document is deemed to be a boiler where one or more of the central heating system controls such as the pump, zone valves and other auxiliary controls are internal to the appliance casing as supplied by the manufacturer.

³ A ‘Combination Boiler’ for the purpose of this document is deemed to be a boiler that provides instantaneous hot water to single or multiple hot water outlets, such as taps, with no water storage capacity (other than small quantities that may, by manufacturers design, be stored internally to prevent any delay in hot water delivery).

⁴ At least 3 ⁴ of the installation occasions must be from the workplace.

⁵ The documented numbers required to be evidenced do include the assessment occasions.

⁶ The appliance must be of a different ‘Primary Range’ type than the one utilised as part of the RWE Assessment.
Unit Ref: T/502/8459 – Maintain gas water heating and wet central heating appliances

Routine full service of a gas fired boiler

A minimum of one assessment conducted in the workplace is required for this unit and one ‘in-centre’ performance assessment provided by BPEC Certification Ltd. The remaining assessment of experience should be carried out in the workplace (See below for the Gas Utilisation Specific Assessment Strategy (Appendix F) for full assessment requirements). Successful completion of the T/502/8459 knowledge assessments is also required for this unit.

<table>
<thead>
<tr>
<th>UNIT ASSESSMENT REQUIREMENTS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessments must be carried out as documented in this table</td>
</tr>
<tr>
<td>Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RANGE</th>
<th>RWE ASSESSMENT</th>
<th>ASSESSMENT OF EXPERIENCE</th>
<th>WORKPLACE ASSESSMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Range:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traditional Boiler ¹</td>
<td>One Successful Assessment</td>
<td>Evidence of experience undertaking the satisfactory full servicing of gas fired boilers is required across the documented ranges.</td>
<td>One Successful Assessment</td>
</tr>
<tr>
<td>System Boiler ²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combination Boiler ³</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas Fire and Back Boiler ⁴</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary Range:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open-Flued Natural Draught Appliance (incl. Draught Diverter) (Appliance Type B₁)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Room Sealed Natural Draught Appliance (Appliance Type C₁)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Room Sealed Fanned Draught Appliance (Appliance Type C₂, or C₁₃ or C₁₂ or C₃₂ or C₃₃ or C₅₂ or C₅₃)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condensing Appliance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non Condensing Appliance</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Routine full service of a gas fired instantaneous water heater

There is a requirement to successfully complete one ‘in-centre’ performance assessment provided by BPEC Certification Ltd. The remaining assessment of experience should be carried out in the workplace (See below for the Gas Utilisation Specific Assessment Strategy (Appendix F) for full assessment requirements).

<table>
<thead>
<tr>
<th>UNIT ASSESSMENT REQUIREMENTS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessments must be carried out as documented in this table</td>
</tr>
<tr>
<td>Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RANGE</th>
<th>RWE ASSESSMENT</th>
<th>ASSESSMENT OF EXPERIENCE</th>
<th>WORKPLACE ASSESSMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Range:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multipoint Water Heater</td>
<td>One Successful Assessment</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Identify and repair faults on gas fired boilers and instantaneous water heaters

There is a requirement to successfully complete one ‘in-centre’ performance assessment provided by BPEC Certification Ltd. The remaining assessment of experience should be carried out in the workplace (See below for the Gas Utilisation Specific Assessment Strategy (Appendix F) for full assessment requirements).

UNIT ASSESSMENT REQUIREMENTS:

- Assessments must be carried out as documented in this table
- Learners must demonstrate sufficient evidence of competence through experience of satisfactorily undertaking the work activities documented across the full range. This shall be evidenced via the Learners Portfolio and be assessed as meeting the minimum documented requirements

<table>
<thead>
<tr>
<th>RANGE</th>
<th>RWE ASSESSMENT</th>
<th>ASSESSMENT OF EXPERIENCE</th>
<th>WORKPLACE ASSESSMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Range:</strong></td>
<td></td>
<td>Evidence of experience undertaking the identification and repairing of faults on gas fired boilers and instantaneous water heaters is required across the documented ranges.</td>
<td>N/A</td>
</tr>
<tr>
<td>Traditional Boiler 1</td>
<td></td>
<td>At least 4 separate fault rectification occasions must occur with the Learner demonstrating experience the Assessment Criteria on each occasion.</td>
<td></td>
</tr>
<tr>
<td>System Boiler 2</td>
<td></td>
<td>At least 2 of the fault rectification occasions must be from the workplace.</td>
<td></td>
</tr>
<tr>
<td>Multipoint Water Heater</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Secondary Range:</strong></td>
<td>One Successful Assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open-Flued or Room Sealed Natural Draught Appliance (Appliance Type B1, or C1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open-Flued or Room Sealed Fanned Draught Appliance (Appliance Type B12, or B13 or B14 or C12 or C13 or C131)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas Safety Control Defect 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical Control Defect 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Control Defect 7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table Notes:

1. A ‘Traditional Boiler’ for the purpose of this document is deemed to be a boiler where the central heating system controls such as the pump, zone valves and other auxiliary controls are external to the appliance casing as supplied by the manufacturer.
2. A ‘System Boiler’ for the purpose of this document is deemed to be a boiler where one or more of the central heating system controls such as the pump, zone valves and other auxiliary controls are internal to the appliance casing as supplied by the manufacturer.
3. A ‘Combination Boiler’ for the purpose of this document is deemed to be a boiler that provides instantaneous hot water to single or multiple hot water outlets, such as taps, with no water storage capacity (other than small quantities that may, by manufacturers design, be stored internally to prevent any delay in hot water delivery).
4. A ‘Gas Fire and Boiler’ for the purpose of this document is deemed to be a boiler, not a back circulator, that is connected to a flexible flue liner and has a gas fire connected to the front of the appliance.
5. The documented numbers required to be evidenced do include the assessment occasions.
6. The appliance must be of a different ‘Primary Range’ type than that the one utilised as part of the RWE Assessment.
7. The defects listed are ‘Appliance Defects’ and relate to controls within the appliance casing and do not refer to defects on controls on the heating or hot water systems.
L3 Environmental Technology units

Unit Ref: K/602/3138 Understand the Fundamental Principles and Requirements of Environmental Technology Systems

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

L3 Solar Thermal units

Unit Ref: F/602/3100 Know the requirements to install, commission and handover solar thermal hot water systems

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

Unit Ref: L/602/3102 Install, commission and handover ‘active’ solar thermal hot water systems

To achieve the completion of this performance unit you must:

- complete the appropriate practical performance activities in simulated conditions as per the requirements for unit EVTSST-03 as specified in the BPEC Practical Assessment manual for this qualification.

Or

- provide satisfactory evidence of having met the requirements of the Learning Outcomes and Assessment Criteria from a real working environment.

Unit Ref: Y/602/3104 Know the requirements to inspect, service and maintain ‘active’ solar thermal hot water systems

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

Unit Ref: K/602/3107 Inspect, service and maintain ‘active’ solar thermal hot water systems

To achieve the completion of this performance unit you must:

- complete the appropriate practical performance activities in simulated conditions as per the requirements for unit EVTSST-03 as specified in the BPEC Practical Assessment manual for this qualification.

Or

- provide satisfactory evidence of having met the requirements of the Learning Outcomes and Assessment Criteria from a real working environment.
L3 Heat Pumps units

Unit Ref: Y/602/3054 Know the requirements to install, commission and handover heat pump systems non-refrigerant circuits

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

Unit Ref: D/602/3072 Install, commission and handover heat pumps non-refrigerant

To achieve the completion of this performance unit you must:

- complete the appropriate practical performance activities in simulated conditions as per the requirements for unit Y/602/3054 as specified in the BPEC Practical Assessment manual for this qualification.

Or

- provide satisfactory evidence of having met the requirements of the Learning Outcomes and Assessment Criteria from a real working environment

Unit Ref: F/602/3078 Know the requirements to inspect, service and maintain heat pump system installations non-refrigerant circuits

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

Unit Ref: L/602/3083 Inspect, service and maintain heat pump installations non-refrigerant circuits

To achieve the completion of this performance unit you must:

- complete the appropriate practical performance activities in simulated conditions as per the requirements for unit F/602/3078 as specified in the BPEC Practical Assessment manual for this qualification.

Or

- provide satisfactory evidence of having met the requirements of the Learning Outcomes and Assessment Criteria from a real working environment.
L3 Rainwater Harvesting and Greywater Reuse units

Unit Ref: T/602/3109 Know the requirements to install, commission and handover rainwater harvesting and greywater reuse systems

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

Unit Ref: K/602/3110 Install, commission and handover rainwater harvesting and greywater reuse systems

To achieve the completion of this performance unit you must:

- complete the appropriate practical performance activities in simulated condition as per the requirements for unit K/602/3110 as specified in the BPEC Practical Assessment manual for this qualification.

Or

- provide satisfactory evidence of having met the requirements of the Learning Outcomes and Assessment Criteria from a real working environment

Unit Ref: M/602/3111 Know the requirements to inspect, service and maintain rainwater harvesting and greywater reuse systems

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

Unit Ref: A/602/3130 Inspect, service and maintain rainwater harvesting and greywater reuse systems

To achieve the completion of this performance unit you must:

- complete the appropriate practical performance activities in simulated conditions as per the requirements for unit A/602/3130 as specified in the BPEC Practical Assessment manual for this qualification.

Or

- provide satisfactory evidence of having met the requirements of the Learning Outcomes and Assessment Criteria from a real working environment
Scheme Documentation

The following documentation will also be supplied by BPEC Certification Ltd. to support the delivery of the L2 and L3 NVQ Diploma Plumbing and Heating qualification.

- Combined qualification assessment manual, including:
  - In centre practical performance assessment guidance
  - In centre practical performance assessment material
  - On the job workplace performance assessment guidance
  - On the job workplace performance guidance material
  - On the job unit evidence checklist
- Knowledge assessment papers and question specifications (centre only)
- Off the job performance training manual
- Portfolio building guidance
- On site assessment guidance
- Tutor delivery support materials
  - Scheme of work and sample lesson plans
  - Full teaching resources for key areas of learning (sample exercises/interactive learning tools)
  - Supporting Powerpoint presentations
  - Links to manufacturer’s and other useful sources of information
- Sample teaching file and learner tracking documentation

Performance Assessments

For all ‘combination units’ learners will be required to successfully complete a summative (performance) assessment. All appropriate information and supporting documentation is contained within the BPEC Qualification manuals for the L1, L2 and L3 Diploma Plumbing Foundation qualifications; the L2 and L3 NVQ Diploma in Plumbing and Heating/L2 and L3 NVQ Diploma in Domestic Heating which applies to the following units:

Level 1 units
- K/505/9403 – Understand and carry out copper pipe fabrication work for domestic plumbing systems
- K/505/9417 – Understand and carry out low carbon steel pipe fabrication work for domestic plumbing systems
- M/505/9418 – Understand and carry out plastic pipe fabrication work for domestic plumbing systems
- T/505/9419 – Understand and demonstrate techniques for installing and securing plumbing pipework

Level 2 units
- J/602/2479 – Understand how to carry out safe working practices in BSE
- D/602/2682 – Understand how to carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems
- H/602/2697 – Understand and apply domestic cold water system installation and maintenance techniques
- F/602/2884 – Understand and apply domestic hot water system installation and maintenance techniques
- Y/602/2888 – Understand and apply domestic central heating installation and maintenance techniques
• F/602/2917 – Understand and apply domestic rainwater system installation and maintenance techniques*
• J/602/2921 – Understand and apply domestic sanitation system installation and maintenance techniques*

*Not applicable to L2 NVQ Diploma in Domestic Heating qualification

Level 3 units

For all ‘combination units’ learners will be required to successfully complete a summative (performance) assessment. A ‘Learner Job Sheet’* (and supporting assessor guidance/rationale) is provided by BPEC Certification Ltd. that sets out the assessment requirements. This information is contained within the BPEC ‘Off the job performance assessment manual’ which applies to units:

• K/502/8930 - Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques
• K/502/9155 - Understand and apply domestic hot water system installation, commissioning, service and maintenance techniques
• M/502/9156 - Understand and apply domestic central heating system installation, commissioning, service and maintenance techniques
• T/502/9157 - Understand and carry out electrical work on domestic plumbing and heating systems and components
• D/502/9296 - Understand and apply domestic sanitation system installation, commissioning, service and maintenance techniques
• H/502/8487 - Specific Core Installation and Maintenance
• T/502/8381 - Install, commission and de-commission gas pipework up to 35mm 1⅞ diameter in domestic and small commercial premises
• D/503/8628 - Tightness test, purge, commission and de-commission gas pipework up to 35mm 1⅞ diameter in small natural gas installations
• Y/502/8454 - Install domestic gas water heaters and wet central heating appliances
• T/502/8459 - Maintain gas water heaters and wet central heating appliances
• L/602/3102 - Install, commission and handover ‘active’ solar thermal hot water systems
• K/602/3107 - Inspect, service and maintain ‘active’ solar thermal hot water systems
• D/602/3072 - Install, commission and handover heat pumps non-refrigerant circuits
• L/602/3083 - Inspect, service and maintain heat pump installations non-refrigerant circuits
• K/602/3110 - Install, commission and handover rainwater harvesting and greywater reuse systems
• A/602/3130 - Inspect, service and maintain rainwater harvesting and greywater reuse systems

*The completed Learner Job Sheet must be retained in the Centre Portfolio only – LEARNER JOB SHEETS MUST NOT BE RETAINED IN THE LEARNER PORTFOLIO

Marking Centre Based Performance Assessments

The learner can be given a maximum of 3 attempts to achieve the centre based performance assessments

1. First Attempt - learners are given a first attempt in all areas of the performance assessment
2. Second Attempt - performance areas not satisfactorily completed will be re-attempted
3. Third Attempt - at the assessors discretion, the learner is re-assessed by oral questioning and/or observing the performance in an attempt to establish competence in all remaining areas.

4. Learners who have not achieved all the assessment criteria 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.

For unit H/502/8487 - (Specific core installation and maintenance) and Y/502/8454 and T/502/8459 - (Install and Maintain Domestic Gas Water Heaters and Wet Central Heating), learners will be required to successfully complete unit summative (performance) assessments. ‘Learner Job Sheets’* (and supporting assessor guidance/rationales) are provided by BPEC Certification Ltd. that sets out the assessment requirements.

*The completed Unit Summative Assessment (Performance) documents must be retained in the Centre Portfolio only until the qualification has been completed. The completed Unit Summative Assessment (Performance) documentation must then be sent to BPEC Certification Ltd when learner certification is claimed – LEARNER UNIT SUMMATIVE ASSESSMENT (PERFORMANCE) DOCUMENTATION MUST NOT BE RETAINED IN THE LEARNER PORTFOLIO

Knowledge and Understanding Assessments

The units listed below all require the learner to complete a unit summative (knowledge) assessment. The knowledge assessments are provided by BPEC Certification Ltd.

The units listed below all require the learner to complete a unit summative (knowledge) assessment. The knowledge assessments (and supporting rationale) are provided by BPEC Certification Ltd.

Level 1 units

- Y/502/8180 – Understand fundamental scientific principles within building services engineering
- K/505/9403 – Understand and carry out copper pipe fabrication work for domestic plumbing systems
- K/505/9417 – Understand and carry out low carbon steel pipe fabrication work for domestic plumbing systems
- M/505/9418 – Understand and carry out plastic pipe fabrication work for domestic plumbing systems
- K/505/9420 – Understand the key features of domestic plumbing systems
- T/505/9419 – Understand and demonstrate techniques for installing and securing plumbing pipework

Level 2 units

- J/602/2479 – Understand how to carry out safe working practices in BSE
- J/602/2482 – Understand how to communicate with others within Building Services Engineering
- D/602/2486 – Understand how to apply environmental protection measures within Building Services Engineering
- J/602/249 – Understand how to apply scientific principles within MES
- D/602/2682 – Understand how to carry out site preparation, and pipework fabrication techniques for domestic plumbing and heating systems
- H/602/2697 – Understand and apply domestic cold water system installation and maintenance techniques
• F/602/2884 – Understand and apply domestic hot water system installation and maintenance techniques
• Y/602/2888 – Understand and apply domestic central heating installation and maintenance techniques
• F/602/2917 – Understand and apply domestic rainwater system installation and maintenance techniques*
• J/602/2921 – Understand and apply domestic sanitation system installation and maintenance techniques*

*Not applicable to L2 NVQ Diploma in Domestic Heating qualification

Level 3 units

• R/602/2498 - Understand how to organise resources within BSE
• K/502/8930 - Understand and apply domestic cold water system installation, commissioning, service and maintenance techniques
• K/502/9155 - Understand and apply domestic hot water system installation, commissioning, service and maintenance techniques
• M/502/9156 - Understand and apply domestic central heating system installation, commissioning, service and maintenance techniques
• T/502/9157 - Understand and carry out electrical work on domestic plumbing and heating systems and components
• D/502/9296 - Understand and apply domestic sanitation system installation, commissioning, service and maintenance techniques
• J/502/9390 - Understand core gas safety principles for natural gas within domestic building services engineering
• H/502/8487 – Specific Core Installation and Maintenance
• Y/502/8454 – Install domestic gas water heaters and wet central heating appliances
• T/502/8459 – Maintain gas water heaters and wet central heating appliances
• K/602/3138 – Understand the Fundamental Principles and Requirements of Environmental Technology Systems
• F/602/3100 – Know the requirements to install, commission and hand over solar thermal hot water systems
• Y/602/3104 – Know the requirements to inspect, service and maintain ‘active’ solar thermal hot water systems
• F/602/3078 – Know the requirements to inspect, service and maintain heat pump system installations non-refrigerant circuits
• Y/602/3054 – Know the requirements to install, commission and handover heat pump systems non-refrigerant circuits
• T/602/3109 - Know the requirements to install, commission and handover rainwater harvesting and greywater reuse systems
• M/602/3111 - Know the requirements to inspect, service and maintain rainwater harvesting and greywater reuse systems
Marking Knowledge Assessments

The pass rate for the knowledge assessments is 80% for the generic plumbing questions and 100% for the environmental and gas questions.

On line exam

1. The learner will complete the first attempt on line.
2. If the learner does not achieve the 100% pass mark, they will be given a second on line attempt at answering any questions answered incorrectly on the first attempt.
3. Providing a level of achievement of 80% for the plumbing questions have been attained, the learner will be deemed as passing the exam.
4. Oral Verification - providing a level of achievement of 80% has been attained for environmental and gas theory, the learner will be orally questioned in an attempt to establish competence in all remaining areas.
5. Learners who have not achieved the 80% pass mark after their second attempt will be deemed to have failed the knowledge assessment. Learners wishing to retake the assessment will be required to re-attempt the full theory exam in its entirety.

Learner Result/Tracker Form

Learner Result/Tracker Forms have been produced for the L1, L2 and L3 Plumbing qualifications. These documents 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/Tracker Form 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.

Unit Evidence Checklists

A Unit Evidence Checklist has been produced for each unit. This document shall be used to record that the learner has completed the unit in a satisfactory manner. Each section of the document shall be completed and the document signed by the learner, the assessor(s) and the internal verifier.

The Unit Evidence Checklist shall be used by the assessor to cross-reference the unit performance criteria to the evidence collected in order to demonstrate learner competence. The Unit Evidence Checklist and the evidence collected shall be retained in the learner portfolio.

Evidence Forms

BPEC Certification Ltd. has designed evidence forms which may be used to capture evidence relating to a learners performance in the workplace. Such evidence may include:

- Assessor feedback to the learner
- Records of supplementary questions posed by the assessor and the learner responses
- Learner feedback – statements made by the learner to clarify their competence
- Witness testimony – statements made by witnesses e.g. supervisor, customer etc. relating to the competence of the learner

These evidence forms are contained in the Qualification Manual and have been designed so that they can be copied/reprinted as many times as is required.
Portfolio Contents

The table below identifies the contents to be retained within the learner and the centre portfolios:

<table>
<thead>
<tr>
<th>Relevant qualifications where recognised prior learning (RPL) is applied</th>
<th>Learner Portfolio</th>
<th>Centre Portfolio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learner result/Tracker form</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Evidence collected e.g. work records, evidence forms</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Knowledge assessment documentation</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Performance assessment documentation (contained in qualification manual)</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Staff Qualification Requirements

Assessors

Plumbing Assessors MUST be vocationally and occupationally competent in the areas they are assessing and have a thorough knowledge of the National Occupational Standards and Units of Assessment.

The assessor must be able to provide appropriate documented evidence that demonstrates they have a minimum of 5 years proven occupational experience in the activities they will be assessing e.g. a signed and dated CV. This verifiable evidence must be at or above the level of competence being assessed.

Where assessors undertake gas assessments in the workplace, and are not supported by a suitable gas operative, then they or their employer must be a member of an appropriate Gas Registration Body in accordance with the Gas Safety (Installation and Use) Regulations. In these circumstances they should also hold suitable insurance for this activity.

Qualifications

Plumbing assessors shall be technically qualified in Plumbing and/or Domestic Heating, and must be able to provide evidence in one or more of the following ways:

- A relevant qualification (e.g. NVQ/SVQ or equivalent in MES Plumbing or H&V Installation (Domestic)
- Registration with the appropriate industry registration body at the relevant occupational level and grade.

Gas assessors MUST be technically qualified in domestic gas installation/maintenance and hold a current certificate of gas safety competence in the areas of gas work they will be assessing that is not more than 5 years old (either current ACS Certificates of Gas Safety Competence or a 6012 S/NVQ are acceptable).

The assessor must also hold one of the following assessor qualifications:

QCF Level 3 Award “Assessing Vocational Related Achievement – in Centres/Colleges or Training Providers” or
QCF Level 3 Certificate “Assessing Vocationally Related Achievement – in Centres/Colleges and The Workplace” or
A1 or D32 /D33 with an Upgrade to A1 as a minimum *
‘Workplace Assessors’ MUST hold:

QCF Level 3 Award “Assessing Competence in the Workplace Environment” or
QCF Level 3 Certificate “Assessing Vocationally Related Achievement – in Centres/Colleges and
The Workplace” or
A2 or D32 with an upgrade to A2 as a minimum*

Assessors holding D units must have evidence of Continuing Professional Development (CPD) to
demonstrate compliance with the A units. Evidence of CPD will be sought by the External Verifier
for all Assessors approved to assess for the centre.

‘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).

Internal Verifiers

Plumbing Internal Verifiers the main focus is with the quality assurance of assessment procedures.
The IV is required to have a minimum of occupational experience evidenced by having a Building
Services Engineering sector related qualification or proven sector competence/experience plus
access to relevant “occupational expertise” to enable them to conduct their role as internal
verifier appropriately. This evidence and access to “occupational expertise” is quality assured by
the Awarding Organisation

Gas internal verifiers should be technically qualified in domestic gas installation / maintenance and
hold a current certificate of gas safety competence in the areas of gas work they will be assessing
that is not more than 5 years old (either current ACS Certificates of Gas Safety Competence or a
6012 S/NVQ are acceptable).

Qualifications

The Internal Verifiers must be able to provide appropriate documented evidence that
demonstrates they have a minimum of 5 years proven occupational experience in the activities
they will be verifying e.g. a signed and dated CV. Particular attention should be paid to providing
evidence of occupational experience in the gas safety critical areas being verified.

Where the Internal Verifiers themselves do not hold a suitable technical qualifications they must
have access to technical expertise from qualified personnel, who hold the relevant qualifications,
to support them where the verification requires technical support and interpretation.

Internal Verifiers must hold the following:

QCF Level 3 Certificate “Assessing Vocationally Related Achievement – in Centres/Colleges and
The Workplace”
QCF Level 4 Award “ Internal Quality assurance of assessment processes and practice” or
QCF Level 4 Certificate “leading the Internal Quality assurance of assessment processes and
practice” or
A1 or D32/D33 with an upgrade to A1 as a minimum*
V1 or D34 with an upgrade to V1 as a minimum*

*The Teaching Qualification for Secondary Education (TQSE) or the Teaching Qualification for
Further Education (TQFE) (which is recognised in Scotland) these awards are acceptable providing
they are the versions that are recognised as equivalents to the A1 award. Internal Verifiers holding
D units must have evidence of CPD to demonstrate compliance with the A and V units.
It is recommended that ‘Candidate Internal Verifiers’ have a clear action plan for achieving the Internal Verifier qualification(s). Internal Verifier approval will be withdrawn if the qualification / units have not been attained within the approved period (18 months).

Continuing Professional Development (CPD)

The occupational competence of assessors and internal verifiers must be updated on a regular basis and be periodically reconfirmed via continuing professional development (CPD) which is recorded by the assessment centres.

It is the responsibility of each assessor and/or Internal Verifier to identify and make use of opportunities for CPD, such as industry conferences, access to trade journals, and SSC 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.

Expert Witness Roles and Responsibilities

- To observe the Learner’s performance undertaking practical assessment tasks in the workplace
- Using the assessment criteria provided, determine whether or not the learner has completed the tasks satisfactorily
- To satisfactorily complete the assessment documentation to reflect the outcomes of the assessment

Expert Witness Competence Requirements

The Expert witness should:

- Be occupationally competent i.e. having up-to-date knowledge of each industry (for the assessment being undertaken), its settings, legislative and regulatory requirements, codes of practice, guidance, working practices and techniques
- Be familiar with the national occupational standards and be able to interpret current working practices and technologies within the area of work
- Evidence from expert witnesses must meet the tests of validity, reliability, authenticity and sufficiency
- Have no conflict of interest in the outcome of their evidence

(It is not necessary for expert witnesses to hold an assessor qualification, as a qualified assessor must assess the performance evidence provided by an expert witness.)
Further Information

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
T 0845 644 6558   F 0845 121 1931   E AOadmin@bpec.org.uk   W www.bpec.org.uk

Annex 1 - Funding

BPEC Certification Ltd. does not provide details on funding as this may vary between regions. Centres should contact the appropriate funding body to check eligibility for funding and any regional/national arrangements which may apply to the centre or learners.

For funding regulatory purposes, learners should not be entered for a qualification of the same type, level and content as that of a qualification they already hold. Please see below for where to find out more about the funding arrangements.

**England**
Skills Funding Agency
Cheylesmore House
Quinton Road
Coventry
CV1 2WT
Email: qualifications@sfa.bis.gov.uk
https://www.gov.uk/government/collections/qualifications-approved-for-public-funding

**Scotland**
Colleges should contact the Scottish Further Education Funding Council, at
www.sfc.ac.uk
Training providers should contact Scottish Enterprise at www.scottish-enterprise.com or one of the Local Enterprise Companies.

**Northern Ireland**
Please contact the Department for Employment and Learning at www.delni.gov.uk

**Wales**
Centres should contact the department for education, lifelong learning and skills:
www.new.wales.gov.uk

Annex 2 – Sector Skills Councils

The Sector Skills Councils have the responsibility for development of the national occupational standards and in many cases, facilitating the development of relevant sector vocational qualifications. Similarly, the Sector Skills Councils formulate the ‘assessment strategy’ for these qualifications, contact details of the relevant Sector Skills Council(s) are shown below:

SummitSkills Limited, Vega House, Opel Drive, Fox Milne, Milton Keynes, MK15 0DF
T: 01908 303960   W: www.summitskills.org.uk