Level 2 Award in Hybrid Electric Vehicle Operation and Maintenance & Level 3 Award in Hybrid Electric Vehicle Repair and Replacement (4290-70/71)

July 2012 Version 1.0
## Qualification at a glance

<table>
<thead>
<tr>
<th>Subject area</th>
<th>Hybrid Electric Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>City &amp; Guilds number</td>
<td>4290</td>
</tr>
<tr>
<td>Age group approved</td>
<td>16+</td>
</tr>
<tr>
<td>Assessment</td>
<td>Assignment</td>
</tr>
<tr>
<td>Fast track</td>
<td>Not available. Full approval applies.</td>
</tr>
<tr>
<td>Support materials</td>
<td>Centre handbook</td>
</tr>
<tr>
<td>Registration and certification</td>
<td>Consult the Walled Garden/Online Catalogue for last dates</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Title and level</th>
<th>City &amp; Guilds number</th>
<th>Accreditation number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 2 Award in Hybrid Electric Vehicle Operation and Maintenance</td>
<td>4290-70</td>
<td>600/5221/1</td>
</tr>
<tr>
<td>Level 3 Award in Hybrid Electric Vehicle Repair and Replacement</td>
<td>4290-71</td>
<td>600/5220/X</td>
</tr>
</tbody>
</table>
## Contents

<table>
<thead>
<tr>
<th>1</th>
<th>Introduction</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Structure</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Centre requirements</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Approval</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Resource requirements</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Candidate entry requirements</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>Delivering the qualification</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Initial assessment and induction</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Support materials</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>Assessment</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>Units</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Unit 722 Automotive Internal Combustion and Electric Hybrid Technology Components and Operation</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Unit 723 Automotive Internal Combustion and Electric Hybrid System Repair and Replacement</td>
<td>15</td>
</tr>
<tr>
<td>Appendix 1</td>
<td>Sources of general information</td>
<td>19</td>
</tr>
</tbody>
</table>
1 Introduction

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

<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who are the qualifications for?</td>
<td>These qualifications are for candidates who need to know more the safety precautions to be taken when working on or near a high voltage hybrid. Therefore, this applies not just to automotive technicians but also, for example, emergency services staff.</td>
</tr>
</tbody>
</table>
| What do the qualifications cover? | As a result of learning, level 2 candidates will have learnt the essential knowledge about:  
  + hybrid system components and operation  
  + how to work safely on hybrid and related vehicle systems  
  + how to work safely around electric vehicles.  
Level 3 candidates will have the essential knowledge for:  
  + taking safety precautions when working on hybrid vehicle systems  
  + using appropriate tools and equipment to carry out hybrid vehicles repairs safely  
  + recording information and making suitable recommendations. |
| What opportunities for progression are there? | They allow candidates to progress into employment or to the following City & Guilds qualifications:  
  + Level 3 Award in Hybrid Electric Vehicle Repair and Replacement  
  + ILM Leadership qualifications |
Structure

To achieve the Level 2 Award in Hybrid Electric Vehicle Operation and Maintenance, learners must achieve 2 credits from unit 722.

To achieve Level 3 Award in Hybrid Electric Vehicle Repair and Replacement, learners must achieve 5 credits from units 722 and 723.

<table>
<thead>
<tr>
<th>Unit accreditation number</th>
<th>City &amp; Guilds unit number</th>
<th>Unit title</th>
<th>Credit value</th>
</tr>
</thead>
<tbody>
<tr>
<td>L/600/3397</td>
<td>722</td>
<td>Automotive Internal Combustion and Electric Hybrid Technology Components and Operation</td>
<td>2</td>
</tr>
<tr>
<td>Y/600/3399</td>
<td>723</td>
<td>Automotive Internal Combustion and Electric Hybrid System Repair and Replacement</td>
<td>3</td>
</tr>
</tbody>
</table>
2 Centre requirements

Approval
There is no fast track approval for this qualification, existing centres who wish to offer this qualification must use the standard Qualification Approval Process.

To offer these qualifications, new centres will need to gain both centre and qualification approval. Please refer to the Centre Manual - Supporting Customer Excellence for further information.

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

Resource requirements
Centres must have access to sufficient equipment in the college, training centre or workplace to ensure candidates have the opportunity to cover all of the practical activities.

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

- be occupationally competent or technically knowledgeable in the area(s) for which they are delivering training and/or have experience of providing training. This knowledge must be to the same level as the training being delivered
- have recent relevant experience in the specific area they will be assessing
- have credible experience of providing training.
- be able to show CPD evidence that they have undertaken hybrid training

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

Assessor and verifiers
While the Assessor/Verifier (A/V) units are valued as qualifications for centre staff, they are not currently a requirement for this qualification.

Continuing professional development (CPD)
Centres must support their staff to ensure that they have current knowledge of the occupational area, that delivery, mentoring, training, assessment and verification is in line with best practice, and that it takes account of any national or legislative developments.
Candidate entry requirements
City & Guilds does not set entry requirements for these qualifications. However, centres must ensure that candidates have the potential and opportunity to gain the qualifications successfully.

Age restrictions
City & Guilds cannot accept any registrations for candidates under 16 as these qualifications are not approved for under 16s.
3 Delivering the qualification

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

- if the candidate has any specific training needs,
- support and guidance they may need when working towards their qualification.
- any units they have already completed, or credit they have accumulated which is relevant to the qualification.
- the appropriate type and level of qualification.

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

Support materials
The following resources are available for these qualifications:

<table>
<thead>
<tr>
<th>Description</th>
<th>How to access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment Pack</td>
<td><a href="http://www.cityandguilds.com">www.cityandguilds.com</a></td>
</tr>
<tr>
<td>Answer Pack</td>
<td><a href="http://www.cityandguilds.com">www.cityandguilds.com</a></td>
</tr>
</tbody>
</table>
4 Assessment

Candidates must:

- successfully complete one assignment for each mandatory unit

City & Guilds has written the following assessments to use with this qualification:

- assignments which are available from the City & Guilds website

<table>
<thead>
<tr>
<th>Unit</th>
<th>Title</th>
<th>Assessment method</th>
</tr>
</thead>
<tbody>
<tr>
<td>722</td>
<td>Automotive Internal Combustion and Electric Hybrid Technology Components and Operation</td>
<td>Assignment</td>
</tr>
<tr>
<td>723</td>
<td>Automotive Internal Combustion and Electric Hybrid System Repair and Replacement</td>
<td>Assignment</td>
</tr>
</tbody>
</table>

**Time constraints**

The following must be applied to the assessment of this qualification:

- Candidates must finish their assessment within their registration period
5 Units

Availability of units
If you want to download a complete set of units, go to www.cityandguilds.com

Structure of units
These units each have the following:
- City & Guilds reference number
- unit accreditation number (UAN)
- title
- level
- credit value
- guided learning hours
- unit aim
- endorsement by a sector or other appropriate body
- learning outcomes which are comprised of a number of assessment criteria

Summary of units

<table>
<thead>
<tr>
<th>Unit</th>
<th>Title</th>
<th>UAN</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>722</td>
<td>Automotive Internal Combustion and Electric Hybrid Technology Components and Operation</td>
<td>L/600/3397</td>
<td>2</td>
</tr>
<tr>
<td>723</td>
<td>Automotive Internal Combustion and Electric Hybrid System Repair and Replacement</td>
<td>Y/600/3399</td>
<td>3</td>
</tr>
</tbody>
</table>
Unit 722  
Automotive Internal Combustion and Electric Hybrid Technology Components and Operation

<table>
<thead>
<tr>
<th>UAN:</th>
<th>L/600/3397</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level:</td>
<td>2</td>
</tr>
<tr>
<td>Credit value:</td>
<td>2</td>
</tr>
<tr>
<td>GLH:</td>
<td>20</td>
</tr>
<tr>
<td>Endorsement by a sector or regulatory body:</td>
<td>This unit is endorsed by IMI, the sector skills council for the automotive retail industry.</td>
</tr>
</tbody>
</table>

Aim: This unit introduces learners to hybrid vehicle technology including, and in particular, the safety requirements of working on vehicles fitted with high voltage hybrid technology.

Learning outcome
The learner will:
1. Know hybrid system components and operation

Assessment criteria
The learner can:
1.1 Identify the components that make up the hybrid system
1.2 Describe the construction and function of battery modules
1.3 Describe the construction and function of hybrid motors
1.4 Describe the construction and function of associated hybrid components

Range
components
• batteries
• motor
• cabling
• control units
• circuit protection
construction and function of battery modules
- types
- capacities
- housings
- materials
- connections
- charging process

construction and function of hybrid motors
- types
- connections
- power rating
- materials
- armatures
- windings

construction and function of associated hybrid components
- cabling
- circuit protection
- control units
- distribution units

Learning outcome
The learner will:
2. Know how to work safely on hybrid and related vehicle systems

Assessment criteria
The learner can:
2.1 State safety precautions to be taken before carrying out routine maintenance
2.2 State safety precautions to be taken before carrying out any repair procedures on hybrid vehicles
2.3 Identify high voltage cabling and associated components
2.4 Describe the precautions required when working with hybrid components

Range
Safety precautions
- overalls
- gloves
- protective footwear
- goggles
- precautions when using electrical equipment
- disposal of waste materials
- dealing with leakage
- isolation of high voltage electrical system
high voltage cabling and associated components

- using wiring diagrams
- wiring colour
- wiring size
- warning signs
- using voltmeters correctly

precautions

- awareness of highly magnetic components
- medical conditions that may be affected by high voltage or magnetic fields
- checking voltage prior to working near or on high voltage systems

Learning outcome

The learner will:

3. Know how to carry out maintenance and repair activities when working on hybrid vehicles

Assessment criteria

The learner can:

3.1 Identify the possibility of the hybrid system affecting repairs on other vehicle systems

3.2 Describe the procedures required to make safe the hybrid system before carrying out repair activities

3.3 Describe the precautions taken prior to removing and replacing high voltage components

3.4 Describe appropriate methods to re-instate vehicles after repairs affecting hybrid systems

3.5 Identify additional tools and equipment required to carry out work on hybrid vehicles

3.6 Describe how to connect an additional 12 volt power source to a hybrid vehicle

Range

possibility of the hybrid system affecting repairs on the other vehicle systems

- connections to other systems
- electro-magnetic interference

procedures

- identification of isolation switches
- preparing vehicle for isolation
- following set procedures

precautions

- check the system is made safe
- check voltage prior to starting work
- make others aware of work being carried out.

methods

- use of fault code readers
- on board displays
Additional tools and equipment
- hand tools
- code readers
- specialist readers
- electrical meters e.g. voltmeters

How to connect additional 12 volt power source
- identification of connections
- correct connection methods
- awareness of current draw capability of vehicle
- use of correct cables
Unit 723  
Automotive Internal Combustion and Electric Hybrid System Repair and Replacement

<table>
<thead>
<tr>
<th>UAN:</th>
<th>Y/600/3399</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level:</td>
<td>3</td>
</tr>
<tr>
<td>Credit value:</td>
<td>3</td>
</tr>
<tr>
<td>GLH:</td>
<td>30</td>
</tr>
</tbody>
</table>

**Endorsement by a sector or regulatory body:**
This unit is endorsed by IMI, the sector skills council for the automotive retail industry.

**Aim:**
This unit enables learners to demonstrate, in a practical way, their knowledge of hybrid vehicle technology and repair procedures. The unit also ensures that the learner is aware of the affect that hybrid technology has on other vehicle systems.

**Learning outcome**
The learner will:
1. Be able to work safely

**Assessment criteria**
The learner can:
1.1 Use suitable **personal protective equipment** throughout all vehicle inspection activities.
1.2 Demonstrate that they work in a way which **minimises the risk of damage** to the vehicle and its systems, other people and their property

**Range**

**Personal protective equipment**
- overalls
- gloves
- protective footwear
- goggles

**Methods to minimise the risk of damage**
- vehicle protection
- precautions when using electrical equipment
- disposal of waste material
- awareness of actions of others
### Learning outcome

The learner will:

2. Be able to use information to carry out the task

### Assessment criteria

The learner can:

2.1 Select suitable **sources of technical information** to support hybrid vehicle repair activities.

2.2 Use suitable sources of technical information to support hybrid vehicle repair activities

#### Range

**sources of technical information**

- manufacturer data
- third party data
- paper based
- electronic
- on vehicle data/warnings
- wiring diagrams
- repair instructions
- bulletins
- verbal instruction

### Learning outcome

The learner will:

3. Be able to use appropriate tools and equipment

### Assessment criteria

The learner can:

3.1 Select appropriate **tools and equipment** to carry out hybrid vehicle repairs

3.2 Demonstrate that **equipment** has been **calibrated** to meet manufacturers’ requirements.

3.3 **Use** the correct **tools and equipment** in the correct way

#### Range

**tools and equipment**

- hand tools
- code readers
- specialist tools
- electrical meters e.g. voltmeter

**Equipment that may be calibrated**

- multimeters
- torque wrenches
- measuring equipment
- manufacturers specialist tools
correct use of tools and equipment
- following manufacturer instructions
- following workplace procedures
- appropriate use of hand tools
- appropriate use of electrical tools
- appropriate use of specialist tools

Learning outcome
The learner will:
4. Know how to carry out hybrid system repairs

Assessment criteria
The learner can:
4.1 Explain the correct procedures required when removing and replacing hybrid system vehicle components
4.2 Explain how to disconnect high voltage supplies correctly e.g. batteries, capacitors

Range
procedures
- observation of H & S
- correct use of PPE
- correct use if tools and equipment
- following repair procedures
- following work place procedures

disconnecting high voltage supplies
- batteries
- motors
- cabling
- control units
- relays
- switches
- charging system
- circuit protection
- associated connectors

Learning outcome
The learner will:
5. Be able to demonstrate hybrid system repairs

Assessment criteria
The learner can:
5.1 Demonstrate the correct procedures to disconnect and reconnect a high voltage battery pack
5.2 Demonstrate the correct procedures to remove and refit a hybrid system component
5.1 Demonstrate appropriate procedures to confirm repairs
5.4 Demonstrate the correct **methods to reset vehicle systems** post-repair eg clear fault codes

<table>
<thead>
<tr>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Components</strong></td>
</tr>
<tr>
<td>• control units</td>
</tr>
<tr>
<td>• motor associated with hybrid operation</td>
</tr>
<tr>
<td>• associated cabling</td>
</tr>
<tr>
<td>• battery pack</td>
</tr>
<tr>
<td><strong>procedures to confirm repairs</strong></td>
</tr>
<tr>
<td>• on vehicle testing</td>
</tr>
<tr>
<td>• checking fault codes</td>
</tr>
<tr>
<td>• voltage checks</td>
</tr>
<tr>
<td>• use of specialist equipment</td>
</tr>
<tr>
<td><strong>methods to reset vehicle systems</strong></td>
</tr>
<tr>
<td>• use of scan tools</td>
</tr>
<tr>
<td>• on board diagnostics</td>
</tr>
<tr>
<td>• use of specialist equipment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>The learner will:</td>
</tr>
<tr>
<td>6. Be able to record information and make suitable recommendations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessment criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>The learner can:</td>
</tr>
<tr>
<td>6.1 Complete <strong>records</strong> accurately, in the format required.</td>
</tr>
<tr>
<td>6.2 Compare inspection and test results with suitable <strong>data</strong></td>
</tr>
<tr>
<td>6.3 Make suitable <strong>recommendations</strong> based upon the results of carrying out the replacement activities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Records</strong></td>
</tr>
<tr>
<td>• job cards</td>
</tr>
<tr>
<td>• warranty records</td>
</tr>
<tr>
<td>• online data transfer</td>
</tr>
<tr>
<td><strong>data</strong></td>
</tr>
<tr>
<td>• wiring diagrams</td>
</tr>
<tr>
<td>• repair instructions</td>
</tr>
<tr>
<td>• bulletins</td>
</tr>
<tr>
<td>• torque settings</td>
</tr>
<tr>
<td>• technical data</td>
</tr>
<tr>
<td><strong>recommendations</strong></td>
</tr>
<tr>
<td>• recommendations for further repairs</td>
</tr>
<tr>
<td>• recommendations for further replacement</td>
</tr>
<tr>
<td>• no further action required</td>
</tr>
<tr>
<td>• recommendations for customer</td>
</tr>
</tbody>
</table>
Appendix 1  Sources of general information

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

Centre Manual - Supporting Customer Excellence contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve ‘approved centre’ status, or to offer a particular qualification, as well as updates and good practice exemplars for City & Guilds assessment and policy issues. Specifically, the document includes sections on:

- The centre and qualification approval process
- Assessment, internal quality assurance and examination roles at the centre
- Registration and certification of candidates
- Non-compliance
- Complaints and appeals
- Equal opportunities
- Data protection
- Management systems
- Maintaining records
- Assessment
- Internal quality assurance
- External quality assurance.

Our Quality Assurance Requirements encompasses all of the relevant requirements of key regulatory documents such as:

- Regulatory Arrangements for the Qualifications and Credit Framework (2008)
- SQA Awarding Body Criteria (2007)
- NVQ Code of Practice (2006)
and sets out the criteria that centres should adhere to pre and post centre and qualification approval.
Access to Assessment & Qualifications provides full details of the arrangements that may be made to facilitate access to assessments and qualifications for candidates who are eligible for adjustments in assessment.

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

- **Walled Garden**: how to register and certificate candidates on line
- **Qualifications and Credit Framework (QCF)**: general guidance about the QCF and how qualifications will change, as well as information on the IT systems needed and FAQs
- **Events**: dates and information on the latest Centre events
- **Online assessment**: how to register for e-assessments.
### Useful contacts

| **UK learners** | **T:** +44 (0)844 543 0033  
**General qualification information**  
E: learnersupport@cityandguilds.com |
| **International learners** | **T:** +44 (0)844 543 0033  
F: +44 (0)20 7294 2413  
E: intcg@cityandguilds.com |
| **Centres** | **T:** +44 (0)844 543 0000  
F: +44 (0)20 7294 2413  
E: centresupport@cityandguilds.com |
| **Single subject qualifications** | **T:** +44 (0)844 543 0000  
F: +44 (0)20 7294 2413  
F: +44 (0)20 7294 2404 (BB forms)  
E: singlesubjects@cityandguilds.com |
| **International awards** | **T:** +44 (0)844 543 0000  
F: +44 (0)20 7294 2413  
E: intops@cityandguilds.com |
| **Walled Garden** | **T:** +44 (0)844 543 0000  
F: +44 (0)20 7294 2413  
E: walledgarden@cityandguilds.com |
| **Employer** | **T:** +44 (0)121 503 8993  
E: business@cityandguilds.com |
| **Publications** | **T:** +44 (0)844 543 0000  
F: +44 (0)20 7294 2413 |

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City & Guilds Group
The City & Guilds Group operates from three major hubs: London (servicing Europe, the Caribbean and Americas), Johannesburg (servicing Africa), and Singapore (servicing Asia, Australia and New Zealand). The Group also includes the Institute of Leadership & Management (management and leadership qualifications), City & Guilds Land Based Services (land-based qualifications), the Centre for Skills Development (CSD works to improve the policy and practice of vocational education and training worldwide) and Learning Assistant (an online e-portfolio).

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