

Specification of Competency Standards
for the Automotive Industry
Unit of Competency

Functional Area - Vehicle Servicing

Title	Master the complicated techniques of alternative power systems
Code	108741L4
Range	This unit of competency is applicable to technicians working at vehicle servicing and inspection departments. Practitioners should be able to master the operating principles of various types of alternative power systems to enhance the efficiency and accuracy of inspection and complicated fault diagnosis.
Level	4
Credit	6 (For Reference Only)
Competency	<p>Performance Requirements</p> <p>1. Knowledge (Electric and hybrid systems)</p> <ul style="list-style-type: none"> • The principles of electrical engineering: <ul style="list-style-type: none"> ○ Master basic electric theory ○ Good understanding of the working principles of DC and AC motors, generator and alternator, their output characteristics, and relevant electricity supply control methods • Electric energy management: <ul style="list-style-type: none"> ○ Master the performance, structure, operating principles and applicative limitations of different kinds of secondary batteries, such as lead acid battery, nickel-based battery and lithium-based battery ○ Good understanding of the methods of battery charging management, the structure and operating principles of all related components ○ Good understanding of the structure, operating principles and applicative limitations of various kinds of fuel cells, fuel cell systems and related components • Electric vehicles: <ul style="list-style-type: none"> ○ Good understanding of the layout, characteristics, structure and operating principles of different transmission systems ○ Master the control principles of electricity supply and regeneration as well as the structure, functions and operating principles of their related circuits and components • Hybrid systems: <ul style="list-style-type: none"> ○ Master the definition, operating characteristics, structure and control methods of various types of hybrid systems, such as the operating sequence of engine, alternator and electric motor ○ Good understanding of the structure and operating principles of power splitting devices of transmission system ○ Master the control principles of electricity supply and regeneration as well as the structure, functions and operating principles of their related circuits and components ○ Good understanding of the electric supply and control methods of motors and various electrical accessories <p>2. Performance (Inspection, fault diagnosis and analysis of electric and hybrid systems performance)</p> <ul style="list-style-type: none"> • Conduct inspection, fault diagnosis and analysis procedures according to fault symptoms (including recurrent or intermittent defects) of electric systems and related components, such as: <ul style="list-style-type: none"> ○ Efficiency declining in charging and discharging of battery

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	<ul style="list-style-type: none"> ○ Declining in acceleration and speed of vehicle ○ Shortened driving range ○ Inaccurate or unstable vehicle speed control ○ Abnormal operating temperature, such as motor, battery or fuel cell ● Excessive fuel consumption. ● Occurring of abnormal operating noise or vibration. ● Conduct inspection, fault diagnosis and analysis procedures according to fault symptoms (including recurrent or intermittent defects) of electrical system of hybrid vehicles, their auxiliary systems and related components, such as: <ul style="list-style-type: none"> ○ Engine defects, such as stalling, insufficient power, weak acceleration, rough engine running or excessive fuel consumption, etc. ○ Declining charging and discharging efficiency of battery, including the efficiency of electricity regeneration ○ Instable control of engine power cut-in and cut-out patterns ○ Abnormal operating temperature, such as motor, battery or engine, etc. ○ Declining acceleration power and speed of vehicle ○ Occurring of abnormal operating noise (including detonation) or vibration ● Review the causes of defects and diagnostic methods; submit report to seniors covering preventive measures, instructions on inspection and maintenance as well as suggestions for improvement.
Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are that the practitioner being assessed shall prove that he/she is:</p> <ul style="list-style-type: none"> ● Capable of mastering the structure, functions, control and operating principles of electric vehicle systems (including battery or fuel cell), their auxiliary systems and related components to enhance the efficiency and accuracy of inspection and complicated fault diagnosis; ● Capable of mastering the structure, functions, control and operating principles of hybrid vehicle systems (including battery and engine), their auxiliary systems and related components to enhance the efficiency and accuracy of inspection and complicated fault diagnosis; ● Capable of mastering the principle of electric vehicle systems as well as the factors affecting vehicle power output, such as motor control efficiency, electric energy management and regeneration, etc., to solve the complicated technical problems effectively and accurately, such as short driving range and weak acceleration; ● Capable of mastering the principle of hybrid vehicle systems as well as the factors affecting vehicle power output and charging performance, such as efficiency of electric management, motor and engine control, etc., to solve the complicated technical problems effectively and accurately, such as fuel consumption, battery performance decay and lack of vehicle power output; 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 respective power systems.
Remark	<p>The credit for this competency unit assumes that the practitioner already has possessed extensive knowledge of electric and hybrid vehicles and understands how the system works for electric and hybrid vehicles.</p>