

Practice Guidelines for Electric Vehicle Maintenance



Preface

This document aims to ensure the safety of electric vehicle (EV) maintenance work in an environment where EVs are rapidly becoming popular. In the process of formulating this document, the Electrical and Mechanical Services Department and the Vehicle Maintenance Technical Advisory Committee referred to standards from around the world, including but not limited to China, the United Kingdom, Australia, the United States of America, Germany and other places.

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1. Scope and General Provisions

1.1. Scope

EVs typically refer to plug-in electric vehicles (PEV), hybrid electric vehicles (HEV), battery electric vehicles (BEV), plug-in hybrid electric vehicles (PHEV), and fuel cell electric vehicles (FCEV). This document provides safety requirements for the maintenance of electric vehicles, including personal protective equipment, workshop environment and facilities, maintenance procedures, and more.

- Routine maintenance and simple repairs, that not involving high voltage (HV) traction batteries, include lubrication, brake repairs, wheel alignment, body or windshield repairs, tire replacement, etc.
- Maintenance work, that involving the HV traction batteries or HV components connected, require the disconnection of the HV system of the EV.
- Precaution is required for handling and storage of the HV traction batteries when the structural integrity of the vehicle is compromised.

Before performing any operations or maintenance on an EV, it is important to refer to the relevant documents provided by the vehicle manufacturer, such as safety instructions, operating guidelines, and maintenance manuals, which will provide further detail of potential hazards associated with the specific EVs. In cases where risks are encountered that are not covered in this document, additional risk mitigation measures should be taken from sources outside of this document to ensure safety.

If there is any conflict or inconsistency between the Chinese and English versions of this document, the Chinese version shall prevail.

1.2. Relevant Regulations

This document set out the basic principles for the operation and work practice of the EV maintenance workshop. When establishing a new EV RVMW and conducting maintenance work on EVs, it is necessary to comply with all current regulations in Hong Kong relating to vehicle maintenance, including:

- **Occupational Health and Safety**

Factories and Industrial Undertakings Ordinance (Cap. 59)

Fire Services Ordinance (Cap. 95)

Dangerous Goods Ordinance(Cap. 295)

Electricity Ordinance (Cap. 406)

Occupational Safety and Health Ordinance (Cap. 509)

Employees' Compensation Ordinance (Cap. 282)

Boilers and Pressure Vessels Ordinance (Cap. 56)

- **Building Planning**

Buildings Ordinance (Cap. 123)

Town Planning Ordinance (Cap. 131)

Fire Safety (Buildings) Ordinance (Cap. 572)

- **Vehicle Performance**

Road Traffic Ordinance (Cap. 374)

- **Business Practices**

Trade Descriptions Ordinance (Cap. 362)

- **Waste**

Waste Disposal Ordinance (Cap. 354)

Public Health and Municipal Services Ordinance (Cap. 132)

- **Air**

Air Pollution Control Ordinance (Cap. 311)

Ozone Layer Protection Ordinance (Cap. 403)

- **Water Quality**

Water Pollution Control Ordinance (Cap. 358)

- **Noise**

Noise Control Ordinance (Cap. 400)

- **Gas Safety**

Gas Safety Ordinance (Cap. 51)

In addition, relevant personnel should also adhere to the Practical Guidelines for Vehicle Repair Workshops compiled by the Vehicle Maintenance Technical Advisory Committee. These guidelines aim to improve the safety and service standards of the local vehicle maintenance industry.

1.3. Terminology and Definitions

For the purposes of this document, the following terms and definitions apply.

1.3.1. Automated External Defibrillator (AED)

- A medical device designed to restore a person's normal heartbeat by delivering electrical pulses to the heart.

1.3.2. Battery Electric Vehicle (BEV)

- A vehicle that obtains energy from an internal rechargeable storage system and can be charged from an external power source.

1.3.3. Fuel Cell Electric Vehicle (FCEV)

- A vehicle that combines a fuel cell system with an electric propulsion system.

1.3.4. Hybrid Electric Vehicle (HEV)

- A vehicle that combines a traditional internal combustion engine system with an electric propulsion system.

1.3.5. Plug-in Electric Vehicle (PEV)

- A vehicle that can be charged from an external power source.

1.3.6. Plug-in Hybrid Electric Vehicle (PHEV)

- A vehicle that combines a traditional internal combustion engine system with an electric propulsion system and can be charged from an external power source.

1.3.7. High Voltage (HV)

- Direct Current (D.C.): Exceeding 60 volts but not exceeding 1,500 volts.
- Alternating Current (A.C.): Exceeding 30 volts root mean square but not exceeding 1,000 volts root mean square.

(Note: Only applicable to the vehicle maintenance industry in Hong Kong.)

1.3.8. Low Voltage (LV)

- Direct Current (D.C.): Not exceeding 60 volts.
- Alternating Current (A.C.): Exceeding 30 volts root mean square but not exceeding 1,000 volts root mean square.

(Note: Only applicable to the vehicle maintenance industry in Hong Kong. Low voltage systems still carry the risk of electric shock, and appropriate measures should be taken following the guidelines of the vehicle manufacturer.)

1.3.9. HV System or Associated Components:

- Examples include battery management system, HV onboard charger, traction motor, motor controller, HV power regeneration system, HV heating resistors, air conditioning system HV compressors, and related motors. Prior to performing any maintenance or replacement procedures, it is essential to thoroughly review the manufacturer's maintenance documentation for the specific EVs, fully understand the procedures involved, and take the necessary safety precautions throughout the entire replacement process.

1.3.10. Traction Battery

- Traction battery (also refers as rechargeable electrical energy storage system) provides electric power for propulsion.

(Note: Rechargeable electrical energy storage system may include any subsystems, necessary auxiliary systems for physical support, thermal management, electronic controls, and housing.)

1.3.11. Energized Circuit

- A circuit that has not been isolated and tested.

1.3.12. Discharging

- The process of isolating the rechargeable electrical energy storage system from the vehicle's HV system and discharging the HV system, excluding the rechargeable electrical energy storage system.

1.3.13. Arc Hazard

- An arc is a discharge of electricity through a medium such as air, resulting in a momentary spark when current passes through. When a conductive path is separated in an energized HV circuit, an arc can occur at the gap between the conductors. Arcs not only cause significant wear on electrical contacts but also prolong the time it takes to disconnect the circuit.

1.3.14. Personal Protective Equipment (PPE)

- Includes insulated gloves, insulated shoes, and other safety protective gear. Before use, the condition of the equipment should be checked and confirmed to be in proper working order.

1.3.15. Original Equipment Manufacturer (OEM)

- The original manufacturer of the vehicle, battery, rechargeable energy storage system, and related components.

1.3.16. Effective Isolation

- The state of being "de-energized" and confirmed to have no "residual energy," meaning that when voltage measurement is performed on the repaired area using appropriate voltage measuring instruments, the voltage reading is zero, indicating that it is safe to work on the component.

1.3.17. Specific Maintenance Plugs or Devices

- Methods specified by the original equipment manufacturer for isolation. Generally, the device used to disconnect power from the traction battery is in the form of a plug, although it may vary depending on vehicle design. EV maintenance mechanics must strictly follow the manufacturer's guidelines to operate specific plugs or devices for isolation/restoration of power.

1.3.18. Type H RVMW

- A RVMW that meets relevant requirements for conducting EV HV system maintenance work and has undergone an audit.

1.3.19. Chemical Sorbent Pad

- A flexible, powder-filled pad used to absorb and contain electrolyte spills.

1.3.20. Safety Data Sheet (SDS)

- Information provided by the original equipment manufacturer regarding the safe use of the equipment.

1.4. New Design and Innovation

- This document does not prevent the use of materials, assembly methods, procedures, etc. that do not meet the specific requirements of this document or are not mentioned in this document, as long as they meet the minimum size and performance requirements specified in this document.

2. Safety Operations of EV Maintenance Mechanic

2.1. Overview

- The extent of injury to the body depends on the magnitude of electric current. Higher voltages generate higher and more dangerous currents. At the same voltage, the magnitude of the current is inversely proportional to the resistance. Therefore, creating higher resistance is an effective measure for electric shock protection.
- LV can still be dangerous. Even though the low current produced by LV may not directly cause electrical shock injury, it can startle a person, causing them to retreat and potentially come into contact with something more dangerous nearby.
- Circuit components in direct current (D.C.) or alternating current (A.C.) electrical work can produce arc flashes, which can cause serious injuries, especially to the eyes and face. Clothing can also ignite due to arc flashes, with severity depending on the arc energy and the type of clothing.
- Individuals carrying pacemakers or other medical devices susceptible to magnetic field interference should not perform maintenance work on EVs, as they may contain strong magnets that can affect these medical devices.
- Metal jewelry should not be worn when working around circuits. Rings, watch bands, necklaces, bracelets, and other metal items can conduct enough current to cause skin burns even at low voltages. Metal jewelry can also damage personal protective equipment, especially insulated gloves.
- For EV equipment, components, or systems not covered in this document, maintenance personnel should apply the principles and techniques contained in this document, as well as specific recommendations from the vehicle manufacturer, to conduct a risk assessment and implement equivalent or more effective safety measures.
- Any occupational health and safety risks or hazards should be controlled in the following order:
 - **Eliminate** the risk or hazard;
 - **Substitute** higher-risk or hazardous processes with safer materials, tools, or equipment;
 - Apply **engineering control** measures;
 - Apply **administrative control** measures; and
 - Use **PPE**
- All registered vehicle mechanics must adhere to the guidelines set forth in this document.

2.2. Registered Vehicle Mechanic (RVM)

2.2.1. Maintenance Service Scope

- Base on the voluntary registration scheme for vehicle maintenance, the existing registered service categories can be summarized based on the quantity of vehicle components involved, scope of work, and characteristics of the trade:
 - Whole Vehicle repairs and servicing activities - including Mechanical (code: M), Electrical (code: E), and Motorcycle Maintenance (code: S1) ;
 - Vehicle Body Service - including Body Repair (code: B1) or Body Painting (code: B2); and
 - Specific Services - including Tire Works (code: S2), Battery Works (code: S3), Oil Change Works (code: S4), Vehicle Accessories Works (code: S5), Air Conditioning Works (code: S6), and Body Assembly Works (code: S7)
- Depending on the different registered service categories, the work may involve different aspects of HV or LV systems in EVs, and the technical requirements for EV maintenance services may vary. Existing registered technicians can apply for additional EV maintenance service scopes, based on their registered service category and meeting the registration requirements for EV maintenance service scopes. These additional scopes include:
 - EV (Elementary) (Code: EVE).
 - EV (LV) (Code: EVL).
 - EV (HV) (Code: EVH).
- The following table specifies the EV maintenance service scopes under each registered service category:

<u>Service Class (Code)</u>	<u>EV Maintenance Service (Code)</u>
Mechanical (M)	EV (LV) (EVL) or EV (HV) (EVH)
Electrical (E)	EV (LV) (EVL) or EV (HV) (EVH)
Body repair (B1)	EV (LV) (EVL) or EV (HV) (EVH)
Body painting (B2)	EV (LV) (EVL) or EV (HV) (EVH)
Motorcycle maintenance (S1)	EV (LV) (EVL) or EV (HV) (EVH)
Tyre work (S2)	EV (Elementary) (EVE)
Battery work (S3)	EV (Elementary) (EVE)
Lubrication work (S4)	EV (Elementary) (EVE)
Car accessories work (S5)	EV (Elementary) (EVE)
Air conditioning work (S6)	EV (Elementary) (EVE)
Body building work (S7)	EV (Elementary) (EVE)

- Annex 1 provides a detailed comparison between the maintenance service scopes of internal combustion engine vehicles and EVs allowing registered technicians to have a better understanding of the maintenance service scopes within their respective service categories.

2.2.2.RVMs with EVE service scope

- Allowed to perform relevant EV maintenance work within their registered service category.
- If the maintenance work requires "power-off" or "power-on" procedures, it must be carried out by registered mechanics who possess the EVL RVMs or EVH RVMs.

Note: RVMs within the scope of EVE maintenance services are not allowed to:

- **Isolate the HV vehicle traction battery system ("power off"); and**
- **Restore the HV vehicle traction battery system ("power on"); and**
- **Diagnose, test, repair, dismantle, replace, or install components of the EV HV system or its interconnected components.**

2.2.3.RVMs with EVL service scope

- Allowed to perform relevant EV maintenance work within their registered service category while wearing appropriate PPE. This includes:
 - Operating specific maintenance plugs or devices to isolate the HV vehicle traction battery system ("power-off").
 - Operating specific maintenance plugs or devices to restore the HV vehicle traction battery system ("power-on").
 - Diagnosing, testing, maintaining, disassembling, replacing, and installing EV low-voltage systems or components.
 - In the case of effectively isolating the HV vehicle traction battery system, using a "one-to-one" method to dismantle, replace, and install the EV HV system or its associated components, but not for diagnosing, testing, or maintaining related components, except for obtaining diagnostic trouble codes (DTCs) using on-board diagnostics (OBD) systems.

Note: RVMs within the scope of EVL maintenance services are not allowed to:

- **Diagnose, test, or repair the HV system or its interconnected components of the EV in a situation where effective isolation of the HV vehicle traction battery system is not possible ("live condition"); and**
- **Diagnose, test, repair, dismantle, replace, or install the entire fixed-position vehicle traction battery and its interconnected HV wires.**

2.2.4.RVMs with EVH service scope

- Allowed to perform relevant EV maintenance work within their registered service category while wearing appropriate personal safety protective equipment. This includes:
 - Isolating the HV vehicle traction battery system ("power-off").
 - Restoring the HV vehicle traction battery system ("power-on").
 - Diagnosing, testing, maintaining, disassembling, replacing, and installing EV HV systems or their associated components when it is not possible to effectively isolate the HV vehicle traction battery system ("live work"),
 - Using a "one-to-one" method to dismantle, replace, and install the entire fixed traction batteries (excluding internal disassembly and maintenance)
 - Performing work within the scope of EVL RVMs maintenance services.
- "Live work" should not be performed unless there are no other practical alternatives (e.g., in the event of a traffic accident where the relevant EV is damaged to the extent that specific isolation maintenance plugs cannot be removed).
- The service scope is not limited to using specific maintenance plugs or devices for the "power-off" procedure (e.g., in the event of a traffic accident where the relevant EV is damaged to the extent that specific isolation maintenance plugs cannot be removed, trained EVH RVMs can perform the "power-off" procedure using other safe methods).
- The service scope is not limited to using specific maintenance plugs or devices for the "power-on" procedure (e.g., trained EVH RVMs can perform the "power-on" procedure using other methods to provide necessary power for measurement and system diagnosis).
- "Live work" on EV HV systems can only be conducted within a Type H RVMW.

2.2.5.Registration and Renewal System

- Existing registered vehicle maintenance mechanics can add the corresponding registration for EV maintenance services after completing from Vehicle Maintenance Technical Advisory Committee (VMTAC) approved EV Maintenance Safety Awareness Course / EV (LV) Maintenance Course / EV (HV) Maintenance Course and perform the corresponding EV maintenance work.

- Registered Manufacturers or Manufacturers' Local Authorized Representatives can recommend currently RVMs who are capable of performing EV LV or HV system maintenance. Applicant need to submit manufacturer-approved certificates and training records, undergo review by the Vehicle Maintenance Registration Unit (VMRU) of the Electrical and Mechanical Services Department (EMSD), add the corresponding registration for EV maintenance services, and perform the corresponding EV maintenance work.
- Adding registration for EV maintenance services will not affect the validity period of the existing registration (i.e., the validity period on the newly issued vehicle maintenance mechanic certificate after adding registration for EV maintenance services will remain the same).
- The application and renewal conditions for the current RVM remain unchanged, with a validity period of 3 years for each registration and renewal. Applicants for renewal must have a minimum of 18 months of in-service records in the relevant service category and have at least 20 hours of continuous professional development records within the previous 3-year registration period.
- EV RVMs who have the qualification for EV maintenance services must prioritize courses related to EV safety when choosing continuous professional development programs.

2.3. Personal Protective Equipment (PPE)

2.3.1.PPE for Routine Maintenance

- If contact with live components or electrolytes is expected during routine maintenance work, appropriate PPE should be worn, including but not limited to the following:
 - Wearing insulated gloves with suitable voltage ratings (refer to standard UNE-EN 60903/IEC 61482-1-2:2018, Class 0).
 - Arc flash protective clothing (refer to standard IEC 61482/ASTM F1959/F, Level 1 protection/DL/T 320-2010, Level 1 protection).
 - Wearing suitable insulated safety shoes (refer to standard UNE EN 50321).
 - Using appropriate insulated mats (refer to standard UNE EN 61111 or equivalent specifications).
- Appropriate PPE for handling electrolytes, damaged batteries, or potential battery coolant leaks includes, but is not limited to, the following:
 - Gloves suitable for organic solvents (e.g., rubber, latex).
 - Aprons or coats suitable for organic solvents (e.g., rubber, durable synthetic materials).
 - Safety shoes suitable for organic solvents (e.g., rubber).
 - Protective goggles or face shields for protection against dust, foreign object impact, and chemical splashes or fumes.
- The Labour Department (LD) is responsible for enforcing the Factories and Industrial Undertakings (Protection of Eyes) Regulations (Cap. 59S), and LD has announced approved specifications for eye protectors, face shields, and fixed guards on their website. Please refer to and follow the relevant standards in detail.

2.3.2.PPE for Handling Live Components by EVH RVMs

- PPE for performing tasks involving live components or disconnecting vehicle traction batteries should include, but not be limited to, the following:
- Insulated gloves: To prevent electric current, suitable insulated gloves with appropriate voltage ratings should be worn each time HV power work is performed. The insulated gloves should comply with UNE-EN 60903/IEC 61482-1-2:2018, Class 0 or higher.
 - Before each use, the surface of the insulated gloves should be inspected for cuts, holes, and embedded materials. The gloves should also be checked for punctures and other defects.
 - Prior to each use, an air test should be conducted by rolling the glove cuff and trapping air in the palm and fingers of the glove. Then, each glove should be individually placed against the cheek to listen and feel for any escaping air.

- Insulated gloves should be kept clean and free from oil, grease, or other harmful substances. The gloves should not have any markings or adhesive tapes attached to them.
- Insulated gloves should be stored in a location as far away as possible from chemicals, oils, solvents, harmful vapors, smoke, discharges, and sunlight. They should be stored in the following manner:
 - ◆ They should be stored in their natural shape inside bags, boxes, or containers specifically designed and intended for their storage.
 - ◆ They should not be folded, creased, turned inside out, compressed, or stored in any way that would cause stretching or compression.
- Chemical aprons: To prevent potential contact with battery acid, a protective apron should be worn that provides external coverage to the front of the body. Rubber aprons can be worn to protect against alkaline substances and should comply with UNE-EN 50365/UNE-EN 166/IEC 61482-1-2:2018.
 - Chemical splash aprons should be worn over standard work clothing to provide an additional layer of protection against hazardous and corrosive chemicals.
 - Chemical aprons should be stored in a location protected from dust, away from moisture and harmful chemicals.
 - Refer to the material manufacturer's instructions for proper storage procedures for chemical aprons.
 - Chemical aprons should be inspected before each use and repaired or replaced if damaged.
- Fabric inner gloves: Fabric inner gloves can be worn inside insulated gloves to provide warmth in cold weather and absorb sweat in hot weather, while facilitating the removal of any outer protective gloves.
 - Protective outer gloves: These gloves provide mechanical risk protection and can be worn over insulated gloves to prevent damage from machinery or tools. The protective outer gloves should comply with EN 388.
 - The type and size of protective outer gloves should be as recommended by the manufacturer of the insulated gloves.
 - Protective outer gloves should not be used if they have tears, holes, or other defects that could compromise their ability to protect the insulated gloves.
 - Protective outer gloves should be kept away from oil, grease, chemicals, and any substances that could damage the insulated gloves.
 - Protective outer gloves should be inspected before each use, paying particular attention to the inner surface for sharp objects, and repaired or replaced if damaged.
- Arc flash face shield and splash goggles:

- When working with HV, an arc flash face shield should be worn to prevent potential injuries from arc flash. The arc flash face shield should comply with EN 50365.
- The face shield includes replaceable protective shield components, and improper opening of the shield can cause damage or expedited wear.
- The face shield should be adjusted prior to use to ensure a proper fit and coverage of the entire head.
- Splash goggles are designed to protect the wearer from liquid splashes but do not provide arc flash protection.
- Follow the manufacturer's instructions for cleaning the arc flash face shield and splash goggles.
- Arc flash face shields and splash goggles should be properly stored and inspected before each use, and repaired or replaced if damaged. °
- Wear arc-rated clothing with a minimum rating of 4 cal/cm² (should comply with IEC 61482-1-2:2018/ASTM F1959/F Class 1 or DL/T 320-2010 Class 1 standards or equivalent specifications).
- Protective safety boots:
 - Leather safety boots can still carry a charge, so insulated safety boots must be worn when working with HV.
 - In case of damage to the traction batteries, wear insulated safety boots that comply with EN50321-1:2018 standard Class 0 level.

All insulated safety boots must be kept dry to maintain their insulation functionality. They should be inspected before each use, and if damaged, they should be repaired or replaced.

2.3.3. Damaged PPE

- Any clothing or personal protective equipment that has come into contact with electrolytes should be decontaminated or disposed of.
- Before using any personal protective equipment, its condition should be checked and verified as suitable for use.

2.4. Energized Circuits System

- Only EVH RVMs are allowed to perform "live" maintenance work on EV HV systems in Type H RVMW.
- Prior to conducting any "live" work, EVH RVMs must conduct a risk assessment and establish preventive measures and preparedness for potential accidents.
- "Live" work should not be carried out unless there are no other feasible options available (e.g., in the case of a traffic accident where the related EV is damaged to the extent that specific isolation maintenance plugs cannot be disconnected).
- When work needs to be performed on "live" circuits, strict adherence to the vehicle manufacturer's guidelines and maintenance documentation is necessary. Full understanding and implementation of the required safety measures throughout the entire replacement process should be ensured, including the use of manufacturer-designated special repair tools.
- Proper insulation tools/equipment should be used when working on "live" circuits (e.g., standing on an insulating mat) and temporary insulation and covering of exposed parts should be applied using insulating mats and/or covers.
- During "live" maintenance work on EV HV systems, another individual with "rescue support capability" should be present and ready to provide rescue support. Individuals considered to have "rescue support capability" include:
 - EVL RVMs or EVL RVMs.
 - Registered electrical workers (commonly known as A, B, C, H licence holders).
 - Individuals holding a valid "Certificate of Safety for Installation and Maintenance of Electrical Equipment" issued by the Occupational Safety and Health Council.
 - Individuals holding a valid First Aid certificate issued by St. John Ambulance, Hong Kong Red Cross, Occupational Safety and Health Council, or Auxiliary Medical Service.

2.5. First Aid

2.5.1.Overview

- Before initiating first aid, reference the vehicle manufacturer's safety guidelines and procedures whenever feasible.
- Rescuing the injured individual should only be done with ensured safety. If any part of the individual's body is still in contact with electric current, the power source must be turned off, the plug removed, or the wires moved to prevent further contact.
- If this cannot be accomplished, stand on a dry insulating material (rubber, wood, bricks, folded thick newspapers, books) and use an object that provides insulation (such as a wooden broomstick) as a lever to push or pull the injured individual away from the power source. Avoid touching the individual directly with bare hands.
- Seek immediate assistance: Call 999 and check the injured individual's airway, breathing, and pulse.
- If possible, qualified first aid personnel should administer first aid to the injured individual. In the absence of first aid personnel, follow the methods described in the "Electric Shock" notice provided by the Labour Department.

2.5.2.Electrical Hazard - Arc Flash, Electric Shock, Electric Burns

- Arc flash can cause clothing to ignite and result in severe burns to the skin. When an arc flash occurs, take the following measures:
 - Remove affected clothing.
 - Rinse the affected skin with cold water.
 - Seek medical attention for the injured person. ◦
- In the event of an electric shock to a maintenance personnel, prioritize personal safety by ensuring the environment is safe and free from further danger. Take necessary preventive measures and call for emergency assistance (999). Perform a preliminary assessment of the injured person's consciousness, breathing, and pulse. Any of the following response measures may be required:
 - Cardiopulmonary resuscitation (CPR).
 - Use of an AED.
 - Transport the injured person to a medical facility for further evaluation, especially if they have lost consciousness at any point.
- In the case of an electric burn, immediately cool the affected area with cold water and apply burn dressings. Electric burns are often more severe than superficial burns on the skin due to the passage of electric current through the body, which can cause internal injuries. Any severe electric burn should be evaluated at a medical facility.

2.5.3. Battery Exposure

- **Please note that the internal disassembly and repair of traction battery, such as vehicle power batteries, are not within the scope of vehicle maintenance services. Damaged HV traction battery should not be handled independently and should be addressed by relevant professionals.**
- Unless the traction battery is accidentally damaged, it is unlikely to come into contact with HV battery electrolyte. A preliminary inspection of the HV enclosure may be necessary before maintenance and servicing.
- If the skin comes into contact with HV battery electrolyte, take the following measures:
 - Remove contaminated clothing.
 - Rinse the affected skin with water for 20 minutes.
 - Seek immediate medical attention.
 - Refer to the relevant SDS for more information.
- If the eyes come into contact with HV battery electrolyte, take the following measures:
 - Immediately flush the eyes exposed to the electrolyte for 15 to 20 minutes, using fingers to separate the eyelids to ensure thorough rinsing.
 - Seek immediate medical attention.
 - Refer to the relevant SDS for more information. ◦
- If battery electrolyte is accidentally ingested, take the following measures:
 - For lithium-ion (Li-ion) electrolyte, rinse the mouth without swallowing.
 - For electrolytes other than lithium-ion, have the individual drink a large amount of water to dilute the electrolyte, but do not give water to an unconscious person.
 - Do not induce vomiting. If spontaneous vomiting occurs, keep the patient's head low and forward to reduce the risk of choking. If unconscious, place the patient's head to the side and ensure an open airway.
 - Seek immediate medical attention.
 - Refer to the relevant SDS for more information.
- If electrolyte vapor is inhaled, take the following measures:
 - Immediately move the person who inhaled the electrolyte to an area with fresh air.
 - Transport the injured person to a medical facility.

Note: If electrolyte leakage occurs and is exposed to the air, it may release electrolyte vapor. Even in non-fire situations, electrolyte vapor can be toxic or highly irritating.

3. Vehicle Repair Workshop Basic Requirements

3.1. Overview

- This section applies to general or specialized automotive work bays and repair workshops, such as vehicle manufacturer service stations and registered vehicle repair workshops under various voluntary vehicle repair registration programs. These workshops may be involved in engine adjustment, suspension, tires, brakes, body repairs, etc., but do not cover the diagnosis, testing, and repair of the traction battery.
- Unless it can be proven that there is no residual voltage in the HV traction battery, **it should be always treated as “live”**, and all feasible safety precautions should be taken.
- The person in charge of the RVMWs should ensure that the repair and maintenance of EVs are only carried out by respective EV RVMs or under their supervision. These EV RVMs should be able to identify all HV systems and components and take all feasible safety precautions before starting work.
- The person in charge of the RVMWs should provide appropriate EV safety training, for example the VMTAC approved EV Maintenance Safety Awareness Course, to any personnel who come into contact with EVs, including but not limited to VM, apprentices, cleaners, etc.
- Disciplinary actions, including but not limited to issuing advisory letters, issuing warning letters, temporarily suspending registration, and revoking registration, will be taken by the VMRU of the EMSD against RVMWs with poor performance. If any RVMW is found to be involved in illegal activities or criminal offenses, they will be referred to the relevant law enforcement agencies for further action.

3.2 Workshop and Facility Requirements

3.2.1 General

- If various RVMWs employ EVE RVMs or EVL RVMs, they can perform specific services or EV LV system maintenance work respectively.
- Only EVH RVMs are allowed to perform live repairs on EV HV systems in Type H RVMWs.
- All levels of RVMWs must provide repair and maintenance services for EVs in covered workshops. These covered service stations/workshops should have wind and rain protection capabilities and adequate ventilation.
- All levels of RVMWs must prominently display the workshop identification signage at visible locations on the premises for visitors to see.
- The person in charge of the RVMWs should affix the names and contact details of the responsible RVMs and first aid personnel (if applicable) at visible locations in the service station/workshop to ensure that information is readily available for emergency assistance.
- The location for performing repair and maintenance services on EVs (i.e., the workshop area) must be clearly separated from the surrounding areas to prevent unauthorized access.
- **If a RVMW (Type 1, 2, 3 or 4) only provides specific services or maintenance services for EV LV systems, the relevant RVMW shall not carry out any maintenance services related to EV HV systems, including “live” work. If you are found to be performing "live" maintenance work on the EV HV systems, it will be considered a violation of this document, and the registration of such RVMW may be revoked.**
- The person in charge of the RVMWs should assess workplace hazards, identify and implement preventive measures to minimize these hazards. Hazards may include slippery surfaces, poor ventilation, untidy or cluttered vehicle working bays, tripping hazards (such as charging cables), and working on potentially live components.
- The person in charge of the RVMWs should also assess the risk of fire incidents, familiarize themselves with the location of fire safety equipment and SDS, and take measures to effectively control potential health and safety risks faced by mechanics and others, including but not limited to clearly marking escape routes and assembly points.
- To prevent wires from being crushed by vehicles, wires should not be placed in vehicle pathways without protective measures. If necessary, wires and pipes should be covered with protective boards.
- For fire safety equipment, please refer to section 6.1.2 of this document.
- For recommended equipment in RVMWs, please refer to **Annex 2: Recommended EV RVMW Equipment Checklist**.
- For equipment related to Type H RVMWs, please refer to **Annex 3: Type H RVMW Self-Inspection Checklist**.

3.2.2 Vehicle Working Bay

- EV maintenance work must be conducted in designated "vehicle working bays" and comply with the requirements for RVMWs. There should be sufficient space for RVMs to perform repairs within each designated "vehicle working bay". The working area should be marked with signage for identification and differentiated from other areas within the workshop using colored lines or other means.

3.2.3 First Aid Equipment Requirements

- The person in charge of the vehicle repair workshop must provide and maintain a first aid kit or cabinet. Each first aid kit or cabinet must be placed in an easily accessible location and clearly labeled with the words "FIRST AID" and Chinese of First Aid.
- The first aid supplies should be kept in good condition at all times. Except for first aid appliances and necessities, other items should not be stored in the first aid kit or cabinet. For the required first aid supplies, please refer to the "Hints On First Aid" and "A Brief Guide To - First Aid" booklets printed by the Occupational Safety and Health Division of the Labour Department.
- It is recommended to equip Type H RVMWs with an automated external defibrillator (AED) to provide an effective rescue method in case of emergencies.

3.2.4 Lifting Appliances

- For inspection, examination, and testing of cranes and lifting equipment, please refer to the "Guidance Notes on the Inspection, Thorough Examination and Testing of Suspended Working Platforms" and relevant regulations Factories and Industrial Undertakings Ordinance, Chapter 59.
- The load on lifting appliances must not exceed their maximum safe working load.
- It should be noted that EVs are heavier than conventional internal combustion engine vehicles. Before using cranes and lifting equipment, it is necessary to verify if the equipment's safe working load is sufficient.
- The weight distribution of EVs should be taken into consideration. Before conducting repairs, refer to the vehicle manufacturer's product instructions and follow their recommended methods for vehicle lifting and maintenance.
- If uneven weight distribution or the possibility of tilting is observed, immediately cease the use of lifting equipment and seek assistance from professionals to conduct a risk assessment.
- EV batteries should be unloaded, transported, and lifted using cranes and lifting equipment designated by the vehicle manufacturer to avoid potential hazards.

3.2.5 RVMW offering Specific Service (EVE)

- The concerned RVMW must employ at least one registered EVE RVMs who should be present during business hours.
- The concerned RVMW is authorized to provide specialized repair services for EVEs (Classes S2 to S7).

3.2.6 RVMW offering EV LV System Maintenance Work

- The concerned RVMW must employ at least one registered EVL RVMs who should be present during business hours.
- The concerned RVMW can provide maintenance services for EV LV systems.
- The concerned RVMW is not permitted to diagnose, test, repair, disassemble, replace, or install the entire fixed traction battery and its associated HV wires.

3.2.7 RVMW offering EV HV System Maintenance Work (Commonly known as Type H RVMW)

- Type H RVMW must employ at least one EVH RVM who should be present during business hours.
- Only Type 1, Type 2, or Type 3 RVMWs can apply to become Registered Type H RVMW and meet the requirements determined by the VMTAC to confirm their capability to perform HV system repairs for EVs.
- Type 1, Type 2, or Type 3 RVMWs must undergo on-site inspections and submit reports conducted by the vehicle manufacturer or qualified third-party certification bodies (**Annex 4**) to be considered eligible for applying as Type H RVMW.
- The person in charge of the Type H RVMW should provide **regular** electrical safety training for example the VMTAC approved EV Maintenance Safety Awareness Course, to all personnel who come into contact with EVs, including but not limited to vehicle mechanics, apprentices, cleaners, etc.
- For conducting "live" work on EVs, the vehicle working bay should be segregated into a "caution zone" and must be clearly identified with warning signs. Separation can be achieved using traffic cones, tape, barriers, etc.
- Within the "caution zone," there should be a minimum distance of 105 centimeters between one side of the EV's body and any fixed structure, fixture, or another vehicle (excluding the vehicle lift). Additionally, a pathway with a **minimum** width of 105 centimeters should be provided from the RVMW's entrance/exit (as shown in the diagram below) to ensure sufficient space for rescue support when necessary. The person in charge of the RVMW should ensure sufficient space is reserved for rescue support when necessary.

- In general, individuals other than those involved in "live" work are prohibited from entering the "caution zone."
- When performing "live" repairs on the HV system of EVs, the EVH RVMs must have another individual with "rescue support capability" on standby to provide immediate rescue assistance. The definition of "rescue support capability" can be found in Section 2.4 of this reference.
- The individual on standby to provide rescue support should remain outside the "caution zone" and only enter when necessary, ensuring at all times that individuals not involved in "live" work do not enter the "caution zone."
- Type H RVMW should have at least one vehicle fire blanket with a coverage area of not less than 800 cm x 600 cm for emergency use. It is recommended that two people operate the fire blanket, unfolding and covering the body of the EV at a safe distance.
- In accordance with section 3.2.3 of this reference, the Type H RVMW should be equipped with an AED and ensure that it is in good standby condition to provide an effective rescue method in case of emergencies.
- Type H RVMW should also use the "AED Locator" online information platform provided by the Fire Services Department to search for and confirm the location of the nearest publicly accessible AED and determine if its availability falls within its business hours. Subsequently, relevant information should be posted prominently in the RVMW
- Unreasonable quantities of fixed traction battery should not be stored.
- Fixed traction battery should be properly labeled and stored in designated areas. Failed or damaged onboard power batteries should also be appropriately labeled and stored.
- For an overview of the requirements for Type H RVMW, please refer to the checklist provided in **Annex 3**.

3.3 Overheating Warning Labels

- The EV traction battery may be damaged when exposed to high temperatures (e.g., in the paint booth of VMW).
- Warning labels from the vehicle manufacturer may be present on the body of the EV. For example, these labels may specify that the battery temperature should not exceed 60°C (or 140°F) and provide indication on the maximum duration of exposure to extreme high temperatures. Before performing heating repair or painting processes on an EV, refer to the relevant documentation prepared by the vehicle manufacturer or contact the vehicle manufacturer to obtain the necessary information.

3.4 RVMW Warning Signs

- Warning signs or restricted area markers should be placed near the vehicle working bay, caution zone, and other areas where entry is prohibited to prevent unauthorized personnel from entering and coming into contact with the EV or its dismantled components.
- The signs should be simple, clear, and prominently displayed. Examples include: "Caution: Isolation Zone, No Entry," "Warning: Diagnostic and repair work in progress using external power source, do not touch," and so on.

4. EV Safety Maintenance Procedures

4.1 Overview

- This section applies to all types of EVs. Before performing any operation or maintenance on an EV, please refer to the relevant documentation prepared by the vehicle manufacturer, such as safety instructions, operation guidelines, and maintenance manuals, to understand the potential hazards associated with the specific EV system.
- Due to the rapid development of EV technology, if there are risks not mentioned in this section, it is necessary to obtain additional risk mitigation measures from sources other than this guide to ensure safety.

4.2 Isolating the EV

4.2.1 Overview

- Each manufacturer has unique isolation procedures for each model of EV. Therefore, before performing any operation or maintenance on an EV, please refer to the relevant documentation prepared by the vehicle manufacturer, such as safety instructions, operation guidelines, and maintenance manuals, to familiarize yourself with the specified isolation procedures and required tools.
- Isolation procedures should only be carried out by EVL RVMs or EVH RVMs.

4.2.2 Procedures for Isolating the EV

- Isolation procedures should only be performed in the RVMW.
- The operation of the EV HV maintenance plug or specific manual disconnect device should be carried out according to the vehicle manufacturer's safety procedures, including but not limited to removing the manual disconnect device or turning the circuit breaker to the off position to physically disconnect the circuit connecting the traction battery and HV components.
- After disconnecting the EV HV maintenance plug or specific manual disconnect device, a waiting period for power interruption should be observed according to the vehicle manufacturer's safety procedures to allow the discharge of capacitors and electronic components in the circuit.
- After the completion of the capacitor and electronic component discharge procedure, an appropriate voltage measuring instrument should be used to measure the voltage and confirm the absence of "residual power," i.e., the voltage reading should be zero.
- EVH RVMs should use suitable locking devices for power plugs to prevent reconnection of the EV HV maintenance plug or specific manual disconnect device. They should also clearly record the date, time, and responsible personnel who completed the isolation procedure.
- EVH RVMs should install a steering wheel warning cover or follow the procedures of the Type H RVMWs to place appropriate warning signs, reminding personnel that the traction battery has been disconnected and unauthorized movement is prohibited.
- RVMs should consider the EV as being in an "energized" state until the status of all potentially "live" and hazardous conductive components is verified.
- Once all the above procedures are completed, and the condition of the EV components has been assessed to ensure safe maintenance work, the EV can be considered "effectively isolated."

4.2.3 Isolation of Traction Battery

- Refer to the relevant documentation prepared by the vehicle manufacturer, such as safety instructions, operation guidelines, and maintenance manuals, to isolate the traction battery. After completing the isolation procedure, the HV power of the EV will be confined within the traction battery.
- The internal disassembly and repair of the traction battery are not within the scope of vehicle maintenance services. EVH RVMs can only perform "one-to-one" disassembly, replacement, and installation of the entire fixed onboard power battery.
- For the maintenance or disposal of the traction battery, seek assistance from the vehicle manufacturer or authorized aftermarket service provider.

4.2.4 Disconnecting Separated Low Voltage Power

- Refer to the relevant documentation prepared by the vehicle manufacturer, such as safety instructions, operation guidelines, and maintenance manuals, to safely disconnect the separated low voltage power of the EV.

4.2.5 Depower Interval

- The specified waiting time by the vehicle manufacturer should be followed to allow for the discharge of capacitors and electronic components.
- During the waiting period, the vehicle should not be operated to prevent any remaining electrical energy stored in capacitors and electronic components from causing harm to individuals.

4.2.6 Current inspection

- Refer to the relevant documentation prepared by the vehicle manufacturer, such as safety instructions, operation guidelines, and maintenance manuals, to check the current after the HV system has been depowered, ensuring that there is no "residual electricity," meaning the measured voltage value is zero.
- If the measured voltage value is not zero, recheck the isolation procedures to ensure the proper completion of all necessary steps. Seek assistance from the vehicle manufacturer when needed to identify any issues and isolate related residual voltage.

4.2.7 Voltage Measurement Instrument

- Refer to the relevant documentation prepared by the vehicle manufacturer, such as safety instructions, operation guidelines, and maintenance manuals, to inspect the voltage measurement instrument (commonly known as a digital multimeter).

- The voltage measurement instrument should be checked for proper functioning before and after testing the traction battery.

4.2.8 Specialized Tools

- Refer to the relevant documentation prepared by the vehicle manufacturer, such as safety instructions, operation guidelines, and maintenance manuals, to inspect the voltage measurement instrument (commonly known as a digital multimeter).
- The voltage measurement instrument should be checked for proper functioning before and after testing the traction battery

4.3 Service and Maintenance of EV

4.3.1 Service Requirements

- Refer to the relevant documentation prepared by the vehicle manufacturer, such as safety instructions, operation guidelines, and maintenance manuals, and provide service and maintenance for EVs following the provided guidelines.
- Ensure that the components installed in the vehicle meet legal, safety, and quality requirements and are used for their intended purpose without posing any undue fire or electrical hazards or causing damage to other equipment.

4.3.2 Identification of Risks at the RVMWs

- Identify risks at the RVMWs and take preventive measures to minimize these risks as much as possible, following the current Hong Kong legal requirements related to vehicle maintenance (see Section 1.2 of this guideline).
- Risks may include slippery floors, poor ventilation, untidy or cluttered vehicle working bays, trip hazards (such as charging cables), and working on "live" components.

4.3.3 Tools and Equipment

- In addition to meeting the tool and equipment requirements of the RVMW, acquire necessary tools and equipment according to the workshop guidelines specified by the vehicle manufacturer.

4.3.4 Technical Data

- Refer to the relevant documentation prepared by the vehicle manufacturer, such as safety instructions, operation guidelines, and maintenance manuals, to obtain the relevant technical data for conducting system testing, calibration, and maintenance of EVs.

4.3.5 Installation of Vehicle Power Battery

- Refer to the relevant documentation prepared by the vehicle manufacturer, such as safety instructions, operation guidelines, and maintenance manuals, to ensure the proper installation and secure connection of the traction battery, to the related HV system.

4.3.6 Fault Identification and Record-Keeping

- Refer to the relevant documentation prepared by the vehicle manufacturer, such as safety instructions, operation guidelines, and maintenance manuals, to identify faults in EVs and take corrective measures.

- Maintain proper records detailing the faults and corresponding corrective measures. Keep the records for at least six months or the vehicle warranty period, whichever is longer.

4.3.7 Auxiliary Components

- Refer to the relevant documentation prepared by the vehicle manufacturer, such as safety instructions, operation guidelines, and maintenance manuals, to inspect the condition and operation of relevant electrical components, identify performance issues, and take corrective measures.
- Maintain proper records detailing the performance issues and corresponding corrective measures. Keep the records for at least six months or the vehicle warranty period, whichever is longer.

4.3.8 Inspection and Storage of Tools

- RVMWs should establish procedures to regularly inspect and properly store repair tools.

4.3.9 Labeling of Faulty Equipment and Tools

- RVMWs should establish procedures to identify, label, and isolate faulty equipment and tools.

4.3.10 Handling of Maintenance Documents

- RVMWs should establish procedures to properly store and handle service and maintenance-related documents.
- Ensure the ability to provide relevant service and maintenance based on the latest documentation provided by the vehicle manufacturer, such as safety instructions, operation guidelines, and maintenance manuals.

4.4 Moving EVs within the RVMW

4.4.1 Overview

- The process of repairing EVs may require moving them to another vehicle working bay. This section provides relevant safety recommendations.
- Before moving an EV, refer to the documentation prepared by the vehicle manufacturer, such as safety instructions, operation guidelines, and maintenance manuals, to ensure that the movement is carried out safely.
- EVs should only be moved according to the guidelines provided by the vehicle manufacturer. The HV wires (commonly known as orange wires) disconnected from the electric motor or regenerative power system should be isolated using electrical insulation tape to prevent electrical arcing.

4.4.2 Vertical Movement of EVs

- When an EV needs to be elevated, use appropriate lifting machinery or devices at the designated jacking points to prevent penetrating damage to the traction battery, located at the bottom of the EV.

4.4.3 Moving EVs with Permanent Magnet Motors or Regenerative Power Systems

- Some EVs may be designed with permanent magnet motors or have their wheels directly connected to the regenerative power system.
- When directly moving EVs with permanent magnet motors or regenerative power systems, as the wheels rotate, current can be generated in the motor windings, posing a risk of electric shock. There is also a potential danger of hazardous HV arcing if the EV is isolated and the circuit has been disconnected.
- Therefore, before moving an EV, refer to the documentation prepared by the vehicle manufacturer and use appropriate methods to isolate the drive wheels from the ground to prevent electrical hazards caused by wheel rotation.

5. Handling Damaged Traction Battery

5.1. Overview

- This section describes the procedures for removing and isolating a damaged traction battery
- Due to the damage to the traction battery, there may be additional risks, such as electrolyte leakage.
- If the housing of the traction battery is physically damaged or shows obvious signs of moisture, contact the vehicle manufacturer for appropriate handling and dismantling procedures.
- Remember that under no circumstances should the battery be internally disassembled or repaired for the entire fixed traction battery. Prior to any actions, review the emergency handling procedures and other relevant documents provided by the vehicle manufacturer, such as safety instructions, operation guidelines, and maintenance manuals.

5.2 Inspection of Traction Battery

5.2.1 Safety Inspection

- Conduct a safety inspection following the maintenance guidelines provided by the vehicle manufacturer. Look for sparks, smoke, or bubbling noises coming from the traction battery, as these signs indicate possible overheating or potential delayed fire hazards.

5.2.2 Odor

- Damaged traction batteries may release harmful gases. If any abnormal odor is detected or there is irritation to the eyes, nose, throat, or skin, refer to the emergency handling procedures and relevant SDS prepared by the vehicle manufacturer. Qualified personnel as described by the manufacturer should handle the situation while wearing appropriate personal protective equipment.

5.2.3 Fluid

- In the event of liquid leakage or bubbling noises from the traction battery, if it is safe to do so, open windows and the front and rear compartments of the vehicle to ensure sufficient ventilation and prevent smoke accumulation.
- EVs equipped with traction battery's cooling systems may have water dripping from the internal evaporator drain pipe.
- If there is liquid leakage, smoke, or abnormal noises from the on-board power battery, refer to the emergency handling procedures and relevant SDS prepared by the vehicle manufacturer. Qualified personnel as described by the manufacturer should handle the situation while wearing appropriate personal protective equipment.

5.2.4 Corrosive Materials

- The materials inside the traction battery may be corrosive, toxic, and flammable. When dismantling a damaged or suspected damaged battery, follow the relevant documents provided by the vehicle manufacturer, such as safety instructions, operation guidelines, and maintenance manuals, to take appropriate preventive measures.

5.2.5 Electrical Shock Hazard

- Avoid direct contact with the damaged traction battery as much as possible, as there is a serious risk of electrical shock.

5.3. Disassembling of Vehicle Power Batteries

5.3.1 HV Wiring

- HV wires or HV components of the battery must not be cut or opened.

5.3.2. Re-calibration Measurement Instrument

- Prior to contacting any uninsulated HV terminals, the voltage reading on the measurement instrument should be zero.

5.3.3. Personal Protective Equipment

- Appropriate safety measures should be taken before disassembling vehicle power batteries. RVMs should adhere to the PPE requirements outlined in section 2.3.2 of this document, as well as follow the procedures specified by the vehicle manufacturer. They should wear suitable PPE and follow relevant documents provided by the vehicle manufacturer, such as safety instructions, operating guidelines, and maintenance manuals, to complete the isolation and battery disassembly procedures.

5.3.4. Battery Storage

- RVMWs should designate separate storage areas for traction batteries. These areas should have temperature and humidity control, proper ventilation systems, and signs or markings indicating that they are designated storage areas for vehicle power batteries.
- Different types of traction batteries should be stored in separate storage areas, clearly labeled to indicate the battery type.
- When storing traction batteries, they should be placed in their default orientation and should not be placed upside down.
- If temporary storage of traction batteries is required in the vehicle working bay, the storage location should be secured to prevent accidental contact (including environmental factors). Adequate electrical isolation and protection against chemical leaks should be provided.
- If feasible, damaged traction batteries should be stored in specific storage containers with warning labels affixed to the battery storage box, for identification and prevention of unauthorized movement and contact.

6. Fire Safety

6.1. Overview

- This section covers the minimum requirements for fire safety measures and equipment in EV repair service stations/facilities, including their location and availability.
- Refer to the SDS provided by the vehicle manufacturer for more information regarding fire protection equipment related to the vehicles, including the types of extinguishing agents to be used and appropriate personal protective equipment.
- Firefighting equipment should be installed/stored near the vehicle working bay.
- Refer to the latest guidelines from the Fire Services Department on " Minimum Fire Service Installations and Equipment And Inspection, Testing And Maintenance Of Installations and Equipment" and comply with the specified provisions in those guidelines.
- The person in charge of the facility should seek professional assistance to periodically assess the fire risks in the vehicle working bays and provide appropriate fire prevention and firefighting equipment based on those risks.

6.2. Fire Safety Equipment

- Systems/devices/equipment to be installed in EV RVMWs:
 - Automatic activation devices (to be installed in conjunction with equipment requiring automatic activation)
 - Emergency lighting system (to be installed throughout the premises and all exit routes)
 - Exit signs (to ensure clear display of all exit routes)
 - Firefighter lift (if applicable, provided in accordance with the "Building Fire Safety Code" requirements)
 - Sprinkler system (if the total floor area of the service station/facility exceeds 230 square meters, this system must be installed and cover all parts of the service station/facility, including staircases leading to the area)
 - Ventilation/air conditioning control system (if installed, the system must be able to stop the airflow caused by mechanical equipment within the designated fire compartments)
 - Fire alarm system (each hose reel location must be equipped with a start button and an audible alarm device)
 - Fire hydrant/hose reel system:
 - ◆ Sufficient fire hydrants and hose reels should be installed on each level to ensure that every part of the facility has access to fire hydrants and hose reels with rubber hoses.
 - ◆ The length of the rubber hoses should not exceed 30 meters, and the hose reels with nozzles should be capable of delivering a water jet of at least 6 meters in length.
 - ◆ Instructions on how to use the fire hose reel should be conspicuously displayed on the wall adjacent to the hose reel.
 - ◆ A metal or plastic hammer, approximately 300 millimeters in length, should be provided near the hose reel to break the glass panel in case of emergency to activate the fire alarm bell and fire pump.
 - Fire Extinguishers
 - ◆ RVMWs should be equipped with dry powder or carbon dioxide fire extinguishers. There should be at least one fire extinguisher for every 100 square meters of workshop floor area.
 - ◆ At least one dry powder or carbon dioxide fire extinguisher should be placed at the entrance and exit of the service station/facility.
 - ◆ The capacity of dry powder fire extinguishers should not be less than 4.5 kilograms, and the capacity of carbon dioxide fire extinguishers should not be less than 3 kilograms.

- ◆ The use of dry powder fire extinguishers can reduce visibility, so it is important to plan escape routes before using them. If the fire is out of control, evacuate immediately to a safe location and alert authorities.
- ◆ Carbon dioxide fire extinguishers can cause suffocation and should not be used in enclosed spaces. After use, move to an open area.
- Fire Blanket
 - ◆ A fire blanket for vehicles should have a coverage area of not less than 800 cm x 600 cm for emergency use. It is recommended to operate the fire blanket with two people, unfolding it and covering the body of the EV from a safe distance.
 - ◆ Note: The use of a fire blanket alone can only control the fire and cannot extinguish fires occurring inside the battery.

6.3. Procedures

6.3.1 Fire Procedure

- In the event of a fire, call 999 for immediate assistance.
- If attempting to extinguish the fire yourself, prioritize your personal safety and assess the risks in the environment.
- Follow the emergency procedures and other relevant documents provided by the vehicle manufacturer to extinguish the fire according to the recommended safety procedures.
- Fire extinguishers are only suitable for small non-battery fires.
- Fire blankets can be used to control smoke and prevent the spread of fire.
- If a fire occurs in the traction battery, utilize special firefighting water equipment to continuously spray a large amount of water from a safe distance to extinguish it.
- Note: The water used for firefighting may introduce additional electrical shock risks, so avoid direct contact of any part of your body with the water stream.

6.3.2 Prevention of Fire Re-ignition and Spread

- After extinguishing an EV fire, the traction battery and other components may still accumulate a significant amount of energy and have the potential for re-ignition. Therefore, after extinguishing visible flames, continue to apply water to cool down the system and prevent re-ignition and the spread of fire to adjacent batteries.
- Follow the emergency procedures and other relevant documents provided by the vehicle manufacturer to determine the necessary time for firefighting and cooling.
- Temporarily store damaged or burning traction battery according to the emergency procedures and other relevant documents provided by the vehicle manufacturer until the battery is fully discharged.

6.3.3 Handling of Toxic Gases

- EV fires may produce toxic gases. Wear appropriate personal protective equipment and take necessary control measures as outlined in the emergency procedures and other relevant documents provided by the vehicle manufacturer.
- Evacuate nearby individuals to prevent inhalation of toxic gases. Call 999 to explain the situation and seek assistance from professional firefighters trained in handling chemicals.

Annex 1 Comparison of Service Scope for Internal Combustion Engine Vehicle Repair and EV Maintenance

<u>Services</u>	<u>Scope of Internal Combustion Engine Vehicle Repair Services</u>	<u>Scope of EV Repair Services:</u>
Mechanical (M)	<ul style="list-style-type: none"> ● This refers to the repair and maintenance work on the chassis, engine, transmission system, braking system, steering system, air conditioning system, oil change, and tire repair. However, it does not include the fuel system of vehicles running on liquefied petroleum gas (LPG). This service also includes some basic low voltage (up to 24 volts) electrical work. 	<p><u>EVL:</u></p> <ul style="list-style-type: none"> ● This refers to the repair and maintenance work on the chassis, transmission system, braking system, steering system, air conditioning system (including HV compressors and related motors), oil change, and tire repair, while working on the vehicle without effectively isolating the HV on-board power battery system. ● It includes the method of "one-to-one" disassembly, replacement, and installation of the entire fixed on-board power battery (excluding internal disassembly and repair of the entire fixed on-board power battery). ● This service also includes some basic extra-low voltage work (up to a maximum of 24 volts) on electrical systems. <p><u>EVL:</u></p> <ul style="list-style-type: none"> ● This refers to the repair and maintenance work on the chassis, transmission system, braking system, steering system, air conditioning system (including HV compressors and related motors), oil change, and tire repair while effectively isolating the HV on-board power battery system. ● It does not include the fixed on-board power battery and its associated HV "orange cable." ● This service also includes some basic extra-low voltage work (up to a maximum of 24 volts) on electrical systems.
Electrical (E)	<ul style="list-style-type: none"> ● This refers to the low-voltage work (up to a maximum of 24 	<p><u>EVL:</u></p> <ul style="list-style-type: none"> ● This refers to the maintenance and

	<p>volts) involved in repairing and maintaining all vehicle internal circuits, electronic systems, and air conditioning systems. It includes tasks such as installation, maintenance, repair, system analysis, and debugging of electrical equipment and devices, as well as the installation of their wiring.</p>	<p>repair work on all vehicle internal circuits, electronic systems, and air conditioning systems that cannot be effectively isolated from the HV on-board power battery system ("live" work). It includes tasks such as installation, maintenance, repair, system analysis, and debugging of electrical equipment and devices, as well as the installation of their wiring.</p> <ul style="list-style-type: none"> ● It also involves the method of "one-to-one" disassembly, replacement, and installation of the entire fixed on-board power battery (excluding internal disassembly and repair of the entire fixed on-board power battery). <p><u>EVL:</u></p> <ul style="list-style-type: none"> ● This refers to the maintenance and repair work on all vehicle internal circuits, electronic systems, and air conditioning systems while effectively isolating the HV on-board power battery system. It includes tasks such as installation, maintenance, repair, system analysis, and debugging of electrical equipment and devices, as well as the installation of their wiring. ● However, it does not include the fixed on-board power battery and its associated HV "orange cable."
<p>Body repair (B1) and Body painting (B2)</p>	<ul style="list-style-type: none"> ● This refers to the work that includes vehicle body repairs and painting. This service also includes some basic electrical work, limited to the disassembly and reinstallation of electrical equipment and devices operating at extra-low voltage (up to a maximum of 24 volts). 	<p><u>EVH:</u></p> <ul style="list-style-type: none"> ● This refers to the ability to perform body repairs, disassembly, and reinstallation of the vehicle body while working on it without effectively isolating the HV on-board power battery system ("live" work). ● This service also includes some basic electrical work, limited to the disassembly and reinstallation of electrical equipment and devices operating at extra-low voltage (up to a maximum of 24 volts).

		<p><u>EVL:</u></p> <ul style="list-style-type: none"> ● This refers to the ability to perform body repairs and painting of the vehicle while effectively isolating the HV on-board power battery system. <p>This service also includes some basic electrical work, limited to the disassembly and reinstallation of electrical equipment and devices operating at extra-low voltage (up to a maximum of 24 volts).</p>
Motorcycle maintenance (S1)	<ul style="list-style-type: none"> ● Limited to motorcycle category maintenance work. 	<p><u>EVL:</u></p> <ul style="list-style-type: none"> ● This refers to the ability to perform body repairs and painting of the vehicle while effectively isolating the HV on-board power battery system. <p>This service also includes some basic electrical work, limited to the disassembly and reinstallation of electrical equipment and devices operating at extra-low voltage (up to a maximum of 24 volts).</p> <p><u>EVL:</u></p> <ul style="list-style-type: none"> ● This refers to the ability to perform maintenance work on electric motorcycles without effectively isolating the HV on-board power battery system ("live" work). ● It also involves the method of "one-to-one" disassembly, replacement, and installation of the entire fixed on-board power battery (excluding internal disassembly and repair of the entire fixed on-board power battery). <p><u>EVL:</u></p> <ul style="list-style-type: none"> ● This refers to the ability to perform maintenance work on electric motorcycles while effectively isolating the HV on-board power battery system. ● However, it does not include the fixed on-board power battery and its associated HV "orange cable".
Tyre work (S2)	<ul style="list-style-type: none"> ● Tire work 	<ul style="list-style-type: none"> ● Tyre work remains unchanged, but it is not allowed to perform fault diagnosis, testing, maintenance, disassembly, replacement, and installation on the HV system or components of the EV, including HV "orange cables" and their connected components
Battery work (S3)	<ul style="list-style-type: none"> ● Battery work (up to maximum of voltage) 	<ul style="list-style-type: none"> ● RVM is only allowed to perform work on replacing extra-low voltage batteries (up to a maximum of 24 volts), but it is not allowed to perform fault diagnosis, testing,

		<p>maintenance, disassembly, replacement, and installation on the HV system or components of the EV, including HV "orange cables" and their connected components</p>
<p>Lubrication work (S4)</p>	<ul style="list-style-type: none"> ● Lubrication work 	<ul style="list-style-type: none"> ● Lubrication work remains unchanged, but it is not allowed to perform fault diagnosis, testing, maintenance, disassembly, replacement, and installation on the HV system or components of the EV, including HV "orange cables" and their connected components
<p>Car accessories work (S5)</p>	<ul style="list-style-type: none"> ● Car accessories work 	<ul style="list-style-type: none"> ● Vehicle accessory work remains unchanged, but it is not allowed to perform fault diagnosis, testing, maintenance, disassembly, replacement, and installation on the HV system or components of the EV, including HV "orange cables" and their connected components
<p>Air conditioning work (S6)</p>	<ul style="list-style-type: none"> ● Air conditioning work 	<ul style="list-style-type: none"> ● Air conditioning work remains unchanged, but it is not allowed to perform fault diagnosis, testing, maintenance, disassembly, replacement, or installation on the HV system or components of the EV, including HV "orange cables" and their connected components such as the HV compressor in the air conditioning system.
<p>Body building work (S7)</p>	<ul style="list-style-type: none"> ● Body building work 	<ul style="list-style-type: none"> ● Body building work remains unchanged, but it is not allowed to perform fault diagnosis, testing, maintenance, disassembly, replacement, or installation on the HV system or components of the EV, including HV "orange cables" and their connected components.

Annex 2 Recommended RVMW Equipment Checklist

Personal Protective Equipment:	Equipped
Insulating gloves (refer to UNE-EN 60903/IEC 61482 standards or equivalent specifications)	<input type="checkbox"/>
Protective outer gloves (refer to EN 388 standards or equivalent specifications)	<input type="checkbox"/>
Chemical apron (refer to UNE-EN 50365/UNE-EN 166/IEC 61482 standards or equivalent specifications)	<input type="checkbox"/>
Arc flash face shield (with chin protection) and splash goggles (refer to UNE-EN 50365/UNE-EN 166/IEC 61482 standards or equivalent specifications)	<input type="checkbox"/>
Arc flash protective clothing (minimum rating of 4 cal/cm ²) (complying with IEC 61482/ASTM F1959/F Level 1 protection standards/DL/T 320-2010 Level 1 protection standards or equivalent specifications)	<input type="checkbox"/>
Protective safety boots (refer to EN50321-1:2018 standard Class 0 or equivalent specifications)	<input type="checkbox"/>
Insulating mat (refer to UNE EN 61111 standard or equivalent specifications)	<input type="checkbox"/>

First Aid Equipment :	Equipped
First aid kit* (in compliance with the guidelines provided by the Labour Department's "Introduction to First Aid" and "First Aid Manual")	<input type="checkbox"/>
AED	<input type="checkbox"/>
Insulated retrieval hook	<input type="checkbox"/>

Firefighting equipment :	Equipped
Fire blanket	<input type="checkbox"/>
Carbon dioxide or dry powder fire extinguisher* (in compliance with the Fire Services Department's "Minimum Fire Service Installation and Equipment Requirements for Inspection, Testing, and Maintenance")	<input type="checkbox"/>
Fire hose reel and fire hydrant* (in compliance with the Fire Services Department's "Minimum Fire Service Installation and Equipment Requirements for Inspection, Testing, and Maintenance")	<input type="checkbox"/>

Facility provisions :	Equipped
Site warning signage (according to this guideline 3.4)	<input type="checkbox"/>
Name and contact telephone number of the on-duty registered technician (according to this guideline 3.2.1)	<input type="checkbox"/>
Establish a "Vehicle working bay" *	<input type="checkbox"/>

Testing and maintenance tools:	Equipped
Insulation tester	<input type="checkbox"/>
Belt tension gauge	<input type="checkbox"/>
IEC 61010 CAT III or CAT IV digital multimeter	<input type="checkbox"/>
Lifting equipment for EVs	<input type="checkbox"/>
HV digital voltmeter and ohmmeter (HV digital volt ohm meter) or two-pole voltage meter	<input type="checkbox"/>
Milliohm meter	<input type="checkbox"/>
Voltage tester (refer to EN 61243-3, IEC 61010-1:2001, UL 61010-1 2nd edition, or equivalent specifications)	<input type="checkbox"/>
Power plug lockout device	<input type="checkbox"/>

* These items are essential facilities for all RVMWs

Annex 3 Type H RVMW Self-Inspection Checklist

Section 1: The Category H registered workshop must have the following items, you can mark with a ✓ in the boxes to confirm compliance and fill in the relevant information:

Personnel:	Equipped	Quantity
At least one registered EVH technician	<input type="checkbox"/>	
Another person with "rescue support capability" (as per Section 2.4 of this guideline)	<input type="checkbox"/>	

Personal Protective Equipment (PPE):	Equipped	Quantity
Insulated gloves rated for the rated voltage (to comply with UNE-EN 60903/IEC 61482 Level 0 or above)	<input type="checkbox"/>	
Protective outer gloves (to comply with EN 388 standard or equivalent)	<input type="checkbox"/>	
Chemical apron (to comply with UNE-EN 50365/UNE-EN 166/IEC 61482 standard or equivalent)	<input type="checkbox"/>	
Arc flash face shield (with chin protection) and splash goggles (to comply with UNE-EN 50365/UNE-EN 166/IEC 61482 standard or equivalent)	<input type="checkbox"/>	
Arc flash protective clothing (minimum rating of 4 cal/cm ²) (to comply with IEC 61482/ASTM F1959/F Level 1 or DL/T 320-2010 Level 1 or equivalent)	<input type="checkbox"/>	
Insulated safety shoes (to comply with EN50321-1:2018 Class 0 standard or equivalent)	<input type="checkbox"/>	
Insulated mat (to comply with UNE EN 61111 standard or equivalent)	<input type="checkbox"/>	

Site and facility requirements:	Equipped	Quantity
"Caution Zone" - an isolated area for working on "live" EVs, separated using cones, tape, or barriers (as per Section 3.2.7 of this guideline)	<input type="checkbox"/>	
Within the "Caution Zone", one side of the EV should maintain a minimum clearance distance of 105 centimeters (as per guideline 3.2.7)	<input type="checkbox"/>	
Provide a pathway with a minimum width of 105 cm from the entrance/exit of the service station/workshop (as per Section 3.2.7 of this guideline)	<input type="checkbox"/>	
Establish a "Vehicle working bay" with a minimum clearance of 50 cm around the EV body and delineate the area with ground marking (as per Section 3.2.2 of this guideline)	<input type="checkbox"/>	
Site warning signage (as per Section 3.4 of this guideline)	<input type="checkbox"/>	
Name and contact telephone number of the on-duty EVx RVMs (as per Section 3.2.1 of this guideline)	<input type="checkbox"/>	

Firefighting Equipment:	Equipped	Quantity
Vehicle fire blanket - not less than 800 cm x 600 cm in size	<input type="checkbox"/>	
Carbon dioxide or dry powder fire extinguisher (compliant with the Fire Services Department's "Minimum Fire Service Installations and Equipment, Inspection, Testing and Maintenance" guidelines)	<input type="checkbox"/>	
Fire hose reel and fire hydrant (compliant with the Fire Services Department's "Minimum Fire Service Installations and Equipment, Inspection, Testing and Maintenance" guidelines)	<input type="checkbox"/>	

First Aid Equipment:	Equipped	Quantity
First aid kit (compliant with the Labour Department's "Introduction to First Aid" and "First Aid Guidelines" directives)	<input type="checkbox"/>	
Insulated Retrieval Hook	<input type="checkbox"/>	
Automated External Defibrillator (AED)	<input type="checkbox"/>	
Display of AED location information or Fire Services Department's "AED on-site" information	<input type="checkbox"/>	

Emergency Response Procedures:	Equipped
Emergency procedures (Section 2.4-2.5 of this guideline)	<input type="checkbox"/>
EV repair procedures (Section 4 of this guideline)	<input type="checkbox"/>
Procedures for handling damaged HV batteries (Section 5 of this guideline)	<input type="checkbox"/>
Firefighting procedures (Section 6.2.2 of this guideline)	<input type="checkbox"/>
Training program for incoming staff (Section 3.2.7 of this guideline, Category H registered workshop responsible person needs to provide safety guidelines/introductory videos and training)	<input type="checkbox"/>

Section 2: The following are non-mandatory testing and maintenance tools that are recommended for Category H registered workshops. The workshop can equip relevant testing or maintenance tools based on their specific needs.

Testing and Maintenance Tools:	Equipped	Quantity
Insulating Tester (Insulation Tester)	<input type="checkbox"/>	
Applicable Standards:		
Digital Multimeter	<input type="checkbox"/>	
Applicable Standards:		
Test Probe	<input type="checkbox"/>	
Applicable Standards:		
HV Digital Volt-Ohm Meter or Two-Pole Voltage Meter	<input type="checkbox"/>	
Applicable Standards:		

Testing and Maintenance Tools:	Equipped	Quantity
Milliohm meter	<input type="checkbox"/>	
Applicable Standards:		

Other Testing or Maintenance Tools:	Equipped	Quantity
Power Plug Locking Devic:	<input type="checkbox"/>	
Applicable Standards:		
Other tools and maintenance tools:		
Applicable Standards:		
Other tools and maintenance tools:		
Applicable Standards:		
Other tools and maintenance tools:		
Applicable Standards:		
Other tools and maintenance tools:		
Applicable Standards:		

Declaration

I have carefully read and completed the above list, and I ensure that the Category H repair workshop/service station I intend to register complies with all the requirements mentioned. I declare that all the information and documents provided in the list, to the best of my knowledge, are true and accurate. I understand that knowingly providing false information or making false statements is a criminal offense and will result in the invalidation of the application. I also acknowledge and agree that the Electrical and Mechanical Services Department and relevant verification authorities may request and verify personnel, equipment, facilities, and procedural information from me and the intended Category H repair workshop/service station.

Applicant's Signature	Name (Block letter)	Position
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Company Representative's Signature	Name (Block letter)	Position
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Company Seal	Date
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Annex 4 Qualified Third-Party Certification Bodies

International Accreditation:

The third-party certification body should be a Hong Kong certification body recognized by the International Accreditation Forum (IAF), which is a member of an internationally recognized quality management system certification organization.

Professional Qualifications:

The third-party certification body should possess relevant expertise or certification experience in the respective field, such as certification personnel with professional knowledge and experience in automotive technology, EVs, or ISO systems (such as ISO9001, ISO45001, etc.).

Technical Capability:

The third-party certification body should have the technical capability to assess the compliance of RVMWs, including expertise in the registration schemes for vehicle maintenance.

Stringent Standards:

The third-party certification body should establish and implement stringent certification standards to ensure that registered vehicle repair workshops have the necessary skills and equipment for HV system maintenance.

Audit Process:

The third-party certification body should have effective audit processes and procedures, including on-site inspections, document reviews, and technical assessments, to ensure compliance of RVMWs.

Assessment Reports:

The certification results report issued by the third-party certification body should indicate whether the workshop has passed the assessment and clearly state the assessment date. Relevant assessment reports should be provided to the registered vehicle repair workshop within 30 days after the on-site inspection.

Compliance Assessment:

Regardless of the assessment outcome, the report issued by the third-party certification body should provide detailed information on the workshop's compliance with each assessment requirement, including items that are compliant or non-compliant.

