Specification of Competency Standards
for the Automotive
Unit of Competency

Functional Area - Vehicle Servicing

Title	Analyse the electric vehicle system faults and execute the rectifying procedures
Code	111766L4
Range	This unit of competency is applicable in electrified vehicle service workshops. Practitioners should be able to master the diagnostic procedures of the electric vehicle systems, and the one-for-one replacement procedures of the high-voltage battery pack onboard according to the instructions in the corresponding vehicle manufacturer's service manual and the relevant requirements on environmental protection, occupational safety and health regulations. They should also be able to provide written reports upon completion of work.
Level	4
Credit	3 *(For Reference Only)*
Competency	**Performance Requirements** 1. Knowledge (Structures and operating principles of various electric vehicle systems and associated components) • Distinguish the structures and operating principles of various electric vehicle systems, such as the powertrain, rechargeable energy storage system (REESS), onboard charger (OBC), heating, ventilation and air conditioning (HVAC), etc. • Conversant with the principles of whole-vehicle control logic and communication protocols of electric vehicles, the application of controller area network (CAN) for signal transmission and the interpretation of bus signals. • Master the differentiation of voltage levels of electrical systems, the hazards and safety rules in the handling of the high-voltage systems onboard. • Master the functions and application of special service tools, personal protection and first-aid equipment for relevant tasks. • Master the functions and applications of diagnostic and testing instruments and equipment for electric vehicles, such as on-board diagnostic systems, insulation testers, etc. • Familiar with the common faults of high-voltage operating systems onboard and the fault diagnosis procedure for the abnormal performance of powertrain, OBC, REESS and HVAC systems of electric vehicles, with reference to instructions in the corresponding vehicle manufacturer's service manual and safety rules. • Good understanding of the relevant legal requirements of occupational safety and health, road and vehicle safety, and environmental protection.

	2. Performance (High-voltage operating systems inspection and diagnosis and battery pack replacement) • Compare the working principles of various high-voltage operating systems onboard, such as the powertrain, OBC, REESS, HVAC, etc. • Differentiate the architecture of whole-vehicle logic control, communication protocol and the interpretation of CAN bus signals. • Correctly differentiate the voltage levels of various operating systems, including cables. • Masterfully apply the personal protective and first-aid equipment, with reference to the legal requirements of occupational safety and health, road and vehicle safety, and environmental protection, for the system diagnosis and high-voltage battery pack replacement processes. • Efficiently examine the normal operation and performance of various high-voltage operating systems of electric vehicles, such as the powertrain, OBC, REESS, HVAC, etc., with reference to the instructions in the corresponding vehicle manufacturer's service manual and safety rules. • Compare the application of special service tools, diagnostic and testing equipment and instruments and associated setup procedures for system diagnosis and high-voltage battery pack replacement with reference to instructions in the corresponding vehicle manufacturer's service manual and safety rules. • Effectively conduct the fault diagnosis procedures for the substandard performance of high-voltage operating systems onboard, including but not limited to system insulation, powertrain and charging efficiencies, battery health and air conditioning efficiency, with reference to instructions in the corresponding vehicle manufacturer's service manual and safety rules. • Analyse the diagnostic results of high-volage operating systems to locate the faulty functions and associated components. • Provide a written report on the system diagnostic results, their root causes, corrective and preventive actions. • Perform the high-voltage battery pack removal and replacement procedures (one for one), including cables/harness and cooling system, with reference to the instructions in the manufacturer's service manual and the requirements concerning occupational health and safety and that of environmental protection, after the system power-down is confirmed by the result of special service tools / authorised competent person. • Conduct the coding procedures, safety and functional tests after the high-voltage system is reinstated.
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 differentiating the working principles and architecture of whole-vehicle logic control, communication protocols and the interpretation of CAN bus signals; • Capable of contrasting the voltage levels of operating systems, including cables onboard; • Capable of applying relevant personal protective equipment and first-aid equipment, special tools and diagnostic instruments for high-voltage battery pack replacement or high-voltage operating system diagnosis, with reference to instructions in the corresponding vehicle manufacturer's service manual and safety rules; • Capable of examining the normal operation and performance of various high-voltage operating systems onboard, including but not limited to the powertrain, OBC, REESS, and HVAC, with reference to the instructions in the corresponding vehicle manufacturer's service manual and safety rules; • Capable of analysing the causes of defective high-voltage operating systems onboard, such as the powertrain, REESS, OBC, HVAC, etc., to locate the faulty functions and associated components leading to the substandard system performance, with reference to the instructions in the corresponding vehicle manufacturer's service manual and safety rules; • Capable of providing a written report on the system diagnostic results, their root causes, corrective and preventive actions; • Capable of executing the removal and one-for-one replacement procedures of the vehicle high-voltage battery pack properly, including cables / harness and cooling system, according to the instructions in the manufacturer's service manual and the relevant requirements on environmental protection,

	occupational safety and health regulations, after the system power-down is confirmed by the result of special service tools / authorised competent person; • Capable of executing the coding procedures and cooling system inspection for the high-voltage battery pack correctly after the high-voltage power system is reinstated; and • Capable of executing safety and functional tests, and providing working reports upon completion of replacement work.
Remark	The credit value of this unit of competency is set on the presumption that the practitioner concerned already possesses good knowledge of high-voltage operating systems and battery packs on electric vehicles. The major ordinance involved in this unit of competency is as follows: • Relevant ordinances to the Road Traffic (Construction and Maintenance of vehicles) Regulations • Occupational Safety and Health