ASSESSMENT CRITERIA FOR IMI ELECTRIC/HYBRID VEHICLE QUALIFICATION (VRQ)

IMI Level 2 Award in Electric/Hybrid Vehicle Hazard Management for Emergency and Recovery Personnel

IMI QUALIFICATION

QFQUAL I.D: 603/1467/9

Note: This guidance is supported by the following documents

- *Oral and Practical Assessments*
- *Candidate Assessment Summary*

Level 2 Award in Electric/Hybrid Vehicle Hazard Management for Emergency and Recovery Personnel (VRQ)

LEARNER ENTRY REQUIREMENTS

Learner entry for this VRQ should be assessed on an individual basis. Selection criteria for entry should take into account each applicant's existing academic/vocational qualifications and experience in working in the retail automotive industry.

Although not mandatory, it is recommended that learners will have 3 GCSEs, or Scottish Standard Grade/Intermediate in Mathematics, English and a Science based subject.

Level 2 Award in Electric/Hybrid Vehicle Hazard Management for Emergency and Recovery Personnel
There are no pre-requisites for this single unit qualification.

Mandatory unit must be completed to achieve the qualification

Unit Ref:	Unit Title & I.D. Number	Unit Level	Guided Learning Hours	Total Qualification Time
EV2.1	Electric/Hybrid Vehicle Hazard Management for Emergency and Recovery Personnel (L/615/7415)	2	13	15

GLH - 13
TQT - 15

LEARNER PROGRESSION

Typical progression routes on completion of this qualification are:

Level 2 Award in Electric/Hybrid Vehicle Routine Maintenance Activities
This award is designed for technicians who maintain and repair electric/hybrid vehicles. It contains the ***knowledge and skills*** required to work safely around a vehicle's high & low voltage electrical system and electric drive train system, whilst carrying out repairs or maintenance. On completion of this qualification, technicians will have gained knowledge of both low and high voltage technologies and an understanding of their dangers.

Or

Level 3 Award in Electric/Hybrid Vehicle Repair and Replacement
This award is designed for technicians who maintain and repair electric/hybrid vehicles. It contains the ***knowledge and skills*** required to work safely in and around the vehicle's high & low voltage electrical system and electric drive train system whilst carrying out repairs or maintenance.

UNIT REF: EV2.1	UNIT TITLE: ELECTRIC/ HYBRID VEHICLE HAZARD MANAGEMENT FOR EMERGENCY AND VEHICLE RECOVERY PERSONNEL

Level: 2	GLH: 13	TQT: 15
Rationale: This unit is designed for those people who may encounter accident damaged or broken down electric/hybrid (all variations) vehicles, e.g. emergency services and roadside recovery operators. It contains the *knowledge* required to work safely around a vehicle that may have or had damage to its high energy/electrical system. **Note:** ***This is a knowledge unit only and does not deem someone competent to work on the high energy electrical systems of an electric/hybrid vehicle.***		

LEARNING OUTCOMES The Learner will:	ASSESSMENT CRITERIA The Learner can:
1. Know about the types of electric/hybrid vehicles available	1.1 Describe how to identify electric/hybrid vehicles 1.2 Give examples of the different types of alternative fuel vehicles which are currently available 1.3 Outline the main differences between electric and hybrid vehicles, including charging 1.4 Define the voltages used for motor vehicle high energy systems 1.5 Give examples of the typical voltages used for a range of electric/hybrid vehicles 1.6 Identify alternative fuel source vehicles
2. Understand the hazards around motor vehicle high energy electrical systems	2.1 Describe the hazards associated with high energy electricity 2.2 State the hazards that may be present in the event of a vehicle accident or when charging 2.3 Identify potential hazards when making connections for charging electric/hybrid vehicles 2.4 Identify the hazards associated with the transportation, storage and disposal of electric/hybrid vehicle high voltage batteries

3. Know how to work safely around electric/hybrid vehicles	3.1 Identify the typical location of high energy electrical cables and components on electric/hybrid vehicles 3.2 Describe how to identify motor vehicle high energy electrical cabling and associated components 3.3 Explain the differences between AC (including 3 phase) and DC and the associated hazards 3.4 Identify the different types of hazards associated with energy storage 3.5 Describe the potential hazards that may be present when an electric/hybrid vehicle has been damaged or is deemed faulty
4. Know how to reduce the risk of injury when encountering electric/hybrid vehicles	4.1. Describe the methods that vehicle manufacturers use to provide protection from high energy electrical cabling and components 4.2. Identify who may be at risk in the event of electric/hybrid vehicle incidents 4.3. Describe how to make an initial/dynamic risk assessment of the electric/hybrid vehicle damage and or faults 4.4. Describe how to take steps to secure the safety of themselves and others at incident scenes involving electric/hybrid vehicles 4.5. Describe the precautions that can be taken to reduce risks by those encountering damaged electric/hybrid vehicles
5. Know how to safely transport and store electric/hybrid vehicles	5.1 Identify the hazards associated with the transportation of electric/hybrid vehicles 5.2 Describe the factors that determine the location the damaged vehicle is delivered to for repair or storage 5.3 Describe the additional requirements of recovery vehicles when transporting electric/hybrid vehicles 5.4 Understand hazards associated with storing damaged electric/hybrid vehicles

Unit Content	Assessment Criteria
How to identify electric/hybrid vehicles: a. construction b. badging c. model d. procedure to follow if initial identification is not possible e. cable colouring Examples of the electric/hybrid vehicles that are currently available a. hybrid incl. i. hybrid electric vehicle (HEV) ii. plug in hybrid electric vehicle (PHEV) iii. micro hybrid b. battery electric vehicle (BEV) c. fuel cell vehicle d. two wheel vehicles e. commercial vehicles f. passenger transport g. mechanical handling equipment (MHE) h. plant The main differences between electric / hybrid vehicles including charging to include: a. layouts b. components c. batteries / rechargeable energy storage systems (RESS) d. motors e. charging equipment and cables **Definition of voltages used for motor vehicle high energy systems** a. ECE R100 (relating to vehicle regulations) paragraph 2.14 clearly defines high voltage: "High Voltage means the classification of an electric component or circuit, if its working voltage is > 60 V and ≤ 1500 V DC or > 30 V and ≤ 1000 V AC root mean square (rms)." NOTE: This is different to definitions in commercial and domestic use which are: a. Extra Low Voltage <50 V rms AC and <120 V DC b. Low Voltage 50-1000 V rms AC and 120-1500 V DC c. High Voltage >1000 V rms AC and >1500 V DC Examples of the typical voltages used for a range of electric / hybrid vehicles a. 40-1000V DC Alternative fuel systems could include a. Hydrogen b. Methanol	1.1-1.6

Unit Content	Assessment Criteria
The hazards that are associated with high energy vehicle electrical systems a. fire b. explosion c. arc flash d. gases/fumes e. chemicals f. vehicle operation i.e. automatic start/stop systems, quietness of operation g. high voltage h. high current i. EMF – for example pacemaker, insulin pumps and other medical devices j. residual magnetic energy stored in high energy components Resulting injuries to include a. fatality b. electric shock and cardiac arrest c. burns from chemical and fire d. falling from height or being thrown due to electric shock e. manual handling injuries from lifting heavy components f. eye injuries g. skin damage from burns h. breathing difficulties and complications from fumes i. failure of medical equipment– for example pacemaker, insulin pumps and other medical devices The hazards that may be present in the event of damaged vehicle or when charging to include: a. Increased risk of exposure to the hazards listed above b. Surrounding conditions including precautions when charging in the presence of water – i.e. rain, valeting etc. c. Incorrect use of extension leads when charging d. suitability of power supply used when charging e. residual magnetic energy stored in high energy components Safety precautions to be taken before approaching and interacting with electric/hybrid vehicles a. risk assessment b. awareness of damaged components c. dealing with leakage d. isolation of high energy electrical system e. safe connection when charging f. workplace procedures for driving electric/hybrid vehicles (no sound) g. workplace procedures for the use of signage and barriers when people are working on electric/hybrid vehicles h. types of signage in use in and around electric/hybrid vehicle repair i. risks to health when working around electric/hybrid vehicles ie, pacemakers and other medical equipment possibly affected Identify the hazards associated with the transportation, storage and disposal of electric/ hybrid vehicle high voltage batteries. Legal implications of incorrect battery, transportation, recycling and disposal including specialist packaging a. awareness of legislation for battery storage and transportation b. environmental pollution c. awareness of restrictions of access to vehicles and components	2.1-2.4

Unit Content	Assessment Criteria
The typical location and layout of high energy cables and components on electric hybrid vehicles a. Specific Manufacturer's or vehicle technical information to be used Identifying an electric/hybrid vehicle's live/ready state could include a. locations and types of warning and hazard symbols b. system displays and messages Difference between AC including 3 phase and DC voltage: a. definitions of AC including 3 phase/dc -alternating current/direct current b. identify components that use AC including 3 phase / DC voltage Levels of current and voltage that may present hazards include: a. contact time b. AC including 3 phase /DC current and voltage levels c. factors affecting resistance to current flow d. The effect of different AC including 3 phase and DC electrical currents passing through human body i. IEC 60479 ii. IEC 479-2 Potential hazards caused by damages or failure could include: a. exposed wiring b. leakages c. hidden potential dangers based on vehicle damage – battery location d. potential dangers linked to damaged high voltage battery Storage of damaged electric/ hybrid vehicles a. warning labels relating to chemicals and hazards b. procedure for signage / barriers c. restricted personnel d. reasons for extended vehicle storage could include i. crime – evidence management ii. fatality iii. insurance iv. awaiting repair / parts	3.1-3.5
The methods that vehicle manufacturers use to provide protection from high energy cabling and components a. direct protection- enclosure, insulation, location, ingress protection b. indirect protection- fuse, isolation monitoring, potential equalisation Who may be at risk in the event of electric/hybrid vehicle incidents a. occupants b. on-lookers c. recovery personnel d. emergency services e. Recipient of the damaged vehicle (body or vehicle repair (shop) How to make an initial assessment of the extent of vehicle damage and or faults a. dynamic risk assessment b. personal protection c. visual inspection	4.1-4.5

How to take steps to secure the safety of themselves and others at incident scenes involving electric/hybrid vehicles. a. evacuation procedures b. site protection The precautions that can be taken to reduce risks by those encountering damaged electric/hybrid vehicles a. adequate training b. overalls with non-conductive fasteners c. gloves (correctly rated) d. protective footwear; rubberised soles; non-metallic protective toe caps e. face masks f. dealing with leakage from battery packs g. isolation of high energy electrical system; vehicle shut down procedures h. dynamic risk assessment	
Hazards associated with the transportation of electric/hybrid vehicles could include a. requirements of transportation/recovery vehicle to include i. isolation of flat bed ii. rubber/plastic matting iii. plastic runners iv. suitable recovery equipment and methods when lifting electric/ hybrid vehicles b. hazards associated with towing to include i. limitations of speed and distance you can tow ii. potential energizing of components/systems iii. electrocution when attaching recovery equipment Accessing additional support using: a. IT sources b. Internet/web based systems c. mobile phone aps d. additional support a. OEM support – obtain technical support on roadside b. OEM recovery safety cards – location of high voltage components to include vehicle batteries, air bags and safe handling instructions Factors that determine the location the damaged vehicle is delivered to for repair or storage could include: a. location suitability / equipped to handle vehicle b. suitably trained staff available for receipt and safe storage of electric/hybrid vehicle Hazards associated with storing damaged electric/hybrid vehicles could include a. damage to vehicle battery due to self-discharge in prolonged storage b. hazards to personal and risk of personal injury	5.1-5.4