Electric Vehicle Charging Technologies

Contents

2-3. Electric Vehicle Charging Technologies

In 2010, the number of electric vehicles (EVs) in Hong Kong was only 96. However, according to the statistics from the Environmental Protection Department (EPD), the figure as at end-December 2019 increased significantly to 13 866. The number of public charging devices also increased from 1 036 (only 10 of them were quick chargers) in 2013 to 2 929 (of which 1 108 were medium chargers and 588 were quick chargers) in end-December 2019.

In order to extend the driving range of EVs, EV manufacturers are using batteries with higher capacity, and the charging time required also increases correspondingly. In this connection, the trade should keep upgrading EV charging technologies in a bid to address various problems (see attached figure).

Higher battery capacity for longer driving range			
Model	Year	Driving Range(km)	Efficiency
Model S	2017	572	5.7km/kWh
Model S	2020	627	6.2km/kWh
ZE 40 R90	2017	395	9.6km/kWh
ZE 40 R135	2020	474	9.1km/kWh
Leaf	2017	250	8.3km/kWh
Leaf e+	2019	570	9.2km/kWh
i3 94Ah	2016	200	6.1km/kWh
i3 120Ah	2019	260	6.2km/kWh
Old Model 2019/2020 Model			

The most common fixed form of EV chargers is charging posts, the standards of which are mainly divided into CCS Combo (Europe and the United States), ChAdeMO (Japan) and GB (Chinese National Standards), etc. As chargers of the above standards and shapes of charging sockets vary, coupled with the different charging speeds and communications protocols, the standards cannot be switched among them.

The charging speed is mainly divided into medium (with a charging power of 3.3 to 21 kW) and quick (with a charging power of 50 kW) subject to the power supply system. For instance, three-phase alternating current can deliver a quick charging speed, but ordinary households find it difficult to install such facility. Besides, it takes four to six hours to fully charge an EV with a battery capacity of 25 kWh at a medium speed, but it only takes 45 minutes to charge the same using a quick charger.

On electric transportation, European countries and the United States have started to implement a pantograph ultra-fast charging solution with a maximum charging power of 600 kW. When an electric bus picks up/drops off passengers at a station, WiFi is used to communicate with the pantograph above which will then be automatically lowered to connect to the pole on the roof of the bus for charging. A 300 kW pantograph can charge 20 kWh (which can run approximately 40 km) in four minutes on average, approximately six times faster than a typical quick charging station. The vehicles can be charged at a higher speed if a charging facility with a higher charging power is used.

Apart from charging EVs, European countries, the United States and Japan have also started to explore such relevant technologies as vehicle-to-home (power supply from EV to home) and vehicle-to-grid (power supply from EV to the power grid). In addition, various vehicle manufacturers and technical standards organisations are also actively formulating and developing wireless charging standards. In general, EV charging technologies have continued to be upgraded, heading towards a direction of higher charging power and level of convenience.

The Automotive Platforms and Application Systems R&D Centre is responsible for co-ordinating the funding application of automotive technology projects under the Innovation and Technology Fund. For more details, please visit the following website: http://www.apas.hk.

Automotive Platforms and Application Systems R&D Centre
(under the Hong Kong Productivity Council)

4-5. Welding Safety

Welding work is widely carried out in the automotive maintenance trade. Common welding methods include gas welding and electric arc welding. Welding can be a very dangerous task if we lack the knowledge of welding safety and sound workshop and facility management, as unsafe behaviour or performing welding work without appropriate safety measures is the main cause of accidents with serious casualties. As such, a brief account of the safety measures for welding is given in this issue.

Hazards of Welding

Fire and explosion hazards

- The hot slag and sparks generated during the welding process ignite flammable materials in the working area. Flammable residues on the workpieces may result in a fire or explosion due to leakage of accumulated flammable gases/oxygen.
- Flashback from the blowpipe, heating of acetylene cylinder or high-pressure oxygen gas (without fuel gas) which promotes combustion of oil, etc.

Electric shock hazards

- Electric shock caused by electric arc welding in a humid environment, welding equipment not earthed and accidentally touching the exposed live parts without putting on suitable insulating gear, etc.
- Electricity leakage due to defective functioning of the electric arc welding machine, including damaged cable ducts, etc.

Health hazards

- Heat cataract or arc eye caused by intense light and radiation (such as infrared, ultraviolet, etc.) in the absence of appropriate protective goggles; or corneal ulcer and conjunctivitis caused by flying foreign objects (such as hot slag, sparks, etc).
- Burns caused by flying sparks or slag when welding is carried out in the absence of appropriate protective gear; or burns caused by accidentally touching the hot surfaces of workpieces.
- Skin burns caused by over-exposure to radiation generated during welding.

Precautionary Measures

Ventilation measures

- A general dilution ventilation system introduces fresh air into the workplace by mechanical means to dilute air contaminants, being applicable to infrequent and short-duration welding.
- A local exhaust ventilation system is required for welding processes that emit toxic fumes or involve heavy indoor production work so that air contaminants are captured and removed by forced air current through hood and duct near the point of emission.

Safety devices of welding equipment

Safety devices for gas welding or flame cutting	
Safety device	Purpose
Pressure regulator with pressure gauge	Regulate and monitor the pressure of gas supply
Non-return valve	Located at the gas inlet of the blowpipe to prevent back-feeding of oxygen to the fuel gas line and vice versa
Flashback arrester	Incorporate pressure or temperature cut-off valve to prevent propagation of flashback from the blowpipe and gas supply lines into the cylinders
Pressure relief device for gas cylinder	Reduce the chance of explosion arising from increase in temperature and pressure caused by improper handling or severe strike of gas cylinders

Safety devices for electric arc welding	
Safety device	Purpose
Earthing clamp	The earthing clamp connects the other end of the welding cable to the bench, or directly clamps the workpiece
Automatic voltage regulator	Control and reduce the open circuit no-load voltage of the welding transformer to minimise the risk of electric shock
Insulation protection	Welding cables should be protected by a suitable insulation layer to avoid exposure of the inner copper conductor due to careless placement which may lead to electric shock
Earth wire	An independent earth wire should be available to connect the welding machine to the power supply so as to reduce the risk of electric shock
Residual current device	Provide protection against electricity leakage that may occur in the welding machine and cut off the power supply

Safety Measures

Personal protective equipment

Personal protective equipment is the last line of defence of safety measures. However, a higher risk of hazards may be posed to users if such equipment is incorrectly chosen or inappropriately maintained.

- Use protective goggles (or face shields) that are up to standard to avoid damage caused by harmful light and prevent hot slag from splashing into the eyes. Protective lenses come in a variety of types, lenses of different standards shall be used according to different welding or cutting methods for protection. When selecting eye protection equipment, reference should be made to the approved requirements of the Factories and Industrial Undertakings (Protection of Eyes) Regulations.
- Select and put on clothes and gear made of good insulation materials (fire resistance, electrical insulation) for skin and body protection, such as aprons, long gloves, shoe covers, safety shoes and hats/safety helmets, etc.
- Welding workers should use appropriate or approved breathing apparatus for protection where engineering control (such as ventilation measures) has not been effectively implemented or has failed to effectively reduce the hazard of inhalation of toxic fumes/gases due to limitations of the working environment.

Code of practice on work safety

Strictly observe the code of practice on welding safety to ensure the safety and health of relevant persons at work.

Please refer to the following web pages for related codes of practice and training courses:

Codes of practice

Labour Department - Safety and Health at Work for Manual Electric Arc Welding
https://bit.ly/2NzmcRe

Labour Department - Safety and Health at Work for Gas Welding and Flame Cutting
http://bit.ly/2G47e1f

Training courses

Occupational Safety and Health Council - (EAW) Electric Arc Welding Safety
http://bit.ly/2NAVAPQ

Occupational Safety and Health Council - (GW) Gas Welding Safety Training
http://bit.ly/36YtO7s

6. Transient Chassis Dynamometer Test

To further improve roadside air quality, the EPD started to tighten vehicle emission standards and testing methods as early as mid-2014. Remote sensing devices are placed at various locations across the territory to test whether pollutants (hydrocarbon, carbon monoxide (CO) and nitrogen oxide (NOx), etc.) of petrol and liquefied petroleum gas (LPG) vehicles exceed the limits of emission standards. If a vehicle's emission exceeds the stipulated emission limit, the EPD will send the vehicle owner a letter requesting him/her to send the vehicle to the transient emission test centre designated by the EPD within 12 working days for an emission test and assessment using the chassis dynamometer. If the vehicle fails the emission test within the specified time frame, its vehicle licence may be revoked.

The most accurate way to assess whether a vehicle can pass an emission test under operating conditions is to conduct a transient emission test. First, place the vehicle on a chassis dynamometer, have it run for about 200 seconds and measure its emission, then let it run, shift, accelerate, cruise and decelerate according to standard operating conditions to obtain a test report. The test report lists side by side the real-time data of exhaust gas and air-fuel ratio, which facilitates maintenance technicians to deduce the problem. The vehicle will fail the test if any of its pollutants exceeds the emission limits.

Using a chassis dynamometer can comprehensively test the emission reduction efficiency of a vehicle's catalytic converter under different driving conditions. Therefore, when examining emission problems, a five-gas emission analyser which provides an air-fuel ratio or υ value should be employed so as to analyse the problem in a more effective manner. Key testing items include:

1. Under normal driving conditions, the set target of υ value is 1.00. A value of over 1 means there is too much air (too lean), while a value of less than 1 means there is too much fuel (too rich). The limit during an idling test is 0.97 to 1.03, deviation from this range will reduce the emission reduction efficiency. Attention should be drawn to whether there is damage along the vehicle engine to the exhaust pipe, which may lead to the entry of oxygen and thus affect the υ value.
2. Check if the signal of the oxygen sensor swings normally and frequently.
3. Eliminate common faults which may lead to an imbalance of air-fuel ratio, such as damage to ignition coil/spark plug, atomisation or poor opening/closing of nozzle, leakage of intake manifold, poor condition of airflow meter/manifold absolute pressure sensor/throttle position sensor, etc.
4. Check if there is sufficient regular maintenance, e.g. replacing engine oil and general parts such as oil filter, air filter, etc.
5. Check whether the exhaust gas recirculation (EGR) valve operates normally. A poorly operated EGR valve may lead to unstable idling and excessively high value of NOx during driving.
6. Check and clean the intake manifold and the throttle.
7. Check whether the three-way catalytic converter fails to function properly due to its ageing conditions, which leads to excessively high values of CO and NOx during driving.

Maintenance technicians may also conduct a road test as a simple simulation test if the maintenance workshop is not equipped with a chassis dynamometer. They can evaluate the chance of a vehicle passing the test by using the emission analyser installed on the vehicle for measuring the engine's emissions under different operating conditions and comparing the results with qualified vehicles of the same type. Technicians must ensure that objects such as the emission analyser, sampling lines and pipes are all securely and safely installed before performing the road test.

7. Quality Customer Service

Quality customer service not only increase customer confidence and repatronage intentions, but also enhances the image of the vehicle maintenance trade. From the time that a customer sends his/her vehicle to a maintenance workshop until it is picked up after completion of maintenance, a number of documentary records have to be kept to enable both parties clearly understand the work concerned in order to protect their interests. These documents contain quotations, maintenance records, invoices, complaint records, etc. In this issue, let us take a look at maintenance records first.

Maintenance records mainly take down the services or maintenance work provided by vehicle mechanics to an individual vehicle. We can check against the records if there is any enquiry after completion of maintenance and the vehicle has been returned to the customer. At the same time, a database is established for maintenance workshops and customers, gathering solutions to different damages and keeping records of the maintenance history in respect of individual customers, thus reminding them to inspect and maintain their vehicles in a timely manner. With the increasing popularity of data analysis software and by scrutinising the maintenance data collected, the hours of maintenance work, utilisation of parts, appropriate mileage for maintenance and so on can be better analysed to improve vehicle maintenance efficiency.

Basically, a maintenance record shall consist of the following items:

- Maintenance date and record date
- Vehicle registration number
- Existing damage to the vehicle bodyshell and interior configurations
- Description of the services provided
- Information of the vehicle mechanics involved
- Signature of the registered vehicle mechanic or his/her supervisor
- Registered vehicle mechanicôs stamp
- The maintenance of LPG vehicles shall be endorsed by a competent person for the work performed under his/her supervision

To handle customer enquiries, maintenance records should be kept for at least three years or until expiry of the vehicle warranty period, whichever is longer. The EMSD website provides a basic template of maintenance record. Vehicle mechanics are welcome to download and use the form directly at the following website.
https://www.emsd.gov.hk/filemanager/en/content_651/MntnncRecord_Form_Tmplt-R4a.pdf

8-9. Latest Updates of the Vehicle Maintenance Registration Unit

A series of five seminars on vehicle maintenance technology organised by the EMSD for free

The EMSD organised two seminars on vehicle maintenance technology at the Hong Kong Productivity Council on the evenings of 26 November and 14 December 2019. The seminars offered rich content, including introduction to vehicle maintenance technology, EV technology, new automotive technology, safety of maintenance workshops and discussion of common questions about the registration schemes, etc. A virtual reality (VR) vehicle maintenance workshop was set up outside the venue so that participants could experience and understand the standard settings of three different types of maintenance workshops in a VR context. The two seminars held earlier were met with overwhelming response, all the places had been filled in just a few days after enrolment started. The Vehicle Maintenance Registration Unit (VMRU) will notify registered vehicle mechanics of the latest updates on technical seminars by e-mail or WhatsApp. Please stay tuned and enrol as soon as possible if you are interested in the seminars.

Disseminating information relating to registered vehicle maintenance workshops online

In order to publicise registered vehicle maintenance workshops, the EMSD will include the geographical locations, servicing items and servicing vehicles, etc. of these workshops in the information accessible to members of the public on its website, so that they can learn more about the services of registered workshops online. Staff from the VMRU will contact the registered workshops later to collect information and seek their consent to make such information public.

Vehicle Maintenance Poster Design Competition

The deadline of the Voluntary Registration Scheme for Vehicle Maintenance Poster Design Competition has been extended to 30 April 2020. All Hong Kong citizens are welcome to participate in the Competition. For details, please visit the following website: https://www.emsd.gov.hk/en/supporting_government_initiatives/registration_scheme_for_vehicle_maintenance/index.html.

Continuing education online

To further promote online self-learning, the VMRU has newly released online reading materials, vehicle mechanics can earn continuing professional development (CPD) hours by answering quiz questions. Registered mechanics may read the Practice Guidelines for Vehicle Maintenance Workshops, log on to the following website (https://forms.gle/Y1Wa1bizYwMVN17M9) through the QR code, and answer the questions to obtain two CPD hours by online self-learning.

- Participants who answer all the questions correctly will earn two CPD hours and be notified by the VMRU individually.
- Only registered vehicle mechanics with valid registration may participate, each not more than once.
- If there are duplicate submissions, only the last submitted answers before the end of the quiz will be accepted.
- The decision of the VMRU on the quiz will be final.

The quiz will end on 30 April 2020.

The Practice Guidelines for Vehicle Maintenance Workshops is available at the following website: https://www.emsd.gov.hk/filemanager/en/content_651/Practice_Guidelines_for_Vehicle_Maintenance_Workshops.pdf

10. Latest Developments of the Registration Schemes

1. Registered vehicle mechanics who have switched to work in another vehicle maintenance workshop should notify the VMRU by e-mail (vmru@emsd.gov.hk) or fax (3968 7646) of the name, address and telephone number of the new workshop.

2. If there is any change in the information of the vehicle maintenance workshop (such as name of the workshop, registration number of the workshop, address, contact number and business registration certificate, etc.) or alteration in the type of workshop being registered, the person-in-charge of the workshop must, within 14 working days from such change, notify the VMRU of the change in writing, and submit the relevant documents for processing.

Information on the Voluntary Registration Scheme for Vehicle Mechanics:	
Total number of vehicle mechanics	10 382 Note1
Number of registered vehicle mechanics (as at end-December 2019)	9 011
Information on the Voluntary Registration Scheme for Vehicle Maintenance Workshops:	
Total number of vehicle maintenance workshops	2 783 Note2
Number of registered workshops (as at end-December 2019)	2 054

Note 1: 2016 Manpower Survey Report (updated on 25 August 2017) by the VTC and the Automobile Training Board.

Note 2: Database of the VMRU (updated on 19 July 2019).

If you wish to help protect our environment by receiving the electronic version of RVM Newsletters and leaflets, please send us the completed reply slip by **e-mail (vmru@emsd.gov.hk)** or **WhatsApp (9016 3185)**. We will contact you by means of e-mail or mobile communication as far as possible.

Reply Slip

I / My company would like to receive the RVM Newsletters and other information leaflets by ☐ e-mail / ☐ WhatsApp.

Please provide the relevant contact details based on the above selected means of communication:

E-mail address: _____ WhatsApp: _____

The electronic version of RVM Newsletters is also available at the EMSD website:
https://www.emsd.gov.hk/en/supporting_government_initiatives/registration_scheme_for_vehicle_maintenance/publications_and_circulars/rvm_newsletter/index.html.

Use of "Ten-year Experience" for Registration Renewal

Please note that registered vehicle mechanics are required to apply for renewal on time. Those who have successfully registered in the past with the "ten-year experience" criterion but have yet to renew their registration may be required to meet the new registration requirements, i.e. to renew their registered status by obtaining craft certificates or passing the trade test. If the registration has expired for more than four months, please call 2808 3545 to enquire the renewal details.

Note: The criterion of "ten-year experience" as the means for vehicle mechanics to obtain registration has been disused since 31 December 2016

11. Prize Quiz (Issue No. 28)

Q1. According to the records of the EPD, what was the total number of public charging devices as at end-December 2019?

A. 2, 019
B. 2, 929
C. 3, 721
D. 9, 764

Q2. It is mentioned in an article that a test report will be obtained after the transient chassis dynamometer test. Which of the following data will be listed in the report apart from the real-time air-fuel ratio?

A. Spark gap
B. Viscosity of engine oil
C. Thickness of brake pad
D. Exhaust gas

Q3. Which of the following is a hazard of welding?

A. Fire and explosion
B. Body health
C. Electric shock
D. All of the above

Q4. It is mentioned in an article that the maintenance record of quality customer service shall consist of:

A. Validity of the driving licence
B. Signature of the registered vehicle mechanic or his/her supervisor
C. Business registration of the registered workshop
D. Expiry date of the vehicle licence

Q5. To promote online self-learning by registered mechanics, the VMRU has newly released online reading materials, vehicle mechanics can earn CPD hour(s) by answering quiz questions online. How many CPD hour(s) can a participant earn if he/she answers all the questions correctly?

A. 1
B. 2
C. 5
D. 7

How to participate? (Issue No. 28)

Please submit the answers directly at the following website (https://forms.gle/sYzZfGhJcojR9Yxm8) by scanning the QR code. Vehicle mechanics may also complete the form below, circle the correct answers, and send it to the VMRU by fax or e-mail (fax: 3968 7646 or e-mail: vmru@emsd.gov.hk).

Deadline: 30 April 2020

Question	Answer
1	A. B. C. D.
2	A. B. C. D.
3	A. B. C. D.
4	A. B. C. D.
5	A. B. C. D.

Name: _____

Vehicle Mechanic Registration No.: VM_____

E-mail Address: _____

Contact Telephone No.: _____

- Participants who answer all the questions correctly will earn one CPD hour and be notified by the VMRU individually.
- Only registered vehicle mechanics with valid registration may participate, each not more than once in each quiz.
- If there are duplicate submissions, only the last submitted answers before the deadline will be accepted.
- The decision of the VMRU on the quiz will be final.
- The correct answers will be announced in the next issue of the RVM Newsletter.

Results of the prize quiz in RVM Newsletter Issue No. 27:

The answers in Issue No. 27 are as follows:					
Question	1	2	3	4	5
Answer	C	D	B	A	A

12. Training Institutes Providing Continuing Professional Development Courses for Vehicle Mechanics (in random order)

Name of Training Institute	Website / Contents	Enquiry Tel. No.	QR Code
Traffic Services Employees Association	http://www.facebook.com/tseahk	2575 5544	
Pro-Act Training and Development Centre (Automobile)	http://www.pro-act.edu.hk/automobile The Certificate in Vehicle Mechanical Repair programme# run by the Pro-Act Training and Development Centre (Automobile) may serve as another means for qualifying as registered vehicle mechanics. Mechanics who are interested in enrolling in the above programme may visit the Centre's website. # For details and latest developments of the programme, the information issued by the Pro-Act Training and Development Centre shall prevail.	2449 1310	
The Institute of the Motor Industry Hong Kong	http://www.hkimi.org.hk The Institute of the Motor Industry Hong Kong (IMIHK), formerly known as the Institute of the Motor Industry (IMI) - Hong Kong Branch, brings the mission and vision of the IMI to the Hong Kong automobile industry. After the handover in 1997, the IMI - Hong Kong Branch applied to be renamed the IMIHK in Hong Kong. Eligible members of the trade are welcome to join the IMIHK or enrol in its courses or talks.	2625 5903	
Hong Kong Vehicle Repair Merchants Association Limited	https://www.facebook.com/HKVRMA/	2399 7977	
Hong Kong Vehicle Repairing Industry Employee General Union	http://www.vrunion.hk	2393 9955	
Occupational Safety and Health Council	http://www.oshc.org.hk The Safety Handling of Chemicals course aims to provide employees with basic knowledge of the safe handling of chemicals. The course content includes hazards of chemicals, labelling of chemicals, safety precautions, personal protective equipment, emergency procedures, etc. For more course details, please contact the Occupational Safety and Health Training Centre.	2311 3322	
The Society of Operations Engineers (Hong Kong Region)	http://www.soe.org.hk/	2617 0311	
Qualifications Framework recognised courses	https://www.hkqr.gov.hk	2836 1700	

Gentle Reminder

The contents in each issue help you catch up on the development of the registration schemes and enhance the quality of service. Please stay tuned! Each issue can be downloaded from the EMSD website at:

https://www.emsd.gov.hk/en/supporting_government_initiatives/registration_scheme_for_vehicle_maintenance/publications_and_circulars/rvm_newsletter/index.html.

For enquiries on the contents of the RVM Newsletter, please contact the VMRU of the EMSD.
Fax: 3968 7646
E-mail: vmru@emsd.gov.hk
Tel.: 2808 3545