Specification of Competency Standards
for the Automotive
Unit of Competency

Functional Area - Vehicle Servicing

Title	Master the complicated techniques of electrical and electronic systems
Code	111757L4
Range	This unit of competency is applicable to technicians working at vehicle service and inspection departments. Practitioners should be able to master the working principles of electrical and electronic systems as well as multiplexing, their effects on vehicle performance to enhance the efficiency and accuracy of inspection and diagnosis of vehicle systems.
Level	4
Credit	9 *(For Reference Only)*
Competency	**Performance Requirements**

	1. Knowledge (Relevant electrical and electronic systems) • Master the operating principles and output characteristics of different types of electric motors and electric generators, such as torque, speed and generation of electricity. • Good understanding of the working principles and controlling methods of the starting and charging system of combustion engine vehicles, and the onboard charging system of electrified vehicles • Master the operating principles of various types of electrical and electronic sub-systems, including related components and control systems • Good understanding of the applications of analogue and digital devices and their systems, such as integrated circuits, analogue/digital converters, amplifiers, comparators, microprocessors, etc. • Master the structure, operating principles, output characteristics and applications of sensors and actuators applied on vehicles, such as thermal sensing, pressure responsive, photosensitive, air flow, position, electric current, electromagnetic solenoids of various functions, etc. • Master electronic control principles, including closed-loop control. • Good understanding of the principle of multiplexing for the whole-vehicle control logic and communication protocols of vehicle, such as the controller-area network (CAN), local interconnect network (LIN), FlexRay, media-oriented systems transport (MOST), etc., for signal transmission and the interpretation of bus signals. • Good understanding of the operating principles and applications of various types of electronic control systems and related components, including but not limited to: ◦ Chassis stability control ◦ Cruise control ◦ Supplemental restraint control ◦ Heating, ventilation and air-conditioning control ◦ Transmission control (for combustion engine vehicles) ◦ Engine management (for combustion engine vehicles and hybrid electric vehicles) ◦ Traction motor power control (for electrified vehicles) ◦ Battery power management (for electrified vehicles) ◦ Fuel cell power management (for fuel cell electric vehicles) • Master the application and data analysis skills of various types of measuring/diagnosis equipment, such as oscilloscopes, on-board diagnostic devices, etc.

	2. Performance (Inspection, fault diagnosis and analysis of electrical and electronic systems)
	• Conduct inspection, fault diagnosis and analysis procedures according to fault symptoms of recurrent and intermittent defects of the electronic control systems, including but not limited to
	  ◦ Power system defects of combustion engine vehicles, such as stalling, weak acceleration, rough engine running, excessive fuel consumption, etc.
	  ◦ Power system defects of electrified vehicles, such as weak acceleration, lack of power, abnormal noise in operation, excessive hydrogen or electricity consumption, inappropriate power regeneration, etc.
	  ◦ Transmission system defects, such as incorrect shift points, incorrect power splitting, harsh gear shifting, inoperative slip limitation, etc.
	  ◦ Chassis stability control system defects, such as ineffective or inaccurate auto brake function, inaccurate lane keep function, inoperative anti-lock brake, acceleration skidding, unstable high-speed cornering, etc.
	  ◦ Cruise control system defects, such as inoperative or inaccurate speed control, etc.
	  ◦ Heat, ventilation and air-conditioning system defects, such as ineffective temperature control and ventilation effects, etc.
	  ◦ Supplemental restraint system warnings and unintended deployment
	• Conduct inspection, fault diagnosis and analysis procedures according to fault symptoms of recurrent and intermittent defects of the vehicle multiplexing bus and related components, such as failure or distortion of signal transmission, optical fibre damage, etc.
	• Conduct inspection, fault diagnosis and analysis procedures according to fault symptoms, including recurrent and intermittent phenomena and visual warnings, of electrical systems, such as the starting system and charging system of combustion engine vehicles, heating, ventilation and air conditioning systems, vehicle body electrical devices, onboard charging system of electrified vehicles, etc.
	• 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, controlling and operating principles of various electrical and electronic systems to enhance the efficiency and accuracy of inspection and complicated fault diagnosis; • Capable of mastering electrical and electronic theories as well as the interpretation of bus signals of the multiplexing system to solve the complicated technical problems, such as engine stalling, heating, ventilation and air conditioning failure, unstable or inoperative system communication, weak traction motor power and low onboard charging efficiency of electrified vehicles, etc., effectively and accurately; and • Capable of compiling reports covering preventive measures, instructions on inspection and maintenance as well as providing suggestions for improvement, etc., according to the specific defects relating to respective electrical and electronic systems.

Remark	The credit value for this competency unit assumes that the practitioner possesses extensive knowledge of automotive technology, combustion engine and electrified vehicle repair and testing procedures. When conducting the work on electrified vehicles, 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. The servicing process of electrified vehicles should be under the high-voltage system power-down condition and is confirmed by the checking result of special service tools/authorised competent person. If the live high-voltage system is involved during the operation, the practitioner concerned should be a recognised competent person in electrified vehicles, such as a registered vehicle mechanic who has completed an electric vehicle – high voltage training course, or equivalent. (This UoC replaced 108738L4)