Specification of Competency Standards
for the Automotive
Unit of Competency

Functional Area - Vehicle Servicing

Title	Master the complicated techniques of power systems on hydrogen fuel cell electric vehicles
Code	111760L4
Range	This unit of competency is applicable to technicians working at the designated work area of vehicle service and inspection departments. Practitioners should be able to master the operating principles of the power systems on hydrogen fuel cell electric vehicles to enhance the efficiency and accuracy of inspection and fault diagnosis.
Level	4
Credit	6 *(For Reference Only)*

Competency	**Performance Requirements**
	
	1. Knowledge (Power systems of hydrogen fuel cell electric vehicles)
	• Master the use of special service tools, personal protection and first-aid equipment for relevant tasks.
	• The principles of electrical and electrochemical engineering:
	  ○ Master basic theories of electricity and electrochemistry
	  ○ Good understanding of the working principles of electric motors, generators and alternators, their output characteristics, and relevant electric power control methods
	  ○ Understand the performance, structure, operating principles, characteristics, safety precautions, recycling measures and applicative limitations of different kinds of secondary batteries, including but not limited to sodium-based batteries and lithium-ion batteries
	  ○ Good understanding of the working principle of hydrogen fuel cell and the output characteristic under various working conditions.
	  ○ Understand the performance, structure, safety precautions, recycling measures and applicative limitations of the hydrogen fuel cell equipped on vehicles
	• Electrical energy management:
	  ○ Good understanding of the methods of battery energy storage and control, traction power and power regeneration regulation, and associated thermal control management, the structure and operating principles of all related components
	  ○ Good understanding of the affecting parameters on the electrical energy output of a fuel cell unit, such as the operating temperature and humidity controls, fuel and oxidant supplies against load demand, etc.
	• Power system of hydrogen fuel cell electric vehicles:
	  ○ Understanding of the structure, characteristics, installation and associated safety setup for the hydrogen storage tanks onboard
	  ○ Master the control principles of electricity supply and regeneration as well as the structure, functions and the common faulty functions of their related circuits and components
	  ○ Good understanding of the external electric power charging and control
	  ○ Good understanding of the layout, operation and characteristics of hydrogen fuel cell systems and the associated sub-system components, including but not limited to leakage detection, storage, pressure regulation, humidity control, and oxidant supply

	2. Performance (Inspection, fault diagnosis and performance analysis of hydrogen fuel cell electric vehicle system) • Conduct inspection, fault diagnosis and analysis procedures according to fault symptoms (including recurrent or intermittent defects) of the hydrogen fuel cell electric system and related components, such as: ◦ Declining charging and discharging efficiency of battery, including the efficiency of electricity regeneration ◦ Declining conversion efficiency of fuel cell unit ◦ Increasing concentration of hydrogen in exhaust ◦ Declining in acceleration power, load and speed response of vehicle ◦ Shortened driving range and excessive fuel consumption ◦ Inaccurate or unstable vehicle speed control ◦ Abnormal operating temperature of components, such as the traction motor, battery, power electronics, fuel cell system, etc. ◦ Occurrence of abnormal operating noise or vibration ◦ Review the causes of defects and diagnostic methods; submit written report to seniors covering preventive measures, instructions on inspection and maintenance, as well as suggestions for improvement.
Assessment Criteria	The integrated outcome requirements of this unit of competency are that the practitioner being assessed shall prove that he/she is: • Capable of mastering the structure, functions, control and operating principles of the power system of hydrogen fuel cell electric vehicles, including fuel and electrical energy storage, their auxiliary systems and related components to enhance the efficiency and accuracy of inspection and fault diagnosis; • Capable of mastering the principle of electric drive systems as well as the factors affecting vehicle power output, such as fuel cell system and motor efficiency, fuel and electrical energy management, electricity regeneration, humidity and thermal management, etc., to solve the complicated technical problems effectively and accurately, such as increasing hydrogen consumption for a given load, excessive hydrogen exhaust, hesitating load response and weak acceleration power, abnormal noisy operation and vibration; and • Capable of compiling report covering preventive measures, compiling instructions on inspection and maintenance, as well as providing suggestions for improvement, etc., according to specific defects found in the respective power system.
Remark	The credit for this competency unit assumes that the practitioner already possesses extensive knowledge of hydrogen fuel cell electric vehicles and the operational characteristics of associated systems and components. The practitioner concerned should be a recognised competent person in electrified vehicles, such as a registered vehicle mechanic who has completed an electric vehicle – low voltage training course, or equivalent, and be a competent person in hydrogen fuel cell electric vehicles recognised by the authority concerned; the process should be under the high-voltage system power-down condition and confirmed by the checking result of special service tools/authorised competent person. When live high-voltage system is involved in the work, the practitioner shall possess of a recognised competency/qualification, such as the electric vehicle – high voltage training course, or equivalent. The major ordinance involved in this unit of competency is as follows: • Road Traffic (Construction and Maintenance of vehicles) Ordinance • Gas Safety Ordinance • Occupational Safety and Health Ordinance (This UoC replaced 108741L4)