

**Electrical & Mechanical Services  
Industry**

**Railway Engineering Branch**

**Specification of Competency  
Standards**

**1<sup>st</sup> Edition**

**March 2009**

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## Chapter 1

### Preface

#### **Background of the Industry**

Railway transportation is an efficient and environmentally friendly transportation service. Trams were providing mass transportation service for citizens on the northern shore of Hong Kong Island as far back as 1904. Kowloon-Canton Railway (KCR) also came into operation in 1910, which became a main transportation line between Hong Kong and China. On the other hand, the classical-style Peak trams had started to carry tourists to the Peak for a fantastic view of the Victoria Harbour at an even earlier time in 1888. Following the rapid population growth in the 60's and the 70's of the last century and the tremendous development of the industrial and commercial sectors in Hong Kong, road surface transportation became unable to satisfy the demand and so Hong Kong Government developed Mass Transit Railway service.

#### **Current Situation of the Industry**

2. Mass Transit Railway (MTR) has been expanding since it came into operation in 1979 and it has now become an underground network formed by six main lines, including Kwun Tong Line, Tsuen Wan Line, Island Line, Tseung Kwan O Line, Tung Chung Line and Airport Express. In addition, Penny's Bay Rail Link (Sunny Bay Station) came into service in September 2005 to cater for the development of the Disney Theme Park. On the other hand, to cater for the development of new towns, the rapid population growth in the northern part of the New Territories and the frequent trade between China and Hong Kong, KCR became electrified in 1982 and it continued to expand and now comprises the Light Rail that came into service for Tuen Mun and Yuen Long residents in 1988; the West Rail that came into service in 2003, connecting Nam Cheong in Kowloon and Yuen Long and Tuen Mun in the northwest New Territories; and the Ma On Shan Rail Link that came into service in 2004, connecting Ma On Shan and Tai Wai and extended the East Rail to East Tsim Sha Tsui. In 2007, the Sheung Shui to Lok Ma Chau Spur Line came into service to provide relief for the congestion at Lo Wu Control Point. The total length of the existing railway network in Hong Kong is over 200 kilometres, accounting for about 40% of all public transport journey, and even close to 50% in terms of total journey distance travelled by passengers. The number of passenger trips was over 5 million per day.

3. To develop a safe, reliable, efficient, and environmentally friendly transportation system, the Government of the Hong Kong Special Administrative Region unveiled the "Railway Development Strategy 2000", which mapped out the railway network expansion blueprint for Hong Kong up to the year 2016. According to this strategic plan, six additional railways will come into service in 2016, including two MTR Island Line Extensions, Sha Tin to Central Link, Kowloon Southern Link and Northern Link, and the Regional Express Line. Moreover, a Port Rail Line specially designed for freight traffic will be studied. In view of the many future development plans mentioned above, there will be vigorous railway development works and the demand for manpower will continue to increase. The introduction of every new railway system will normally bring new technology, in particular electrical and mechanical engineering technology, and computer control and information technology, which in turn will significantly enhance the techniques of local practitioners in related industries.

4. On the other hand, as Hong Kong developed its railway transportation service tremendously in the recent two decades, it cultivated a number of experts in railway engineering and service. The extremely high quality service provided by various railways of Hong Kong in terms of safety, reliability and operation efficiency is admired by the railway transportation organizations in many countries and regions. As a result, a number of countries and regions have employed the railway consultation or engineering service provided by the railway corporations in Hong Kong. This turns Hong Kong's railway engineering and service techniques into an export industry gradually.

5. Railway engineering mainly includes two major domains, namely civil engineering and electrical and mechanical engineering. Since this set of specification of competency standards only cover electrical and mechanical services industry, the specification of competency standards for civil engineering will be compiled separately.

6. Each railway has a different design to cater for the operational characteristics of various railway lines, including length of route, area covered, number of passengers carried and the surrounding environment, etc. When classified by electricity supply systems, Hong Kong's electric railway systems can be roughly classified into the following categories:

- (i) 500 volt direct current railway system of trams
- (ii) 750 volt direct current railway system of Light Rail
- (iii) 1,500 volt direct current railway system of MTR
- (iv) 25,000 volt alternate current railway system of KCR East Rail, West Rail and Ma On Shan Rail Link

7. Despite the differences in their electricity supply system, there are many common areas with respect to the electrical and mechanical facilities of the railway systems and there are similarities and differences in the techniques required. Under such a complicated situation, the units of competency of specification of competency standards will be of great use in detailing the competency required for various functions, summarizing similarities and highlighting differences, and building a detailed qualifications framework. Under this qualifications framework, a distinct specification of competency standards will be compiled for the application of practitioners, employers and training institutes to help enhance the standard and quality of techniques.

## **Specification of Competency Standards**

8. In view of the industry's current situation and future development trend, it is imminent that the Specification of Competency Standards (SCS) be formulated to provide a solid framework for training to enhance the industry's technical capability, competitiveness and quality of service.

9. The SCS consists of competency standards of different levels. Competency standards are benchmarks for the industry-specific knowledge, professional skills and soft skills required for performing different job functions of the industry. The functional areas and competency standards under SCS will be practical and competence-based. The SCS not only sets out the professional knowledge and skills required for today, but also takes into account factors such as the development trend of both the industry and the society.

10. In the long run, the industry-recognised SCS will become the blueprint for training. It will not only ensure that training providers can meet the industry's present and future needs by offering training courses covering all the knowledge and skills required by the industry, but also provide employees with a clear set of learning pathways, so that they can draw up their own learning and career roadmaps. As such, the SCS will complement the full-scale implementation of the Qualifications Framework by the Government.

11. The E&M Industry Training Advisory Committee (ITAC), comprising representatives of employers, employees, the Government and professional bodies of the industry, has prepared a preliminary version of "SCS for the E&M Industry –Railway Engineering Branch" with reference to its current status and development trend, as well as the standard and format adopted in the Mainland and overseas, with a view to providing practitioners with clear guidelines for devising their own learning and career roadmaps.

## Chapter 2

### Qualifications Framework

#### Qualifications Framework

12. The E&M Industry Training Advisory Committee (ITAC) was set up by the Education Bureau in January 2005 to facilitate the implementation of the Hong Kong Qualifications Framework (QF) in the industry. The proposed QF is a voluntary system. It is a seven-level hierarchy that provides benchmarks for determining the level of complexity and difficulty of individual competencies. It is also used to order and support qualifications of different natures and titles. The QF has in place an independent quality assurance (QA) system that would enhance recognition and acceptance of the qualifications in the industry, irrespective of the mode and source of learning.

13. The E&M ITAC is responsible for the development of its industry-specific, task-based SCS for the identified core functional areas. The SCS, in the form of Units of Competencies (UoCs), provides not only quantitative and qualitative specifications on the competencies required for specific tasks, but also the integrated outcome standards required as well as information on the QF level and credits.

14. The SCS may be used to aid vocational curriculum design by vocational education and training providers, or in-service employee development by HR personnel, or best practice recognition and qualifications by awarding bodies within the industry. SCS is the cornerstone to enhance workforce competitiveness and industry sustainability in the long run.

15. The QF aims to provide clear learning pathways for individuals to draw up their own roadmaps to obtain quality assured qualifications. Learners can either pursue a specific learning pathway to upgrade their skills in a particular area of specialization in a gradual and orderly manner (vertical development), or progress through traversing learning pathways to become multi-skilled (horizontal development). Through the full-scale implementation of the QF, we will foster a vocational environment and culture conducive to lifelong learning and continuing education in the industry. With the active participation of employers and employees as well as the wide acceptance of the industry, the QF will also encourage the development of quality training programmes by providers to meet the needs of the community and the industry.

### **Qualifications Framework levels**

16. The QF has seven levels, from level 1 to level 7, where level 1 is the lowest and level 7 the highest. The outcome characteristic of each level is depicted by a set of generic level descriptors (GLD) (Appendix 1). The GLD specifies for each QF level its generic complexity, demand and challenges in the four dimensions below:

- a. Knowledge and intellectual skills;
- b. Process;
- c. Application, autonomy and accountability; and
- d. Communications, IT skills and numeracy.

The UoCs (See Chapter 4) are benchmarked to the QF levels in accordance with the GLD. It is worth noting that competency elements in a UoC may fall in some or all of the GLD dimensions as what it naturally should be. The QF level assignment is essentially a holistic judgement on the unit's integrated outcome requirement.

17. QF levels are discrete. That is, there cannot be assignment of UoC in-between QF levels. Also, UoCs that may not fully match the characteristic requirement of one or more dimensions of a level would be "rounded" to the level below.

## Chapter 3

### Competency Standards

#### **Major Functional Areas of the Railway Electrical and Mechanical Sector**

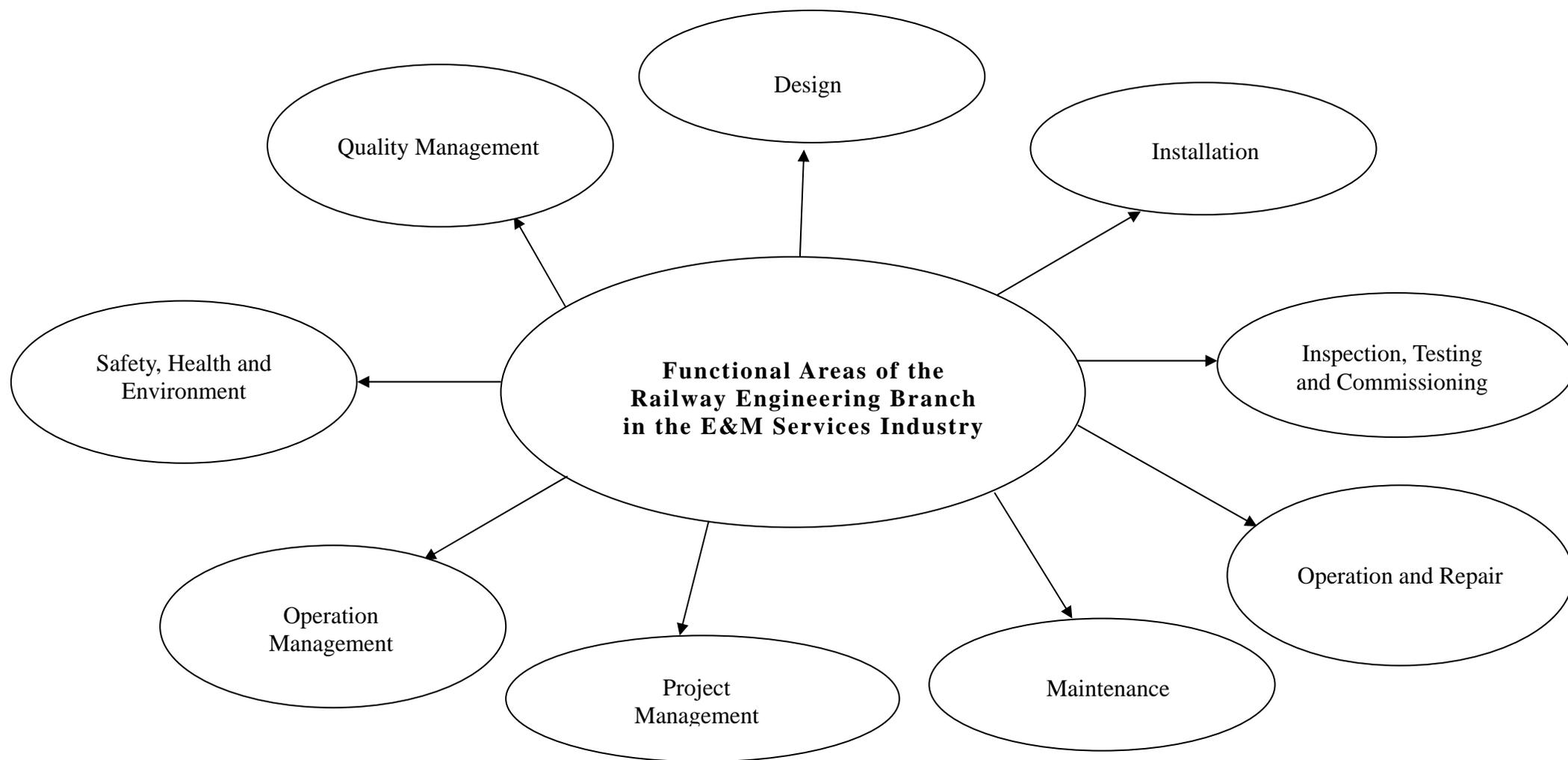
18. Electrical and Mechanical Industry—Major functional areas of the Railway Electrical and Mechanical Sector
- (i) **Design**  
This functional area covers the application of electrical and mechanical related knowledge, technology and skills, and design technique. Practitioners should consider system goals and environmental factors as well as relevant facilities of the railway system in order to design highly effective, safe and reliable railway electrical and mechanical systems and equipment including railway electricity supply, signalling, train, ticketing and gate systems, and special electrical and mechanical installations at the stations.
  - (ii) **Installation**  
This functional area requires practitioners to apply electrical and mechanical related knowledge and skills to install various kinds of railway electrical and mechanical systems and equipment according to ideas of design, installation specifications, codes of practice and regulations related to electrical and mechanical works.
  - (iii) **Inspection, Testing and Commissioning**  
This functional area requires practitioners to formulate and carry out testing procedures according to railway electrical and mechanical system requirements and equipment specifications, to examine system's functions and interlock safety protection devices, and to calibrate and set the systems and equipment so as to achieve the best performance and comply with the safety standard.
  - (iv) **Operation and Repair**  
This functional area requires practitioners to understand and be familiar with railway electrical and mechanical systems and equipment. They should be able to monitor the operation of systems and equipment, and, before or once irregularities appear, make suitable plans and arrangements to minimize the damage caused by equipment faults. They should also master the troubleshooting technique and use inspection and testing instruments and equipment to locate the problems. They should be able to analyze fault records and formulate proposals on the enhancement of systems and equipment.
  - (v) **Maintenance**  
This functional area requires practitioners to analyze the performance of equipment components, and apply electrical and mechanical related knowledge in safe operation of railway electrical and mechanical systems and equipment. They should be able to formulate and carry out regular inspection, testing and upgrading procedures and plans so as to ensure the safety and reliability of equipment in most effective ways. They should be able to analyze repair records and worn-out condition of components, and formulate proposals on the enhancement of systems and equipment.

- (vi) Project Management  
This functional area requires practitioners to apply knowledge of electrical and mechanical project management in formulating and coordinating railway electrical and mechanical engineering processes and plans, controlling the costs and resources, and enabling the project to complete successfully on time according to the policies on environmental protection, safety and health.
- (vii) Operation Management  
This functional area requires practitioners to apply enterprise management skills in formulating operation plan, human resources training schemes and environmental protection and safety policies according to the code of operation for transportation system so as to achieve effective enterprise management and provide safe and reliable railway transportation services.
- (viii) Safety, Health and Environmental Protection  
This functional area requires practitioners to apply safety and health management knowledge and skills in conducting risk assessments and establish safety, health and environment protection systems according to relevant legislations and the code of railway safety, so as to protect the safety of staff and passengers.
- (ix) Quality Management  
This functional area requires practitioners to apply knowledge and skills of railway electrical and mechanical engineering quality management to formulate and implement railway electrical and mechanical engineering quality management systems and procedures, so as to ensure the quality of railway electrical and mechanical equipment and provide safe, comfortable and reliable railway transportation services.

Please refer to Diagram 1 for further information.

19. Based on the generic level descriptors and the major functional areas, the E&M ITAC has formulated a “List of Competencies” (Chapter 4) for the industry. The list provides details of the training requirements of the industry in regard to the different competency levels and functional areas. It is designed to provide clear and unified guidelines for drawing up individual learning roadmaps. Learners may either pursue a specific learning pathway to upgrade their skills in a particular area of specialisation in a gradual and orderly manner (vertical development), or progress along a number of learning pathways to become multi-skilled (horizontal development).

**Functional Map showing the Major Functional Areas of the Railway Engineering Branch  
in the Electrical & Mechanical Services Industry**



### **Competency Standards**

20. Competency standards refer to the skills and knowledge required for a particular job function. They represent the industry benchmarks for the skills, knowledge and attributes required to perform competently in a particular job. Thus they are the most important part of the SCS.

### **Units of Competencies**

21. The E&M ITAC has set out the competency standards for various job functions in the form of units of competencies, which describe the performance and standard required for each competency. Please refer to Chapter 4 for details.

Every “unit of competency” comprises eight basic items:

1. Title
2. Code
3. Range
4. Level
5. Credits
6. Competency
7. Assessment Criteria
8. Remarks

### **Recognition of Prior Learning**

22. A major concept of QF is that individuals may acquire knowledge and skills from their work experience, apart from attending formal training courses. People may, through the Recognition of Prior Learning (RPL) mechanism, obtain relevant qualifications if their experience, skills and knowledge gained in the workplace meet the competency standards set by the ITAC.

**Chapter 4**

**Units of Competencies of  
the Railway Engineering Branch in the  
Electrical & Mechanical Services Industry**

## List of Competencies of the Railway Engineering Branch in the Electrical & Mechanical Services Industry

<b>Functional Areas</b>	<b>Design</b>	<b>Installation</b>	<b>Inspection, Testing and Commissioning</b>	<b>Operation and Repair</b>	<b>Maintenance</b>	<b>Project Managements</b>	<b>Safety, Health and Environment</b>	<b>Safety, Health and Environment</b>	<b>Quality Management</b>
	<b>(DE)</b>	<b>(IN)</b>	<b>(IT)</b>	<b>(OR)</b>	<b>(MA)</b>	<b>(PM)</b>	<b>(OM)</b>	<b>(SH)</b>	<b>(QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
<b>1</b>	Use typical electrical meters 3 Credits <u>EMCUDE101A</u> P.47	Use typical electrical meters 3 Credits <u>EMCUDE101A</u> P.47	Use typical electrical meters 3 Credits <u>EMCUDE101A</u> P.47	Use typical electrical meters 3 Credits <u>EMCUDE101A</u> P.47	Use typical electrical meters 3 Credits <u>EMCUDE101A</u> P.47	Use typical electrical meters 3 Credits <u>EMCUDE101A</u> P.47	Use general personal protective equipment 3 Credits <u>EMCUSH108A</u> P.59	Use general personal protective equipment 3 Credits <u>EMCUSH108A</u> P.59	Use general personal protective equipment 3 Credits <u>EMCUSH108A</u> P.59
	Use general personal protective equipment  3 Credits <u>EMCUSH108A</u> P.59	Use general machining equipments  9 Credits <u>EMCUIN101A</u> P.48	Apply basic bench fitting techniques and use small typical hand tools  9 Credits <u>EMCUIN106A</u> P.51	Use general loading and lifting equipment  9 Credits <u>EMCUIN102A</u> P.49	Use general machining equipments  9 Credits <u>EMCUIN101A</u> P.48	Use general personal protective equipment  3 Credits <u>EMCUSH108A</u> P.59	Safety operation in confined spaces  3 Credits <u>EMCUSH110A</u> P.61	Perform manual handling operation  3 Credits <u>EMCUSH109A</u> P.60	Safety operation in confined spaces  3 Credits <u>EMCUSH110A</u> P.61
	Safety operation in confined spaces  3 Credits <u>EMCUSH110A</u> P.61	Use general loading and lifting equipment  9 Credits <u>EMCUIN102A</u> P.49	Non-destructive test (NDT) - Liquid Penetrant Testing  2 Credits <u>EMCUMA102A</u> P.56	Apply basic bench fitting techniques and use small typical hand tools  9 Credits <u>EMCUIN106A</u> P.51	Use general loading and lifting equipment  9 Credits <u>EMCUIN102A</u> P.49	Safety operation in confined spaces  3 Credits <u>EMCUSH110A</u> P.61	Comply with the legal requirements on electrical and mechanical occupational safety and health 3 Credits <u>EMCUSH111A</u> P.62	Safety operation in confined spaces  3 Credits <u>EMCUSH110A</u> P.61	Comply with the legal requirements on electrical and mechanical occupational safety and health 3 Credits <u>EMCUSH111A</u> P.62
	Comply with the legal requirements on electrical and mechanical occupational safety and health 3 Credits <u>EMCUSH111A</u> P.62	Apply basic bench fitting techniques and use small typical hand tools  9 Credits <u>EMCUIN106A</u> P.51	Use general personal protective equipment  3 Credits <u>EMCUSH108A</u> P.59	Non-destructive test (NDT) - Liquid Penetrant Testing  2 Credits <u>EMCUMA102A</u> P.56	Apply basic bench fitting techniques and use small typical hand tools  9 Credits <u>EMCUIN106A</u> P.51	Comply with the legal requirements on electrical and mechanical occupational safety and health 3 Credits <u>EMCUSH111A</u> P.62	Comply with the legal requirements on environmental protection  3 Credits <u>EMCUSH112A</u> P.63	Comply with the legal requirements on electrical and mechanical occupational safety and health 3 Credits <u>EMCUSH111A</u> P.62	Comply with the legal requirements on environmental protection  3 Credits <u>EMCUSH112A</u> P.63

<b>Functional Areas</b>	<b>Design (DE)</b>	<b>Installation (IN)</b>	<b>Inspection, Testing and Commissioning (IT)</b>	<b>Operation and Repair (OR)</b>	<b>Maintenance (MA)</b>	<b>Project Managements (PM)</b>	<b>Safety, Health and Environment (OM)</b>	<b>Safety, Health and Environment (SH)</b>	<b>Quality Management (QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
<b>1</b>	Comply with the legal requirements on environmental protection 3 Credits <u>EMCUSH112A</u> P.63	Use general plate bending machines  9 Credits <u>EMCUIN110A</u> P.53	Perform manual handling operation  3 Credits <u>EMCUSH109A</u> P.60	Use general personal protective equipment  3 Credits <u>EMCUSH108A</u> P.59	Use general plate bending machines  9 Credits <u>EMCUIN110A</u> P.53	Comply with the legal requirements on environmental protection 3 Credits <u>EMCUSH112A</u> P.63		Comply with the legal requirements on environmental protection 3 Credits <u>EMCUSH112A</u> P.63	
		Use general personal protective equipment  3 Credits <u>EMCUSH108A</u> P.59	Safety operation in confined spaces  3 Credits <u>EMCUSH110A</u> P.61	Perform manual handling operation  3 Credits <u>EMCUSH109A</u> P.60	Use air-conditioning and refrigeration instruments and tools 3 Credits <u>EMCUMA101A</u> P.54			Handle general chemicals safely  3 Credits <u>EMCUSH113A</u> P.64	
		Perform manual handling operation  3 Credits <u>EMCUSH109A</u> P.60	Comply with the legal requirements on electrical and mechanical occupational safety and health 3 Credits <u>EMCUSH111A</u> P.62	Safety operation in confined spaces  3 Credits <u>EMCUSH110A</u> P.61	Non-destructive test (NDT) - Liquid Penetrant Testing  2 Credits <u>EMCUMA102A</u> P.56				
		Safety operation in confined spaces  3 Credits <u>EMCUSH110A</u> P.61	Comply with the legal requirements on environmental protection  3 Credits <u>EMCUSH112A</u> P.63	Comply with the legal requirements on electrical and mechanical occupational safety and health 3 Credits <u>EMCUSH111A</u> P.62	Use general personal protective equipment  3 Credits <u>EMCUSH108A</u> P.59				

<b>Functional Areas</b> <b>QF Levels</b>	<b>Design</b> <b>(DE)</b>	<b>Installation</b> <b>(IN)</b>	<b>Inspection, Testing and Commissioning</b> <b>(IT)</b>	<b>Operation and Repair</b> <b>(OR)</b>	<b>Maintenance</b> <b>(MA)</b>	<b>Project Managements</b> <b>(PM)</b>	<b>Safety, Health and Environment</b> <b>(OM)</b>	<b>Safety, Health and Environment</b> <b>(SH)</b>	<b>Quality Management</b> <b>(QM)</b>
	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
<b>1</b>		Comply with the legal requirements on electrical and mechanical occupational safety and health 3 Credits <u>EMCUSH111A</u> P.62	Handle general chemicals safely  3 Credits <u>EMCUSH113A</u> P.64	Comply with the legal requirements on environmental protection  3 Credits <u>EMCUSH112A</u> P.63	Perform manual handling operation  3 Credits <u>EMCUSH109A</u> P.60				
		Comply with the legal requirements on environmental protection 3 Credits <u>EMCUSH112A</u> P.63		Handle general chemicals safely  3 Credits <u>EMCUSH113A</u> P.64	Safety operation in confined spaces  3 Credits <u>EMCUSH110A</u> P.61				
		Handle general chemicals safely  3 Credits <u>EMCUSH113A</u> P.64			Comply with the legal requirements on electrical and mechanical occupational safety and health 3 Credits <u>EMCUSH111A</u> P.62				
					Comply with the legal requirements on environmental protection 3 Credits <u>EMCUSH112A</u> P.63				

<b>Functional Areas</b>	<b>Design (DE)</b>	<b>Installation (IN)</b>	<b>Inspection, Testing and Commissioning (IT)</b>	<b>Operation and Repair (OR)</b>	<b>Maintenance (MA)</b>	<b>Project Managements (PM)</b>	<b>Safety, Health and Environment (OM)</b>	<b>Safety, Health and Environment (SH)</b>	<b>Quality Management (QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
<b>1</b>					Handle general chemicals safely 3 Credits <u>EMCUSH113A</u> P.64				
					Perform routine train equipment cleaning and lubrication for maintenance 4 Credits <u>EMRAMA101A</u> P.57				
<b>2</b>	Select general electrical materials and electrical equipment  6 Credits <u>EMCUDE204A</u> P.66	Select general electrical materials and electrical equipment  6 Credits <u>EMCUDE204A</u> P.66	Non-destructive test (NDT) - magnetic particle inspection  2 Credits <u>EMCUMA201A</u> P.83	Basic manual metal arc welding (MMAW)/shielded metal arc welding (SMAW)  6 Credits <u>EMCUIN225A</u> P.78	Use all kinds of machining equipment for electrical and mechanical engineering parts processing 9 Credits <u>EMCUIN214A</u> P.73	Apply effective communication skills in discussions of electrical and mechanical issues  3 Credits <u>EMCUOM204A</u> P.92	Apply effective communication skills in discussions of electrical and mechanical issues  3 Credits <u>EMCUOM204A</u> P.92	Apply effective communication skills in discussions of electrical and mechanical issues  3 Credits <u>EMCUOM204A</u> P.92	Apply effective communication skills in discussions of electrical and mechanical issues  3 Credits <u>EMCUOM204A</u> P.92
	Use computer to draw mechanical drawings  8 Credits <u>EMCUDE212A</u> P.68	Assemble power unit according to installation drawing  4 Credits <u>EMCUIN205A</u> P.70	Apply effective communication skills in discussions of electrical and mechanical issues 3 Credits <u>EMCUOM204A</u> P.92	Basic oxy-acetylene welding(OAW) / oxyfuel and arc cutting(OAC)  5 Credits <u>EMCUIN226A</u> P.80	Install general plastic pipes and fittings  3 Credits <u>EMCUIN216A</u> P.74	Know about common Chinese terminologies of electrical and mechanical services 6 Credits <u>EMCUOM207A</u> P.93	Know about common Chinese terminologies of electrical and mechanical services 6 Credits <u>EMCUOM207A</u> P.93	Know about common Chinese terminologies of electrical and mechanical services 6 Credits <u>EMCUOM207A</u> P.93	Know about common Chinese terminologies of electrical and mechanical services 6 Credits <u>EMCUOM207A</u> P.93

<b>Functional Areas</b>	<b>Design</b>	<b>Installation</b>	<b>Inspection, Testing and Commissioning</b>	<b>Operation and Repair</b>	<b>Maintenance</b>	<b>Project Managements</b>	<b>Safety, Health and Environment</b>	<b>Safety, Health and Environment</b>	<b>Quality Management</b>
	<b>(DE)</b>	<b>(IN)</b>	<b>(IT)</b>	<b>(OR)</b>	<b>(MA)</b>	<b>(PM)</b>	<b>(OM)</b>	<b>(SH)</b>	<b>(QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
2	Use computer to draw electrical drawings  8 Credits <u>EMCUDE213A</u> P.69	Perform routine wiring tasks  9 Credits <u>EMCUIN208A</u> P.71	Know about common Chinese terminologies of electrical and mechanical services 6 Credits <u>EMCUOM207A</u> P.93	Basic weld joint edge production and assembly  15 Credits <u>EMCUIN227A</u> P.82	Install metallic (steel/stainless steel/galvanized iron) pipes and fittings  3 Credits <u>EMCUIN217A</u> P.75	Apply basic risk assessment methods  3 Credits <u>EMCUSH205A</u> P.94	Apply basic risk assessment methods  3 Credits <u>EMCUSH205A</u> P.94	Apply basic risk assessment methods  3 Credits <u>EMCUSH205A</u> P.94	
	Apply effective communication skills in discussions of electrical and mechanical issues  3 Credits <u>EMCUOM204A</u> P.92	Use all kinds of machining equipment for electrical and mechanical engineering parts processing 9 Credits <u>EMCUIN214A</u> P.73	Gas test in confined spaces  3 Credits <u>EMCUSH213A</u> P.99	Non-destructive test (NDT) - magnetic particle inspection  2 Credits <u>EMCUMA201A</u> P.83	Install non-metallic (copper/aluminium) pipes and fittings  3 Credits <u>EMCUIN218A</u> P.76	Implement work site occupational health and safety management  3 Credits <u>EMCUSH206A</u> P.95	Implement work site occupational health and safety management  3 Credits <u>EMCUSH206A</u> P.95	Implement work site occupational health and safety management  3 Credits <u>EMCUSH206A</u> P.95	
	Know about common Chinese terminologies of electrical and mechanical services 6 Credits <u>EMCUOM207A</u> P.93	Install general plastic pipes and fittings  3 Credits <u>EMCUIN216A</u> P.74		Apply effective communication skills in discussions of electrical and mechanical issues 3 Credits <u>EMCUOM204A</u> P.92	Install cast iron pipes and fittings  3 Credits <u>EMCUIN219A</u> P.77	Handle general industrial accidents  3 Credits <u>EMCUSH208A</u> P.96	Handle general industrial accidents  3 Credits <u>EMCUSH208A</u> P.96	Handle general industrial accidents  3 Credits <u>EMCUSH208A</u> P.96	
		Install metallic (steel/stainless steel/galvanized iron) pipes and fittings  3 Credits <u>EMCUIN217A</u> P.75		Know about common Chinese terminologies of electrical and mechanical services  6 Credits <u>EMCUOM207A</u> P.93	Basic manual metal arc welding (MMAW)/shielded metal arc welding (SMAW)  6 Credits <u>EMCUIN225A</u> P.78	Implement preventive measures on general occupational safety and health  3 Credits <u>EMCUSH212A</u> P.98	Implement preventive measures on general occupational safety and health  3 Credits <u>EMCUSH212A</u> P.98	Obtain data and information of occupational safety and health and environmental protection to compile relevant statistics 3 Credits <u>EMCUSH211A</u> P.97	

<b>Functional Areas</b>	<b>Design (DE)</b>	<b>Installation (IN)</b>	<b>Inspection, Testing and Commissioning (IT)</b>	<b>Operation and Repair (OR)</b>	<b>Maintenance (MA)</b>	<b>Project Managements (PM)</b>	<b>Safety, Health and Environment (OM)</b>	<b>Safety, Health and Environment (SH)</b>	<b>Quality Management (QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
2		Install non-metallic (copper/aluminium) pipes and fittings  3 Credits <u>EMCUIN218A</u> P.76		Gas test in confined spaces  3 Credits <u>EMCUSH213A</u> P.99	Basic oxy-acetylene welding(OAW) / oxyfuel and arc cutting(OAC)  5 Credits <u>EMCUIN226A</u> P.80			Implement preventive measures on general occupational safety and health 3 Credits <u>EMCUSH212A</u> P.98	
		Install cast iron pipes and fittings  3 Credits <u>EMCUIN219A</u> P.77			Basic weld joint edge production and assembly 15 Credits <u>EMCUIN227A</u> P.82				
		Basic manual metal arc welding (MMAW)/shielded metal arc welding (SMAW) 6 Credits <u>EMCUIN225A</u> P.78			Non-destructive test ( NDT ) - magnetic particle inspection  2 Credits <u>EMCUMA201A</u> P.83				
		Basic oxy-acetylene welding(OAW) / oxyfuel and arc cutting(OAC) 5 Credits <u>EMCUIN226A</u> P.80			Non-destructive test ( NDT ) - ultrasonic testing  3 Credits <u>EMCUMA202A</u> P.84				
		Basic weld joint edge production and assembly 15 Credits <u>EMCUIN227A</u> P.82			Repair diesel engines  4 Credits <u>EMCUMA203A</u> P.85				

<b>Functional Areas</b>	<b>Design (DE)</b>	<b>Installation (IN)</b>	<b>Inspection, Testing and Commissioning (IT)</b>	<b>Operation and Repair (OR)</b>	<b>Maintenance (MA)</b>	<b>Project Managements (PM)</b>	<b>Safety, Health and Environment (OM)</b>	<b>Safety, Health and Environment (SH)</b>	<b>Quality Management (QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
2		Apply effective communication skills in discussions of electrical and mechanical issues 3 Credits <u>EMCUOM204A</u> P.92			Service protection and indicator of diesel engines  3 Credits <u>EMCUMA204A</u> P.86				
		Know about common Chinese terminologies of electrical and mechanical services 6 Credits <u>EMCUOM207A</u> P.93			Service generators and accessories  4 Credits <u>EMCUMA205A</u> P.87				
		Gas test in confined spaces  3 Credits <u>EMCUSH213A</u> P.99			Service control, protection and indicator of generators 4 Credits <u>EMCUMA206A</u> P.89				
					Analysis of non-destructive test (NDT) - Liquid penetrant Testing 3 Credits <u>EMCUMA207A</u> P.91				

<b>Functional Areas</b>	<b>Design (DE)</b>	<b>Installation (IN)</b>	<b>Inspection, Testing and Commissioning (IT)</b>	<b>Operation and Repair (OR)</b>	<b>Maintenance (MA)</b>	<b>Project Managements (PM)</b>	<b>Safety, Health and Environment (OM)</b>	<b>Safety, Health and Environment (SH)</b>	<b>Quality Management (QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>				
2					Apply effective communication skills in discussions of electrical and mechanical issues 3 Credits <u>EMCUOM204A</u> P.92				
					Know about common Chinese terminologies of electrical and mechanical services 6 Credits <u>EMCUOM207A</u> P.93				
					Gas test in confined spaces 3 Credits <u>EMCUSH213A</u> P.99				
3	Design air-conditioning systems and equipment 6 Credits <u>EMCUDE303A</u> P.101	Use computer to draw complicated mechanical engineering drawings 5 Credits <u>EMCUDE315A</u> P.106		Investigate general industrial accidents  3 Credits <u>EMCUSH305A</u> P.189	Implement quality control and quality assurance  4 Credits <u>EMCUQM303A</u> P.191				

<b>Functional Areas</b>	<b>Design (DE)</b>	<b>Installation (IN)</b>	<b>Inspection, Testing and Commissioning (IT)</b>	<b>Operation and Repair (OR)</b>	<b>Maintenance (MA)</b>	<b>Project Managements (PM)</b>	<b>Safety, Health and Environment (OM)</b>	<b>Safety, Health and Environment (SH)</b>	<b>Quality Management (QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
<b>3</b>	Use programmable logic controller (PLC) to write circuit control programme 6 Credits <u>EMCUDE306A</u> P.103	Use programmable logic controller (PLC) to write circuit control programme 6 Credits <u>EMCUDE306A</u> P.103	Use programmable logic controller (PLC) to write circuit control programme 6 Credits <u>EMCUDE306A</u> P.103	Use programmable logic controller (PLC) to write circuit control programme 6 Credits <u>EMCUDE306A</u> P.103	Use programmable logic controller (PLC) to write circuit control programme 6 Credits <u>EMCUDE306A</u> P.103	Use computer to draw for complicated electrical engineering drawings 5 Credits <u>EMCUDE316A</u> P.107		Perform occupational safety and health supervision 3 Credits <u>EMCUSH308A</u> P.190	Record quality issues on electrical and mechanical services 3 Credits <u>EMCUQM306A</u> P.192
	Apply diodes and transistors in electronic control circuits 8 Credits <u>EMCUDE311A</u> P.104	Apply diodes and transistors in electronic control circuits 8 Credits <u>EMCUDE311A</u> P.104	Apply diodes and transistors in electronic control circuits 8 Credits <u>EMCUDE311A</u> P.104	Apply diodes and transistors in electronic control circuits 8 Credits <u>EMCUDE311A</u> P.104	Apply diodes and transistors in electronic control circuits 8 Credits <u>EMCUDE311A</u> P.104	Use computer to draw combined services drawings of building services 5 Credits <u>EMCUDE317A</u> P.108			
	Use computer to draw complicated mechanical engineering drawings 5 Credits <u>EMCUDE315A</u> P.106	Choose typical materials for electrical and mechanical work 3 Credits <u>EMCUDE318A</u> P.109	Perform electrical and mechanical installation and testing according to the drawings and specifications of electrical devices and wiring 4 Credits <u>EMCUIN306A</u> P.111	Perform electrical and mechanical installation and testing according to the drawings and specifications of electrical devices and wiring 4 Credits <u>EMCUIN306A</u> P.111	Perform electrical and mechanical installation and testing according to the drawings and specifications of electrical devices and wiring 4 Credits <u>EMCUIN306A</u> P.111	Record quality issues on electrical and mechanical services 3 Credits <u>EMCUQM306A</u> P.192			

<b>Functional Areas</b>	<b>Design (DE)</b>	<b>Installation (IN)</b>	<b>Inspection, Testing and Commissioning (IT)</b>	<b>Operation and Repair (OR)</b>	<b>Maintenance (MA)</b>	<b>Project Managements (PM)</b>	<b>Safety, Health and Environment (OM)</b>	<b>Safety, Health and Environment (SH)</b>	<b>Quality Management (QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
<b>3</b>	Use computer to draw for complicated electrical engineering drawings  5 Credits <u>EMCUDE316A</u> P.107	Perform electrical and mechanical installation and testing according to the drawings and specifications of electrical devices and wiring 4 Credits <u>EMCUIN306A</u> P.111	Use measuring tools and instruments to install, connect or measure overhead line installations  5 Credits <u>EMCUIN309A</u> P.113	Use measuring tools and instruments to install, connect or measure overhead line installations  5 Credits <u>EMCUIN309A</u> P.113	Use measuring tools and instruments to install, connect or measure overhead line installations  5 Credits <u>EMCUIN309A</u> P.113	Apply CAD standard and information technology to draw electrical and mechanical engineering drawings  5 Credits <u>EMRADE303A</u> P.110			
	Use computer to draw combined services drawings of building services  5 Credits <u>EMCUDE317A</u> P.108	Use measuring tools and instruments to install, connect or measure overhead line installations 5 Credits <u>EMCUIN309A</u> P.113	Repair overhead line and related equipment  6 Credits <u>EMCUOR302A</u> P.140	Perform general lifting machinery and lifting equipment inspection  3 Credits <u>EMCUIN313A</u> P.115	Perform general lifting machinery and lifting equipment inspection  3 Credits <u>EMCUIN313A</u> P.115				
	Choose typical materials for electrical and mechanical work 3 Credits <u>EMCUDE318A</u> P.109	Install overhead line isolator control circuit  6 Credits <u>EMCUIN310A</u> P.114	Repair faults in current transformers and control equipment 6 Credits <u>EMCUOR304A</u> P.141	Operate and maintain abrasive wheels safely  3 Credits <u>EMCUIN315A</u> P.116	Operate and maintain abrasive wheels safely  3 Credits <u>EMCUIN315A</u> P.116				
	Repair overhead line and related equipment  6 Credits <u>EMCUOR302A</u> P.140	Perform general lifting machinery and lifting equipment inspection  3 Credits <u>EMCUIN313A</u> P.115	Repair air-conditioning system and control equipment  6 Credits <u>EMCUOR305A</u> P.142	Apply fault finding techniques to find the root causes of fault  3 Credits <u>EMCUOR301A</u> P.139	Perform manual metal arc welding (MMAW)/shielded metal arc welding (SMAW) at specified positions 20 Credits <u>EMCUIN316A</u> P.117				

<b>Functional Areas</b>	<b>Design (DE)</b>	<b>Installation (IN)</b>	<b>Inspection, Testing and Commissioning (IT)</b>	<b>Operation and Repair (OR)</b>	<b>Maintenance (MA)</b>	<b>Project Managements (PM)</b>	<b>Safety, Health and Environment (OM)</b>	<b>Safety, Health and Environment (SH)</b>	<b>Quality Management (QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
<b>3</b>	Repair faults in current transformers and control equipment  6 Credits <u>EMCUOR304A</u> P.141	Operate and maintain abrasive wheels safely  3 Credits <u>EMCUIN315A</u> P.116	Repair faults in generator and its accessories  9 Credits <u>EMCUOR307A</u> P.143	Repair overhead line and related equipment  6 Credits <u>EMCUOR302A</u> P.140	Perform tungsten inert gas(TIG) / gas tungsten arc welding (GTAW) at specified positions 5 Credits <u>EMCUIN317A</u> P.119				
	Repair air-conditioning system and control equipment  6 Credits <u>EMCUOR305A</u> P.142	Perform manual metal arc welding (MMAW)/shielded metal arc welding (SMAW) at specified positions 20 Credits <u>EMCUIN316A</u> P.117	Repair faults in diesel engines  9 Credits <u>EMCUOR308A</u> P.144	Repair faults in current transformers and control equipment  6 Credits <u>EMCUOR304A</u> P.141	Perform oxy-acetylene welding(OAW) / oxyfuel and arc cutting(OAC) at specified positions 20 Credits <u>EMCUIN318A</u> P.121				
	Repair faults in generator and its accessories  9 Credits <u>EMCUOR307A</u> P.143	Perform tungsten inert gas(TIG) / gas tungsten arc welding (GTAW) at specified positions 5 Credits <u>EMCUIN317A</u> P.119	Repair faults in control and protection device of diesel engines and generators 9 Credits <u>EMCUOR309A</u> P.145	Repair air-conditioning system and control equipment  6 Credits <u>EMCUOR305A</u> P.142	Perform metal inert gas(MIG) / gas metal arc welding (GMAW) at specified positions  20 Credits <u>EMCUIN319A</u> P.122				
	Repair faults in diesel engines  9 Credits <u>EMCUOR308A</u> P.144	Perform oxy-acetylene welding(OAW) / oxyfuel and arc cutting(OAC) at specified positions 20 Credits <u>EMCUIN318A</u> P.121	Test diesel engines  3 Credits <u>EMCUMA314A</u> P.172	Repair faults in generator and its accessories  9 Credits <u>EMCUOR307A</u> P.143	Perform weld joint edge production and assembly according to drawings  15 Credits <u>EMCUIN320A</u> P.124				

<b>Functional Areas</b>	<b>Design</b>	<b>Installation</b>	<b>Inspection, Testing and Commissioning</b>	<b>Operation and Repair</b>	<b>Maintenance</b>	<b>Project Managements</b>	<b>Safety, Health and Environment</b>	<b>Safety, Health and Environment</b>	<b>Quality Management</b>
	<b>(DE)</b>	<b>(IN)</b>	<b>(IT)</b>	<b>(OR)</b>	<b>(MA)</b>	<b>(PM)</b>	<b>(OM)</b>	<b>(SH)</b>	<b>(QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
<b>3</b>	Repair faults in control and protection device of diesel engines and generators  9 Credits <u>EMCUOR309A</u> P.145	Perform metal inert gas(MIG) / gas metal arc welding (GMAW) at specified positions  20 Credits <u>EMCUIN319A</u> P.122	Record quality issues on electrical and mechanical services  3 Credits <u>EMCUQM306A</u> P.192	Repair faults in diesel engines  9 Credits <u>EMCUOR308A</u> P.144	Perform manual metal arc welding (MMAW) / shielded metal arc welding (SMAW) on different kinds of steel according to drawings 4 Credits <u>EMCUIN321A</u> P.125				
	Apply CAD standard and information technology to draw electrical and mechanical engineering drawings 5 Credits <u>EMRADE303A</u> P.110	Perform weld joint edge production and assembly according to drawings  15 Credits <u>EMCUIN320A</u> P.124		Repair faults in control and protection device of diesel engines and generators  9 Credits <u>EMCUOR309A</u> P.145	Perform metal inert gas(MIG) / gas metal arc welding (GMAW) according to drawings  4 Credits <u>EMCUIN322A</u> P.127				
	Repair the faults in electrical systems of electric trains  5 Credits <u>EMRAOR301A</u> P.147	Perform manual metal arc welding (MMAW) / shielded metal arc welding (SMAW) on different kinds of steel according to drawings 4 Credits <u>EMCUIN321A</u> P.125	Repair the faults in electrical systems of electric trains  5 Credits <u>EMRAOR301A</u> P.147	Repair the faults in electrical systems of electric trains  5 Credits <u>EMRAOR301A</u> P.147	Perform oxy-acetylene welding(OAW) / oxyfuel and arc cutting(OAC) according to drawings  4 Credits <u>EMCUIN323A</u> P.128				

<b>Functional Areas</b>	<b>Design</b>	<b>Installation</b>	<b>Inspection, Testing and Commissioning</b>	<b>Operation and Repair</b>	<b>Maintenance</b>	<b>Project Managements</b>	<b>Safety, Health and Environment</b>	<b>Safety, Health and Environment</b>	<b>Quality Management</b>
	<b>(DE)</b>	<b>(IN)</b>	<b>(IT)</b>	<b>(OR)</b>	<b>(MA)</b>	<b>(PM)</b>	<b>(OM)</b>	<b>(SH)</b>	<b>(QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
<b>3</b>	Repair the faults in electric traction control systems of trains  9 Credits <i>EMRAOR302A</i> P.149	Perform metal inert gas(MIG) / gas metal arc welding (GMAW) according to drawings  4 Credits <u>EMCUIN322A</u> P.127	Repair the faults in electric traction control systems of trains  9 Credits <i>EMRAOR302A</i> P.149	Repair the faults in electric traction control systems of trains  9 Credits <i>EMRAOR302A</i> P.149	Perform tungsten inert gas(TIG) / gas tungsten arc welding(GTAW) according to drawings 4 Credits <u>EMCUIN324A</u> P.129				
	Repair the faults in pneumatic friction brake systems of trains  7 Credits <i>EMRAOR303A</i> P.151	Perform oxy-acetylene welding(OAW) / oxyfuel and arc cutting(OAC) according to drawings 4 Credits <u>EMCUIN323A</u> P.128	Repair the faults in pneumatic friction brake systems of trains  7 Credits <i>EMRAOR303A</i> P.151	Repair the faults in pneumatic friction brake systems of trains  7 Credits <i>EMRAOR303A</i> P.151	Repair overhead line and related equipment  6 Credits <u>EMCUOR302A</u> P.140				
	Repair the faults in pneumatic systems of trains  6 Credits <i>EMRAOR304A</i> P.153	Perform tungsten inert gas(TIG) / gas tungsten arc welding(GTAW) according to drawings 4 Credits <u>EMCUIN324A</u> P.129	Repair the faults in pneumatic systems of trains  6 Credits <i>EMRAOR304A</i> P.153	Repair the faults in pneumatic systems of trains  6 Credits <i>EMRAOR304A</i> P.153	Repair faults in current transformers and control equipment  6 Credits <u>EMCUOR304A</u> P.141				
	Repair the faults in electric multi-car train door systems  5 Credits <i>EMRAOR305A</i> P.155	Repair overhead line and related equipment  6 Credits <u>EMCUOR302A</u> P.140	Repair the faults in electric multi-car train door systems  5 Credits <i>EMRAOR305A</i> P.155	Repair the faults in electric multi-car train door systems  5 Credits <i>EMRAOR305A</i> P.155	Repair air-conditioning system and control equipment 6 Credits <u>EMCUOR305A</u> P.142				

<b>Functional Areas</b>	<b>Design</b>	<b>Installation</b>	<b>Inspection, Testing and Commissioning</b>	<b>Operation and Repair</b>	<b>Maintenance</b>	<b>Project Managements</b>	<b>Safety, Health and Environment</b>	<b>Safety, Health and Environment</b>	<b>Quality Management</b>
	<b>(DE)</b>	<b>(IN)</b>	<b>(IT)</b>	<b>(OR)</b>	<b>(MA)</b>	<b>(PM)</b>	<b>(OM)</b>	<b>(SH)</b>	<b>(QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
<b>3</b>	Repair the faults in train bogies, gangways and couplings 5 Credits <i>EMRAOR306A</i> P.156	Repair faults in current transformers and control equipment 6 Credits <u>EMCUOR304A</u> P.141	Repair the faults in train bogies, gangways and couplings 5 Credits <i>EMRAOR306A</i> P.156	Repair the faults in train bogies, gangways and couplings 5 Credits <i>EMRAOR306A</i> P.156	Repair faults in generator and its accessories  9 Credits <u>EMCUOR307A</u> P.143				
	Repair the faults in the train line and pneumatic pipe line controlling the whole train 4 Credits <i>EMRAOR307A</i> P.158	Repair air-conditioning system and control equipment 6 Credits <u>EMCUOR305A</u> P.142	Repair the faults in the train line and pneumatic pipe line controlling the whole train 4 Credits <i>EMRAOR307A</i> P.158	Repair the faults in the train line and pneumatic pipe line controlling the whole train 4 Credits <i>EMRAOR307A</i> P.158	Repair faults in diesel engines  9 Credits <u>EMCUOR308A</u> P.144				
	Repair the faults in railway overhead feeder systems  6 Credits <i>EMRAOR308A</i> P.160	Repair faults in generator and its accessories 9 Credits <u>EMCUOR307A</u> P.143	Repair the faults in railway overhead feeder systems 6 Credits <i>EMRAOR308A</i> P.160	Repair the faults in railway overhead feeder systems 6 Credits <i>EMRAOR308A</i> P.160	Repair faults in control and protection device of diesel engines and generators 9 Credits <u>EMCUOR309A</u> P.145				
		Repair faults in diesel engines  9 Credits <u>EMCUOR308A</u> P.144			Repair electrical devices for electric traction control system 6 Credits <u>EMCUMA302A</u> P.162				

<b>Functional Areas</b>	<b>Design (DE)</b>	<b>Installation (IN)</b>	<b>Inspection, Testing and Commissioning (IT)</b>	<b>Operation and Repair (OR)</b>	<b>Maintenance (MA)</b>	<b>Project Managements (PM)</b>	<b>Safety, Health and Environment (OM)</b>	<b>Safety, Health and Environment (SH)</b>	<b>Quality Management (QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
3		Repair faults in control and protection device of diesel engines and generators 9 Credits <u>EMCUOR309A</u> P.145			Repair electronic control equipment for traction control system and main current transformer 9 Credits <u>EMCUMA303A</u> P.164				
		Record quality issues on electrical and mechanical services 3 Credits <u>EMCUQM306A</u> P.192			Repair air-conditioning and refrigeration systems 6 Credits <u>EMCUMA304A</u> P.166				
		Install mechanical equipment of trains  9 Credits <u>EMRAIN302A</u> P.130			Repair overhead line equipment (feeder, insulation, suspension and earthed systems) 6 Credits <u>EMCUMA305A</u> P.168				
		Install pneumatic equipment of trains  6 Credits <u>EMRAIN303A</u> P.131			Service overhead power system equipment (isolator, power supply system switchboard and control circuit) 6 Credits <u>EMCUMA306A</u> P.169				

<b>Functional Areas</b>	<b>Design (DE)</b>	<b>Installation (IN)</b>	<b>Inspection, Testing and Commissioning (IT)</b>	<b>Operation and Repair (OR)</b>	<b>Maintenance (MA)</b>	<b>Project Managements (PM)</b>	<b>Safety, Health and Environment (OM)</b>	<b>Safety, Health and Environment (SH)</b>	<b>Quality Management (QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
3		Install electrical equipment and wiring of trains  9 Credits EMRAIN304A P.133			Analysis of non-destructive test (NDT) - Ultrasonic Testing 3 Credits <u>EMCUMA311A</u> P.170				
		Install trackside equipment of the railway signalling and control system 6 Credits EMRAIN308A P.135			Test diesel engines  3 Credits <u>EMCUMA314A</u> P.172				
		Install train air-conditioning system and equipment 5 Credits EMRAIN309A P.137			Record quality issues on electrical and mechanical services  3 Credits <u>EMCUQM306A</u> P.192				
		Repair the faults in electrical systems of electric trains 5 Credits <i>EMRAOR301A</i> P.147			Repair the faults in electrical systems of electric trains 5 Credits <i>EMRAOR301A</i> P.147				
		Repair the faults in electric traction control systems of trains 9 Credits <i>EMRAOR302A</i> P.149			Repair the faults in electric traction control systems of trains 9 Credits <i>EMRAOR302A</i> P.149				

<b>Functional Areas</b>	<b>Design</b>	<b>Installation</b>	<b>Inspection, Testing and Commissioning</b>	<b>Operation and Repair</b>	<b>Maintenance</b>	<b>Project Managements</b>	<b>Safety, Health and Environment</b>	<b>Safety, Health and Environment</b>	<b>Quality Management</b>
	<b>(DE)</b>	<b>(IN)</b>	<b>(IT)</b>	<b>(OR)</b>	<b>(MA)</b>	<b>(PM)</b>	<b>(OM)</b>	<b>(SH)</b>	<b>(QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
<b>3</b>		Repair the faults in pneumatic friction brake systems of trains 7 Credits <i>EMRAOR303A</i> P.151			Repair the faults in pneumatic friction brake systems of trains 7 Credits <i>EMRAOR303A</i> P.151				
		Repair the faults in pneumatic systems of trains 6 Credits <i>EMRAOR304A</i> P.153			Repair the faults in pneumatic systems of trains 6 Credits <i>EMRAOR304A</i> P.153				
		Repair the faults in electric multi-car train door systems 5 Credits <i>EMRAOR305A</i> P.155			Repair the faults in electric multi-car train door systems 5 Credits <i>EMRAOR305A</i> P.155				
		Repair the faults in train bogies, gangways and couplings 5 Credits <i>EMRAOR306A</i> P.156			Repair the faults in train bogies, gangways and couplings 5 Credits <i>EMRAOR306A</i> P.156				
		Repair the faults in the train line and pneumatic pipe line controlling the whole train 4 Credits <i>EMRAOR307A</i> P.158			Repair the faults in the train line and pneumatic pipe line controlling the whole train 4 Credits <i>EMRAOR307A</i> P.158				

<u>Functional Areas</u>	<u>Design (DE)</u>	<u>Installation (IN)</u>	<u>Inspection, Testing and Commissioning (IT)</u>	<u>Operation and Repair (OR)</u>	<u>Maintenance (MA)</u>	<u>Project Managements (PM)</u>	<u>Safety, Health and Environment (OM)</u>	<u>Safety, Health and Environment (SH)</u>	<u>Quality Management (QM)</u>
<u>QF Levels</u>	<u>Unit of Competency</u>	<u>Unit of Competency</u>	<u>Unit of Competency</u>	<u>Unit of Competency</u>	<u>Unit of Competency</u>	<u>Unit of Competency</u>	<u>Unit of Competency</u>	<u>Unit of Competency</u>	<u>Unit of Competency</u>
3		Repair the faults in railway overhead feeder systems 6 Credits <i>EMRAOR308A</i> P.160			Repair the faults in railway overhead feeder systems 6 Credits <i>EMRAOR308A</i> P.160				
					Light repair and performance tests for electric trains 6 Credits <u>EMRAMA301A</u> P.173				
					Light repair and performance tests for diesel locomotive 5 Credits <u>EMRAMA302A</u> P.175				
					Maintain electrical systems for electric trains 6 Credits <u>EMRAMA303A</u> P.177				
					Maintenance brake systems and equipment for trains 6 Credits <u>EMRAMA304A</u> P.179				

<b>Functional Areas</b>	<b>Design (DE)</b>	<b>Installation (IN)</b>	<b>Inspection, Testing and Commissioning (IT)</b>	<b>Operation and Repair (OR)</b>	<b>Maintenance (MA)</b>	<b>Project Managements (PM)</b>	<b>Safety, Health and Environment (OM)</b>	<b>Safety, Health and Environment (SH)</b>	<b>Quality Management (QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>				
<b>3</b>					Maintain electric multi-car door systems 6 Credits <u>EMRAMA305A</u> P.181				
					Maintain train bogies, gangways and couplers 6 Credits <u>EMRAMA306A</u> P.183				
					Maintain the trackside equipment of the railway signal and control system and interlock 6 Credits <u>EMRAMA308A</u> P.185				
					Maintain pneumatic systems of trains 5 Credits <u>EMRAMA309A</u> P.187				
<b>4</b>	Formulate effective storage and updating system for drawings  3 Credits <u>EMCUDE405A</u> P.194	Formulate effective storage and updating system for drawings  3 Credits <u>EMCUDE405A</u> P.194	Formulate effective storage and updating system for drawings  3 Credits <u>EMCUDE405A</u> P.194	Formulate effective storage and updating system for drawings  3 Credits <u>EMCUDE405A</u> P.194	Formulate effective storage and updating system for drawings  3 Credits <u>EMCUDE405A</u> P.194	Formulate effective storage and updating system for drawings  3 Credits <u>EMCUDE405A</u> P.194	Teach electrical and mechanical engineering courses  9 Credits EMRAOM401A P.251	Formulate code of safety for machinery operation  5 Credits EMRASH401A P.252	Implement quality management in electrical and mechanical engineering services 6 Credits <u>EMCUQM402A</u> P.255

<b>Functional Areas</b>	<b>Design (DE)</b>	<b>Installation (IN)</b>	<b>Inspection, Testing and Commissioning (IT)</b>	<b>Operation and Repair (OR)</b>	<b>Maintenance (MA)</b>	<b>Project Managements (PM)</b>	<b>Safety, Health and Environment (OM)</b>	<b>Safety, Health and Environment (SH)</b>	<b>Quality Management (QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
<b>4</b>	Supervise the drafting of engineering drawings  9 Credits <i>EMRADE401A</i> P.195	Supervise the installation of train equipment  9 Credits EMRAIN401A P.197	Inspect, test and commission overhead line equipment and related suspension and earthed installations  6 Credits <u>EMCUIT401A</u> P.210	Troubleshoot intermittent and hidden faults in train  5 Credits EMRAOR401A P.232	Supervise equipment maintenance work to ensure its quality, standard and efficiency  9 Credits <u>EMCUMA401A</u> P.247	Supervise the drafting of engineering drawings  9 Credits <i>EMRADE401A</i> P.195		Perform tasks of power disconnection, isolation and earthing and of issuing works permits (i.e. the duty of an authorized person) 4 Credits EMRASH402A P.253	Promote quality management culture at working level  3 Credits <u>EMCUQM403A</u> P.256
		Undertake component function tests for trains after installation 6 Credits EMRAIN402A P.198	Inspect, test and commission the mechanical equipment of trains 9 Credits EMRAIT402A P.211	Supervise the fault repair of train equipment  9 Credits EMRAOR402A P.234	Inspect, and perform system function tests and running tests for overhauled trains 7 Credits EMRAMA401A P.249				
		Supervise the installation of railway overhead feeder systems  6 Credits EMRAIN404A P.200	Inspect, test and commission the electrical system equipment of trains  9 Credits EMRAIT403A P.213	Troubleshoot intermittent and hidden faults in the railway overhead feeder system 5 Credits EMRAOR403A P.236					
		Undertake component function tests for railway overhead feeder systems after installation 6 Credits EMRAIN405A P.202	Inspect, test and commission the pneumatic system equipment of trains  6 Credits EMRAIT404A P.215	Fix the faults in railway signal interlock system  6 Credits EMRAOR404A P.238					

<b>Functional Areas</b>	<b>Design (DE)</b>	<b>Installation (IN)</b>	<b>Inspection, Testing and Commissioning (IT)</b>	<b>Operation and Repair (OR)</b>	<b>Maintenance (MA)</b>	<b>Project Managements (PM)</b>	<b>Safety, Health and Environment (OM)</b>	<b>Safety, Health and Environment (SH)</b>	<b>Quality Management (QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
4		Install computer control equipment and information network equipment of railway traffic management system 6 Credits EMRAIN406A P.204	Inspect, test and commission the air-conditioning system equipment of trains 4 Credits EMRAIT405A P.217	Fix the faults in railway signal and control system and trackside equipment and SCADA 6 Credits EMRAOR405A P.240					
		Install railway signal interlock system 6 Credits EMRAIN407A P.206	Inspect, test and commission the railway overhead feeder system equipment 6 Credits EMRAIT407A P.219	Fix the faults in automatic train control system equipment on the train 6 Credits EMRAOR406A P.242					
		Supervise the installation of railway signal and control systems 6 Credits EMRAIN408A P.208	Supervise the inspection, commissioning and testing of railway overhead feeder system 6 Credits EMRAIT408A P.221	Fix the faults in the railway traffic management system 6 Credits EMRAOR407A P.244					

<b>Functional Areas</b>	<b>Design (DE)</b>	<b>Installation (IN)</b>	<b>Inspection, Testing and Commissioning (IT)</b>	<b>Operation and Repair (OR)</b>	<b>Maintenance (MA)</b>	<b>Project Managements (PM)</b>	<b>Safety, Health and Environment (OM)</b>	<b>Safety, Health and Environment (SH)</b>	<b>Quality Management (QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
4			Inspect, test and commission railway traffic management system  6 Credits EMRAIT409A P.223	Analyze operation information and records of railway signal and control system equipment to clear the root causes of faults 3 Credits EMRAOR408A P.246					
			Inspect, test and commission railway signal interlock system 6 Credits EMRAIT410A P.225						
			Inspect, test and commission trackside equipment and SCADA System 6 Credits EMRAIT411A P.227						
			Inspect, test and commission automatic train control system equipment on the train 6 Credits EMRAIT412A P.229						

<b>Functional Areas</b>	<b>Design (DE)</b>	<b>Installation (IN)</b>	<b>Inspection, Testing and Commissioning (IT)</b>	<b>Operation and Repair (OR)</b>	<b>Maintenance (MA)</b>	<b>Project Managements (PM)</b>	<b>Safety, Health and Environment (OM)</b>	<b>Safety, Health and Environment (SH)</b>	<b>Quality Management (QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
<b>4</b>			Supervise the inspection, commissioning and testing of railway signal and control system 6 Credits EMRAIT413A P.230						
<b>5</b>	Analyze and assess performance of electrical system and equipment  9 Credits <u>EMCUDE501A</u> P.258	Write all kinds of electrical and mechanical engineering reports in Chinese 6 Credits <u>EMCUDE506A</u> P.264	Write all kinds of electrical and mechanical engineering reports in Chinese 6 Credits <u>EMCUDE506A</u> P.264	Write all kinds of electrical and mechanical engineering reports in Chinese 6 Credits <u>EMCUDE506A</u> P.264	Write all kinds of electrical and mechanical engineering reports in Chinese 6 Credits <u>EMCUDE506A</u> P.264	Analyze and assess performance of electrical system and equipment  9 Credits <u>EMCUDE501A</u> P.258	Write all kinds of electrical and mechanical engineering reports in Chinese 6 Credits <u>EMCUDE506A</u> P.264	Write all kinds of electrical and mechanical engineering reports in Chinese 6 Credits <u>EMCUDE506A</u> P.264	Write all kinds of electrical and mechanical engineering reports in Chinese 6 Credits <u>EMCUDE506A</u> P.264
	Use programmable logic controller (PLC) to upgrade control equipment  9 Credits <u>EMCUDE502A</u> P.259	Write all kinds of electrical and mechanical engineering reports in English 6 Credits <u>EMCUDE507A</u> P.265	Write all kinds of electrical and mechanical engineering reports in English 6 Credits <u>EMCUDE507A</u> P.265	Write all kinds of electrical and mechanical engineering reports in English 6 Credits <u>EMCUDE507A</u> P.265	Write all kinds of electrical and mechanical engineering reports in English 6 Credits <u>EMCUDE507A</u> P.265	Design safe and efficient control, interlocking and protection systems for power supply system 6 Credits <u>EMCUDE503A</u> P.261	Write all kinds of electrical and mechanical engineering reports in English 6 Credits <u>EMCUDE507A</u> P.265	Write all kinds of electrical and mechanical engineering reports in English 6 Credits <u>EMCUDE507A</u> P.265	Write all kinds of electrical and mechanical engineering reports in English 6 Credits <u>EMCUDE507A</u> P.265

<b>Functional Areas</b> <b>QF Levels</b>	<b>Design</b> <b>(DE)</b>	<b>Installation</b> <b>(IN)</b>	<b>Inspection, Testing and Commissioning</b> <b>(IT)</b>	<b>Operation and Repair</b> <b>(OR)</b>	<b>Maintenance</b> <b>(MA)</b>	<b>Project Managements</b> <b>(PM)</b>	<b>Safety, Health and Environment</b> <b>(OM)</b>	<b>Safety, Health and Environment</b> <b>(SH)</b>	<b>Quality Management</b> <b>(QM)</b>
	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
5	Design safe and efficient control, interlocking and protection systems for power supply system  6 Credits <u>EMCUDE503A</u> P.261	Formulate installation instructions for overhead line system  6 Credits <u>EMCUIN501A</u> P.305	Formulate instructions on overhead line system inspection, testing and commissioning  6 Credits <u>EMCUIT501A</u> P.316	Analyze fault records to find frequent faults and their root causes  5 Credits EMRAOR501A P.341	Formulate maintenance instructions for mechanical equipment and train air-conditioning systems 9 Credits EMRAMA501A P.344	Write all kinds of electrical and mechanical engineering reports in Chinese  6 Credits <u>EMCUDE506A</u> P.264	Implement engineering operation and supervisory management  6 Credits <u>EMCUOM502A</u> P.368	Implement risk management for electrical and mechanical services  9 Credits <u>EMCUSH502A</u> P.371	Formulate and implement quality management courses and training programmes  4 Credits <u>EMCUQM503A</u> P.382
	Analyze quality of electricity data and design suitable device to improve electricity quality  6 Credits <u>EMCUDE504A</u> P.262	Formulate installation instructions for mechanical equipment of trains  9 Credits EMRAIN501A P.306	Formulate instructions on inspection, testing and commissioning of switchboard, control circuit, protector and electricity quality improvement device 6 Credits <u>EMCUIT502A</u> P.317	Use new technologies and methods to support fault finding in trains  6 Credits EMRAOR502A P.343	Formulate maintenance instructions for pneumatic system equipment of trains  6 Credits EMRAMA502A P.346	Write all kinds of electrical and mechanical engineering reports in English  6 Credits <u>EMCUDE507A</u> P.265	Implement risk management for electrical and mechanical services  9 Credits <u>EMCUSH502A</u> P.371	Formulate occupational safety and health management system  3 Credits <u>EMCUSH504A</u> P.373	Formulate and analyze quality assurance reports  3 Credits <u>EMCUQM504A</u> P.383
	Apply SCADA system to remote control design  6 Credits <u>EMCUDE505A</u> P.263	Formulate installation instructions for pneumatic equipment of trains  6 Credits EMRAIN502A P.308	Conduct comprehensive train tests and analyze train performance  9 Credits EMRAIT505A P.326		Formulate maintenance instructions for electrical systems of trains 9 Credits EMRAMA503A P.348	Formulate project procedures and schedule  9 Credits <u>EMCUPM501A</u> P.361	Manage electrical and mechanical engineering courses  9 Credits EMRAOM501A P.369	Formulate occupational safety and health and environmental protection schemes 6 Credits <u>EMCUSH505A</u> P.374	Formulate schemes to enhance staff's awareness of quality management  5 Credits <u>EMCUQM505A</u> P.384

<b>Functional Areas</b>	<b>Design (DE)</b>	<b>Installation (IN)</b>	<b>Inspection, Testing and Commissioning (IT)</b>	<b>Operation and Repair (OR)</b>	<b>Maintenance (MA)</b>	<b>Project Managements (PM)</b>	<b>Safety, Health and Environment (OM)</b>	<b>Safety, Health and Environment (SH)</b>	<b>Quality Management (QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
5	Write all kinds of electrical and mechanical engineering reports in Chinese  6 Credits <u>EMCUDE506A</u> P.264	Formulate installation instructions for electrical equipment of trains  9 Credits EMRAIN503A P.310	Formulate the inspection, commissioning and testing guidelines and standards for the mechanical equipment of trains 9 Credits EMRAIT501A P.318		Test and select materials for train equipment components  6 Credits EMRAMA504A P.349	Conduct comprehensive train tests and analyze train performance  9 Credits EMRAIT505A P.326		Perform risk assessment for electrical and mechanical work  3 Credits <u>EMCUSH506A</u> P.376	Implement quality management training courses  9 Credits <u>EMCUQM506A</u> P.385
	Write all kinds of electrical and mechanical engineering reports in English  6 Credits <u>EMCUDE507A</u> P.265	Formulate installation instructions for railway overhead feeder system equipment and electricity quality improvement devices 6 Credits EMRAIN504A P.312	Formulate the inspection, commissioning and testing guidelines and standards for the pneumatic equipment of trains 9 Credits EMRAIT502A P.320		Formulate maintenance instructions for railway overhead feeder system equipment  9 Credits EMRAMA505A P.351	Implement risk management for railway electrical and mechanical engineering projects  9 Credits EMRAPM501A P.362		Formulate environmental protection management system  3 Credits <u>EMCUSH507A</u> P.377	Implement quality management standards of International Organization for Standardization (ISO)  3 Credits <u>EMCUQM507A</u> P.386
	Design mechanical equipment of trains  5 Credits EMRADE501A P.266	Formulate installation instructions for railway signal and control system equipment  6 Credits EMRAIN505A P.314	Formulate the inspection, commissioning and testing guidelines and standards for the electrical equipment of trains 9 Credits EMRAIT503A P.322		Formulate maintenance instructions for railway signal and control systems  9 Credits EMRAMA506A P.353	Implement purchasing management for railway electrical and mechanical engineering projects  9 Credits EMRAPM502A P.364		Implement occupational safety and health and environmental protection courses and training programmes 3 Credits <u>EMCUSH508A</u> P.378	Conduct quality management audit for the electrical and mechanical engineering department  9 Credits <u>EMRAQM501A</u> P.387

<b>Functional Areas</b>	<b>Design (DE)</b>	<b>Installation (IN)</b>	<b>Inspection, Testing and Commissioning (IT)</b>	<b>Operation and Repair (OR)</b>	<b>Maintenance (MA)</b>	<b>Project Managements (PM)</b>	<b>Safety, Health and Environment (OM)</b>	<b>Safety, Health and Environment (SH)</b>	<b>Quality Management (QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
5	Design and analyze electronic control circuits  6 Credits EMRADE502A P.267		Formulate the inspection, commissioning and testing guidelines and standards for the train air-conditioning systems  9 Credits EMRAIT504A P.324		Plan, organize and coordinate maintenance work for trains  6 Credits EMRAMA507A P.355	Implement coordination and integration management for railway electrical and mechanical engineering projects  9 Credits EMRAPM503A P.366		Conduct safety, health and environmental protection audit for the electrical and mechanical engineering department 9 Credits EMRASH501A P.380	
	Verify the design of electricity power systems of electric trains and perform design reviews  9 Credits EMRADE503A P.268		Supervise and manage train inspection, commissioning and testing work  9 Credits EMRAIT506A P.327		Plan, organize and coordinate maintenance work for railway overhead feeder system equipment 6 Credits EMRAMA508A P.357				
	Verify the design of diesel locomotive engines and generators and perform design reviews 9 Credits EMRADE504A P.270		Inspect, commission and test power recovery systems  5 Credits EMRAIT507A P.329		Plan, organize and coordinate maintenance work for railway signal and control system equipment 6 Credits EMRAMA509A P.359				

<b>Functional Areas</b>	<b>Design (DE)</b>	<b>Installation (IN)</b>	<b>Inspection, Testing and Commissioning (IT)</b>	<b>Operation and Repair (OR)</b>	<b>Maintenance (MA)</b>	<b>Project Managements (PM)</b>	<b>Safety, Health and Environment (OM)</b>	<b>Safety, Health and Environment (SH)</b>	<b>Quality Management (QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
5	Verify the design of electric traction control systems of trains and perform design reviews  9 Credits EMRADE505A P.272		Perform insulation tests, pressure tests and overall system commissioning tests for the railway overhead feeder system 9 Credits EMRAIT508A P.331						
	Verify the design of friction brake systems of trains and perform design reviews  9 Credits EMRADE506A P.274		Formulate the inspection, commissioning and testing guidelines and standards for the railway traffic management system 9 Credits EMRAIT509A P.333						
	Verify the design of pneumatic systems of trains and perform design reviews  6 Credits EMRADE507A P.276		Formulate the inspection, commissioning and testing guidelines and standards for the railway signal interlock system 6 Credits EMRAIT510A P.335						

<b>Functional Areas</b>	<b>Design (DE)</b>	<b>Installation (IN)</b>	<b>Inspection, Testing and Commissioning (IT)</b>	<b>Operation and Repair (OR)</b>	<b>Maintenance (MA)</b>	<b>Project Managements (PM)</b>	<b>Safety, Health and Environment (OM)</b>	<b>Safety, Health and Environment (SH)</b>	<b>Quality Management (QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
5	Verify the design of inverters of trains and perform design reviews  6 Credits EMRADE508A P.278		Formulate the inspection, commissioning and testing guidelines and standards for the trackside equipment of the railway signal system and the SCADA System 6 Credits EMRAIT511A P.337						
	Verify the design of air-conditioning systems of trains and perform design reviews  6 Credits EMRADE509A P.280		Formulate the inspection, commissioning and testing guidelines and standards for the automatic train control (ATC) system equipment on train 4 Credits EMRAIT512A P.339						
	Verify the design of electric multi-car train door system and perform design reviews 6 Credits EMRADE510A P.282								

<u>Functional Areas</u>	<u>Design (DE)</u>	<u>Installation (IN)</u>	<u>Inspection, Testing and Commissioning (IT)</u>	<u>Operation and Repair (OR)</u>	<u>Maintenance (MA)</u>	<u>Project Managements (PM)</u>	<u>Safety, Health and Environment (OM)</u>	<u>Safety, Health and Environment (SH)</u>	<u>Quality Management (QM)</u>
<u>QF Levels</u>	<u>Unit of Competency</u>	<u>Unit of Competency</u>	<u>Unit of Competency</u>	<u>Unit of Competency</u>	<u>Unit of Competency</u>	<u>Unit of Competency</u>	<u>Unit of Competency</u>	<u>Unit of Competency</u>	<u>Unit of Competency</u>
5	Verify the design of train bogies, gangways and couplers and perform design reviews 9 Credits EMRADE511A P.284								
	Verify the design of train compartment frame, body, head and interior and perform design reviews 9 Credits EMRADE512A P.286								
	Verify the design of train interlock protection loops and perform design reviews 5 Credits EMRADE513A P.288								
	Formulate tenders for railway electrical and mechanical works 9 Credits EMRADE515A P.290								

<b>Functional Areas</b>	<b>Design</b>	<b>Installation</b>	<b>Inspection, Testing and Commissioning</b>	<b>Operation and Repair</b>	<b>Maintenance</b>	<b>Project Managements</b>	<b>Safety, Health and Environment</b>	<b>Safety, Health and Environment</b>	<b>Quality Management</b>
	<b>(DE)</b>	<b>(IN)</b>	<b>(IT)</b>	<b>(OR)</b>	<b>(MA)</b>	<b>(PM)</b>	<b>(OM)</b>	<b>(SH)</b>	<b>(QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
5	Design the railway AC overhead feeder system 6 Credits EMRADE516A P.292								
	Design the mechanical structure and line location of the railway overhead feeder system 6 Credits EMRADE517A P.294								
	Design rectifiers for the railway DC overhead feeder system 6 Credits EMRADE520A P.296								
	Verify the design of railway traffic management systems and perform design reviews 9 Credits EMRADE521A P.297								

<b>Functional Areas</b>	<b>Design</b>	<b>Installation</b>	<b>Inspection, Testing and Commissioning</b>	<b>Operation and Repair</b>	<b>Maintenance</b>	<b>Project Managements</b>	<b>Safety, Health and Environment</b>	<b>Safety, Health and Environment</b>	<b>Quality Management</b>
	<b>(DE)</b>	<b>(IN)</b>	<b>(IT)</b>	<b>(OR)</b>	<b>(MA)</b>	<b>(PM)</b>	<b>(OM)</b>	<b>(SH)</b>	<b>(QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
5	Verify the design of railway signal interlock systems and perform design reviews 9 Credits EMRADE522A P.299								
	Verify the design of trackside equipment of railway signal and control systems and perform design reviews 9 Credits EMRADE523A P.301								
	Verify the design of automatic train control (ATC) system equipment on the train and perform design reviews 9 Credits EMRADE524A P.303								

<b>Functional Areas</b> <b>QF Levels</b>	<b>Design</b> <b>(DE)</b>	<b>Installation</b> <b>(IN)</b>	<b>Inspection, Testing and Commissioning</b> <b>(IT)</b>	<b>Operation and Repair</b> <b>(OR)</b>	<b>Maintenance</b> <b>(MA)</b>	<b>Project Managements</b> <b>(PM)</b>	<b>Safety, Health and Environment</b> <b>(OM)</b>	<b>Safety, Health and Environment</b> <b>(SH)</b>	<b>Quality Management</b> <b>(QM)</b>
	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
<b>6</b>			Formulate instructions and plans for the overall inspection, testing and commissioning of trains  9 Credits EMRAIT601A P.406	Formulate strategies and plans for reducing the faults in train fleet equipment  20 Credits EMRAOR601A P.412	Formulate maintenance plans for trains  20 Credits EMRAMA601A P.418	Apply project management skills and professional knowledge to handle unfulfilled or unperformed contracts effectively  20 Credits EMCUPM601A P.432	Formulate strategies to maintain the safety, reliability, comfort, environmental protection and efficiency of various railway electrical and mechanical systems 20 Credits EMRAOM601A P.433	Formulate overall safety, health and environmental protection policy  20 Credits EMCUSH601A P.435	Formulate quality management strategy  20 Credits EMCUQM601A P.441
	Formulate overall design requirements for electric trains and diesel locomotives and coordinate the design requirements of all parts 20 Credits EMRADE601A P.390		Formulate instructions and plans for the overall inspection, testing and commissioning of railway overhead feeder systems 9 Credits EMRAIT602A P.408	Formulate strategies and plans for reducing the faults in railway overhead feeder system equipment  20 Credits EMRAOR602A P.414	Manage the operation of the railway electrical and mechanical system equipment maintenance teams  20 Credits EMRAMA602A P.420	Formulate overall design requirements for electric trains and diesel locomotives and coordinate the design requirements of all parts 20 Credits EMRADE601A P.390		Formulate improvement plans for occupational safety and health  20 Credits EMCUSH602A P.437	Implement total quality management plan  20 Credits EMCUQM602A P.442
	Manage the operation of the railway electrical and mechanical engineering designing teams  20 Credits EMRADE603A P.394		Formulate instructions and plans for the overall inspection, testing and commissioning of railway signal and control systems 9 Credits EMRAIT603A P.410	Formulate strategies and plans for reducing the faults in railway signal and control system equipment  20 Credits EMRAOR603A P.416	Revamp the maintenance method for train equipment to enhance maintenance quality and efficiency  20 Credits EMRAMA603A P.422	Manage the operation of the railway electrical and mechanical engineering designing teams  20 Credits EMRADE603A P.394		Formulate environmental protection improvement plans  20 Credits EMCUSH603A P.439	

<b>Functional Areas</b>	<b>Design (DE)</b>	<b>Installation (IN)</b>	<b>Inspection, Testing and Commissioning (IT)</b>	<b>Operation and Repair (OR)</b>	<b>Maintenance (MA)</b>	<b>Project Managements (PM)</b>	<b>Safety, Health and Environment (OM)</b>	<b>Safety, Health and Environment (SH)</b>	<b>Quality Management (QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
<b>6</b>	Formulate overall design requirements for railway signal and control systems and coordinate the design requirements of all parts 10 Credits EMRADE606A P.400				Formulate maintenance plans for railway overhead feeder system equipment  20 Credits EMRAMA604A P.424	Formulate overall design requirements for railway signal and control systems and coordinate the design requirements of all parts 10 Credits EMRADE606A P.400			
	Design computer simulated tests for train operation and assess the performance of train equipment  20 Credits EMRADE602A P.392				Revamp the maintenance method for railway overhead feeder system equipment to enhance maintenance quality and efficiency 20 Credits EMRAMA605A P.426	Formulate instructions and plans for the overall inspection, testing and commissioning of trains  9 Credits EMRAIT601A P.406			
	Review the design of railway electrical and mechanical engineering equipment that has applied new technology and make decisions 20 Credits EMRADE604A P.396				Formulate maintenance plans for railway signal and control system equipment  20 Credits EMRAMA606A P.428	Formulate instructions and plans for the overall inspection, testing and commissioning of railway overhead feeder systems  9 Credits EMRAIT602A P.408			

<b>Functional Areas</b>	<b>Design (DE)</b>	<b>Installation (IN)</b>	<b>Inspection, Testing and Commissioning (IT)</b>	<b>Operation and Repair (OR)</b>	<b>Maintenance (MA)</b>	<b>Project Managements (PM)</b>	<b>Safety, Health and Environment (OM)</b>	<b>Safety, Health and Environment (SH)</b>	<b>Quality Management (QM)</b>
<b>QF Levels</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>	<b>Unit of Competency</b>
6	Revamp the design of railway overhead feeder systems by making use of new technological development  9 Credits EMRADE605A P.398				Revamp the maintenance method for railway signal and control system equipment to enhance maintenance quality and efficiency 20 Credits EMRAMA607A P.430	Formulate instructions and plans for the overall inspection, testing and commissioning of railway signal and control systems 9 Credits EMRAIT603A P.410			
	Formulate an overall electric train and diesel locomotive design plan and standard 20 Credits EMRADE607A P.402								
	Formulate an overall railway signal and control system design plan and standard 10 Credits EMRADE608A P.404								
7	Formulate an overall railway system design plan  20 Credits EMRADE701A P.445			Formulate an overall operation and repair policy and plan for the railway system 20 Credits EMRAOR701A P.447	Formulate an overall maintenance policy and plan for the railway system 20 Credits EMRAMA701A P.449		Formulate overall operation development direction and strategy 20 Credits EMCUOM701A P.451		

<b>Functional Areas</b>	<b><u>Design</u></b> <b><u>(DE)</u></b>	<b><u>Installation</u></b> <b><u>(IN)</u></b>	<b><u>Inspection, Testing and Commissioning</u></b> <b><u>(IT)</u></b>	<b><u>Operation and Repair</u></b> <b><u>(OR)</u></b>	<b><u>Maintenance</u></b> <b><u>(MA)</u></b>	<b><u>Project Managements</u></b> <b><u>(PM)</u></b>	<b><u>Safety, Health and Environment</u></b> <b><u>(OM)</u></b>	<b><u>Safety, Health and Environment</u></b> <b><u>(SH)</u></b>	<b><u>Quality Management</u></b> <b><u>(QM)</u></b>
<b><u>QF Levels</u></b>	<b><u>Unit of Competency</u></b>	<b><u>Unit of Competency</u></b>	<b><u>Unit of Competency</u></b>	<b><u>Unit of Competency</u></b>	<b><u>Unit of Competency</u></b>	<b><u>Unit of Competency</u></b>	<b><u>Unit of Competency</u></b>	<b><u>Unit of Competency</u></b>	<b><u>Unit of Competency</u></b>
7							Formulate policies on the safety, reliability, comfort, environmental protection and efficiency of the entire railway system 9 Credits EMRAOM701A P.453		

# **Competency Level 1**

1. Title	Use typical electrical meters
2. Code	EMCUDE101A
3. Range	With regard to electrical and mechanical engineering services, have basic understanding in electrical terms, units and calculations, and electrical components; and use typical electrical meters for general measurement.
4. Level	1
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Basic electrical concepts</p> <ul style="list-style-type: none"> <li>◆ Understand basic electrical concepts, including: <ul style="list-style-type: none"> <li>• Stating briefly the names and uses of common electrical components from distribution board to all final circuits</li> <li>• Distinguish and apply basic electrical terms such as electric current, electric voltage, electric resistance, electric energy and electric power, etc., and their basic units and calculations</li> </ul> </li> <li>◆ Understand the working principles of common meters, including: <ul style="list-style-type: none"> <li>• Structure and working principles of moving coil, moving iron and electric meter</li> <li>• Uses and the pros and cons of the above three types of meters</li> <li>• Structure, working principles and uses of traditional multimeter</li> </ul> </li> <li>◆ Understand the code of safety and operation for using common meters</li> </ul> <p>6.2 Use of meters</p> <ul style="list-style-type: none"> <li>◆ Use typical meters <ul style="list-style-type: none"> <li>• Capable to use multimeters safely and correctly to measure electric current, electric voltage and electric resistance of simple circuits</li> <li>• Capable to use appropriate common meters safely and correctly to measure electric energy (kWH) and electric power (kW)</li> <li>• Know how to maintain typical meters</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to use multimeters to measure electric current, electric voltage and electric resistance of simple circuits according to the code of safety and operation, and make simple calculations of electricity; and</p> <p>(ii) Capable to use appropriate typical meters to measure electric energy and electric power of simple circuits according to the code of safety and operation.</p>
8. Remarks	This unit of competency is applicable to new entrants of electrical and mechanical engineering services.

1. Title	Use general machining equipments
2. Code	EMCUIN101A
3. Range	Use general-purpose machining equipments for servicing, manufacturing and grinding at industrial plants. This unit of competency does not include the ability in making parts according to drawings.
4. Level	1
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Principles of machining equipments and code of safety</p> <ul style="list-style-type: none"> <li>◆ Understand the code of safety and operation of machining equipments</li> <li>◆ Understand major components of general machining equipments: the transmission part, the part to hold and rotate the work piece, and the part to hold and move the cutting tool</li> <li>◆ Understand the operation and limitations of general machining equipments</li> <li>◆ Understand how to choose and install general machine tools</li> </ul> <p>6.2 Use general machine tools correctly</p> <ul style="list-style-type: none"> <li>◆ Follow the codes of safety and operation to use common machining equipments correctly, including general lathes, milling machine, drilling machine, slotting machine, grinding machine, etc.</li> <li>◆ Capable to operate and adjust general machine tools, including: <ul style="list-style-type: none"> <li>• Cutting speed</li> <li>• Feeding method</li> <li>• Rotational speed adjustment</li> <li>• Feeding speed</li> <li>• Cutting depth</li> </ul> </li> <li>◆ Capable to maintain general machining equipments correctly, including routine cleaning</li> <li>◆ Capable to use general machining equipments for servicing, manufacturing and grinding simple electrical and mechanical parts</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to follow the codes of safety and operation procedures to correctly operate general lathe, milling machine, drilling machine, slotting machine, grinding machine, etc. for servicing, manufacturing and grinding simple electrical and mechanical parts.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic workshop mechanical knowledge.

1. Title	Use general loading and lifting equipment		
2. Code	EMCUIN102A		
3. Range	Use general loading and light duty lifting equipment, not including heavy duty lifting equipment, in industrial plants or workplaces where lifting is involved.		
4. Level	1		
5. Credit	9		
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Understand the principles of common lifting machines and devices operation</p> <ul style="list-style-type: none"> <li>◆ Understand the types, use, functions, operation and maintenance of general loading and lifting machines and devices; and noting points when using them <ul style="list-style-type: none"> <li>• Lifting machines include: crane, gin block, winch, rolling wheel, lift purchase and gin wheel</li> <li>• Lifting devices include: hook, chain, rope and overhead conveyor</li> </ul> </li> </ul> <p>6.2 Understand the code of safety and legal requirements for goods handling</p> <ul style="list-style-type: none"> <li>◆ Understand the code of safety and legal requirements for goods handling <ul style="list-style-type: none"> <li>• Understand the danger of moving and using lifting machines and devices</li> <li>• Understand the safety inspection requirements for handling goods</li> <li>• Understand the safety operation of lifting device and sling, and the requirements for pre-use inspection</li> <li>• Understand the code of safety for using lifting machines and the requirements for pre-use inspection</li> </ul> </li> <li>◆ Inspect the safety of the working environment, and clear all obstacles and potential dangers to goods handling work before starting the lifting and loading operations</li> </ul> <p>6.3 Apply general loading methods and lifting equipment correctly</p> <ul style="list-style-type: none"> <li>◆ Use general loading and lifting machines and devices correctly <ul style="list-style-type: none"> <li>• Use general loading and lifting machines and devices correctly under clear instruction, including: <ul style="list-style-type: none"> <li>▸ Using chains and ropes to tie the goods</li> <li>▸ Using lifting devices such as ropes, chain, hook and overhead conveyor to lift up and convey the goods</li> <li>▸ Using hydraulic lifting machines to handle heavy goods</li> <li>▸ Using electric lifting machines to handle goods</li> <li>▸ operating truck lifting platform</li> </ul> </li> </ul> </li> <li>◆ Use general loading methods correctly <ul style="list-style-type: none"> <li>• Carry out basic manual handling operation correctly</li> <li>• Simple ways of using ropes, such as tying knots and rings</li> </ul> </li> </ul>		

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is:  (i) Capable to use general loading and lifting machines and devices correctly and safely for handling general electrical and mechanical equipment.
8. Remarks	(i) This unit of competency is applicable to electrical and mechanical practitioners in general. (ii) The credit value of this unit of competencies is set on the presumption that the person already possesses the competency of the following unit of competency:  The competencies of EMCUSH109A “Implement safety procedures for manual handling operation” °

1. Title	Apply basic bench fitting techniques and use small typical hand tools
2. Code	EMCUIN106A
3. Range	Apply basic bench fitting techniques, including marking, sawing, filing, grinding, drilling and chiseling, in tasks of production, installation and maintenance and repairs for electrical and mechanical works.
4. Level	1
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Know about basic bench fitting techniques and small typical hand tools</p> <ul style="list-style-type: none"> <li>◆ Understand basic bench fitting techniques, including marking, sawing, filing, grinding, drilling and chiselling</li> <li>◆ Understand the operation of small typical hand tools, including cutting tools, measuring instruments, files, assembling and dismantling tools, marking-out tools, portable power drills, drilling machines, and relevant concerns</li> </ul> <p>6.2 Apply basic bench fitting techniques and small typical hand tools in tasks of production, installation and maintenance and repairs</p> <ul style="list-style-type: none"> <li>◆ Understand the correct use of small typical hand tools <ul style="list-style-type: none"> <li>• Capable to use various types of cutting tools correctly, such as bow saws and shears</li> <li>• Capable to use metric and imperial measuring instruments correctly, such as steel rules, venires, inside callipers and outside callipers</li> <li>• Capable to use steel rules and beam squares to measure the length and to check horizontal, vertical and curved surfaces correctly</li> <li>• Capable to select and use files correctly, such as single cut files, flat files, round files, half-round files, triangular files, double cut files, rough-cut and smooth files of different degree of fineness</li> <li>• Capable to select and use scrapers correctly</li> <li>• Capable to use assembling and dismantling tools correctly, such as open-ended spanners, adjustable spanners, box spanners, hexagon ring spanners, screw drivers, jaw vices, hand vices and hammers, to assemble or dismantle simple mechanical devices</li> <li>• Capable to use various types of marking-out tools correctly, such as line needle, hook needle, centre punches, pin punches and dividers</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>• Capable to use portable power drills and drilling machines correctly</li> <li>◆ Apply basic bench fitting techniques and use small typical hand tools</li> <li>• Identify and select common metals <ul style="list-style-type: none"> <li>▸ Capable to identify various types of common metals</li> <li>▸ Capable to select suitable common metals according to uses</li> </ul> </li> <li>• Capable to apply basic bench fitting techniques, including marking, sawing, filing, grinding, drilling and chiselling, to trim materials, to measure work pieces and to make metal work pieces to required dimensions, according to templates or simple drawings</li> </ul> <p>6.3 Code of practice for bench fitting</p> <ul style="list-style-type: none"> <li>◆ Capable to use small typical hand tools and bench fitting techniques in completing tasks of production, installation, maintenance and repairs according to the code of safety</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to make metal pieces to required dimensions according to templates or simple drawings; apply the techniques of marking, sawing, filing, grinding, drilling and chiseling in tasks of production, installation, maintenance and repairs; capable to observe the code of safety.</p>
8. Remarks	<p>This unit of competency is applicable to new entrants of the electrical and mechanical trade.</p>

1. Title	Use general plate bending machines
2. Code	EMCUIN110A
3. Range	Use general-purpose plate bending machines for simple assembly and machining of electrical and mechanical parts in industrial plants.
4. Level	1
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Structure and code of safety for plate bending machine</p> <ul style="list-style-type: none"> <li>◆ Understand the code of safety and operation for using plate bending machine</li> <li>◆ Understand major parts of general plate bending machines</li> <li>◆ Understand the operation of general plate bending machines and their limitations</li> </ul> <p>6.2 Use general plate bending machines correctly</p> <ul style="list-style-type: none"> <li>◆ Use general plate bending machines correctly according to the code of safety and operation</li> <li>◆ Capable to operate and adjust general plate bending machines correctly to bend the metal plates to different angles for simple assembly and machining of electrical and mechanical parts</li> <li>◆ Capable to maintain general plate bending machines correctly, including routine cleaning</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to operate and adjust general plate bending machines correctly, according to the code of safety and operation, to bend the metal plates to different angles for simple assembly and machining of electrical and mechanical parts.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of workshop mechanics.

1. Title	Use air-conditioning and refrigeration instruments and tools
2. Code	EMCUMA101A
3. Range	Use common air-conditioning and refrigeration instruments and tools to perform installation, repair and maintenance in workplaces with air-conditioning and refrigeration systems.
4. Level	1
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of air-conditioning and refrigeration instruments and tools</p> <ul style="list-style-type: none"> <li>◆ Understand basic working principles of instruments and tools, including: <ul style="list-style-type: none"> <li>• Functions and working principles of dry-bulb thermometer, web-bulb thermometer, anemometer, vacuum pump, gauge manifold and vacuum pressure gauge, etc.</li> <li>• Functions of copper tubing tools</li> <li>• Functions of insulation work tools</li> </ul> </li> </ul> <p>6.2 Operation method of air-conditioning and refrigeration instruments and tools</p> <ul style="list-style-type: none"> <li>◆ Use air-conditioning and refrigeration instruments, including: <ul style="list-style-type: none"> <li>• Anemometer</li> <li>• Vacuum pump</li> <li>• Gauge manifold</li> <li>• Vacuum pressure gauge</li> <li>• Use dry-bulb thermometer and web-bulb thermometer to measure the dry-bulb temperature and web-bulb temperature of objects</li> </ul> </li> <li>◆ Use copper tubing tools <ul style="list-style-type: none"> <li>• know how to use tube cutter, flaring tool, swaging tool and tube bender for cutting, flaring , swaging and bending copper tubes</li> <li>• know how to fabricate simple copper tube assemblies, including cutting, flaring,swaging, bending, flare joining , and performing leak checking for copper tube assemblies</li> </ul> </li> <li>◆ Use refrigerant leak detector <ul style="list-style-type: none"> <li>• Know how to use soap solution and electronic leak detector to detect refrigerant leaks from the refrigeration system</li> </ul> </li> <li>◆ Identify and handle refrigerant cylinders <ul style="list-style-type: none"> <li>• Identify the types of refrigerant according to different colours of the refrigerant cylinders</li> <li>• Understand how to use refrigerant cylinders</li> <li>• Capable to store and transport refrigerant cylinders safely</li> </ul> </li> </ul>

7. Assessment Criteria	The integrated outcome requirements of this unit of competency are:  (i) Capable to use air-conditioning and refrigeration instruments correctly; and  (ii) Capable to operate air-conditioning and refrigeration tools, make simple copper tube assemblies, and perform installation, repair and maintenance works.
8. Remarks	This unit of competency is applicable to new entrants of air-conditioning and refrigeration engineering services.

1. Title	Non-destructive test (NDT) – Liquid Penetrant Testing									
2. Code	EMCUMA102A									
3. Range	Use liquid penetrant, at servicing centres or locations with operating equipment, to inspect equipment or materials for surface cracks and make a simple analysis.									
4. Level	1									
5. Credit	2									
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <table border="0"> <tr> <td style="vertical-align: top;">6.1</td> <td style="vertical-align: top;">Techniques and principles of inspecting mechanical equipment or materials for surface cracks</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> <li>◆ Perform visual inspection to locate suspected surface cracks</li> <li>◆ Understand the techniques and principles of inspecting equipment or materials for surface cracks</li> <li>◆ Understand the chemical hazards caused by penetrant and developers, and relevant concerns for use</li> <li>◆ Understand that liquid penetration inspection is not applicable to high temperature materials</li> </ul> </td> </tr> <tr> <td style="vertical-align: top;">6.2</td> <td style="vertical-align: top;">Methods and procedures of analyzing and identifying external cracks on metal equipment or materials</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> <li>◆ Capable to use liquid penetrant and developers effectively to inspect the surface cracks of equipment or materials</li> <li>◆ Capable to mark the position with cracks effectively</li> </ul> </td> </tr> <tr> <td style="vertical-align: top;">6.3</td> <td style="vertical-align: top;">Code of practice for using penetrant and developers</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> <li>◆ Use penetrant and developers safely to complete the non-destructive test</li> </ul> </td> </tr> </table>	6.1	Techniques and principles of inspecting mechanical equipment or materials for surface cracks	<ul style="list-style-type: none"> <li>◆ Perform visual inspection to locate suspected surface cracks</li> <li>◆ Understand the techniques and principles of inspecting equipment or materials for surface cracks</li> <li>◆ Understand the chemical hazards caused by penetrant and developers, and relevant concerns for use</li> <li>◆ Understand that liquid penetration inspection is not applicable to high temperature materials</li> </ul>	6.2	Methods and procedures of analyzing and identifying external cracks on metal equipment or materials	<ul style="list-style-type: none"> <li>◆ Capable to use liquid penetrant and developers effectively to inspect the surface cracks of equipment or materials</li> <li>◆ Capable to mark the position with cracks effectively</li> </ul>	6.3	Code of practice for using penetrant and developers	<ul style="list-style-type: none"> <li>◆ Use penetrant and developers safely to complete the non-destructive test</li> </ul>
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6.3	Code of practice for using penetrant and developers	<ul style="list-style-type: none"> <li>◆ Use penetrant and developers safely to complete the non-destructive test</li> </ul>								
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to use liquid penetrant and developer inspection method safely and correctly to identify equipment or materials for surface cracks which are not easily seen; and to mark the cracks correctly.</p>									
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses the competency of reading mechanical drawings and manuals for materials.									

1. Title	Perform routine train equipment cleaning and lubrication for maintenance
2. Code	EMRAMA101A
3. Range	Clean the mechanical equipment and exposed insulation devices of trains at train maintenance centres, and add correct amount of lubricating grease to the electrical and mechanical equipment of trains.
4. Level	1
5. Credits	4
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Classification and functions of cleaning materials, machinery lubricating grease; and names and functions of major train equipment</p> <ul style="list-style-type: none"> <li>◆ Understand the functions of materials commonly used for cleaning mechanical equipment and electrical insulation devices and precautions for using them</li> <li>◆ Identify lubricating grease commonly used for electrical and mechanical equipment and understand their uses</li> <li>◆ Memorize the names and basic functions of major train equipment</li> </ul> <p>6.2 Methods and procedures of cleaning mechanical equipment of trains and adding lubricating grease to electrical and mechanical equipment of trains</p> <ul style="list-style-type: none"> <li>◆ By complying with the requirements on occupational safety and health and environmental protection, clean the mechanical equipment and exposed insulation devices of trains correctly with the following procedures <ul style="list-style-type: none"> <li>• Follow the code of safety on working under and on top of the train</li> <li>• Choose correct cleaning material for use</li> <li>• Dilute and use the cleaning material correctly</li> <li>• Choose cleaning rag correctly</li> <li>• Carry out correct cleaning procedures</li> <li>• Store, handle and dispose cleaning material correctly</li> </ul> </li> <li>◆ By complying with the requirements on occupational safety and health and environmental protection, add lubricating grease to electrical and mechanical equipment of trains correctly with the following procedures <ul style="list-style-type: none"> <li>• Follow the code of safety on working under and on top of the train</li> <li>• Prepare the lubricating grease correctly</li> <li>• Follow the instructions to add suitable amount of lubricating grease to the electrical and mechanical equipment of trains from the nozzles or other inlets correctly</li> <li>• Store, handle and dispose lubricating grease correctly</li> <li>• Use general cleaning and grease injecting tools effectively</li> </ul> </li> </ul>

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is:  (i) Capable to choose cleaning liquid and materials correctly, and clean the mechanical equipment and exposed insulation devices of trains effectively with correct procedures; and  (ii) Capable to choose lubricating grease correctly, and use greasing guns efficiently to add suitable amount of lubricating grease to mechanical equipment such as train bogie bearings and couplers.
8. Remarks	

1. Title	Use general personal protective equipment
2. Code	EMCUSH108A
3. Range	Use general personal protection device correctly at electrical and mechanical work sites to protect personal safety and health.
4. Level	1
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Various types of personal protective equipment</p> <ul style="list-style-type: none"> <li>◆ Understand the types, utilization, maintenance and limitations of personal protection device such as safety belt, eye protector, safety shoes, insulating gloves, protective guard, helmet and ear plug, etc.</li> <li>◆ Understand the basic maintenance of personal protective equipment</li> </ul> <p>6.2 Use of personal protective equipment</p> <ul style="list-style-type: none"> <li>◆ Capable to use general personal protection device such as safety belt, eye protector, safety shoes, insulating gloves, protective guard, helmet and ear plug, etc.</li> <li>◆ Capable to choose and use general personal protection device correctly by following systematic safety procedures for the best protection</li> <li>◆ Capable to use and maintain personal protection device correctly according to safety guidelines and procedures so as to comply with the law</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to understand various types of personal protection device and their limitations;</p> <p>(ii) Capable to choose and use general personal protection device correctly; and</p> <p>(iii) Capable to use and maintain personal protection device correctly in daily working environment according to safety guidelines and procedures so as to comply with the law.</p>
8. Remarks	This unit of competency is applicable to electrical and mechanical practitioners in general.

1. Title	Perform manual handling operation
2. Code	EMCUSH109A
3. Range	Apply the correct way of manual lifting and handling at electrical and mechanical work sites to avoid bodily injuries.
4. Level	1
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Correct way of manual lifting and handling</p> <ul style="list-style-type: none"> <li>◆ Understand the effects of incorrect lifting and handling, including: <ul style="list-style-type: none"> <li>• The impact on the waist and the back</li> <li>• Causes of manual lifting injuries</li> <li>• Basic knowledge of waist and back care</li> </ul> </li> </ul> <p>6.2 Application of the correct way of manual lifting and handling</p> <ul style="list-style-type: none"> <li>◆ Capable to apply the way of manual lifting and handling correctly and properly to avoid bodily injuries</li> <li>◆ Capable to implement the recommendations of the risk assessment for the manual handling operation</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to illustrate the importance of applying the correct way of manual lifting and handling so as to avoid bodily injuries; and</p> <p>(ii) Capable to apply the correct way of manual lifting and handling for materials that need to be handled manually in routine operation.</p>
8. Remarks	This unit of competency is applicable to frontline electrical and mechanical practitioners in general.

1. Title	Safety operation in confined spaces
2. Code	EMCUSH110A
3. Range	Apply the basic knowledge of safety operation in confined spaces and understand the hazards when working in confined spaces so as to prevent accidents.
4. Level	1
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Basic knowledge of safety operation in confined spaces</p> <ul style="list-style-type: none"> <li>◆ Understand potential hazards and causes for working in confined spaces, including explosion, fire, anoxia, poisonous gas, etc.</li> <li>◆ Understand the types of confined spaces and relevant legal requirements</li> <li>◆ Understand the safety procedures, including the use of general protective equipment, for working in confined spaces</li> </ul> <p>6.2 Basic safety for working in confined spaces</p> <ul style="list-style-type: none"> <li>◆ Possess basic safety knowledge of carrying out electrical and mechanical engineering works in confined spaces</li> <li>◆ Capable to work in confined spaces according to safety procedures, preventive measures of working in confined spaces and relevant legal requirements</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to work in confined spaces according to safety procedures, preventive measures of working in confined spaces and relevant legal requirements.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic safety knowledge.

1. Title	Comply with the legal requirements on electrical and mechanical occupational safety and health
2. Code	EMCUSH111A
3. Range	Comply with the codes of practice and legal requirements on occupational safety and health when working at electrical and mechanical work sites.
4. Level	1
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Codes of practice and ordinances for occupational safety and health</p> <ul style="list-style-type: none"> <li>◆ Understand the requirements for site workers imposed by the codes of practice and ordinances for occupational safety and health, and how to ensure personal occupational safety with correct working procedures. These codes and ordinances include: <ul style="list-style-type: none"> <li>• Occupational Safety and Health ordinance and Regulations</li> <li>• Factories and Industrial Undertakings Ordinance and Regulations</li> <li>• Factories and Industrial Undertakings (Electricity) Regulations</li> <li>• Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations</li> </ul> </li> </ul> <p>6.2 Comply with codes of practice and ordinances for occupational safety and health</p> <ul style="list-style-type: none"> <li>◆ Capable to comply with the legal requirements on occupational safety and health to carry out routine, repetitive or clearly defined electrical and mechanical engineering work safely</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to understand the requirements for site workers imposed by the codes of practice and ordinances for occupational safety and health; and to carry out routine, repetitive or clearly defined electrical and mechanical engineering work with proper working procedures.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic safety knowledge.

1. Title	Comply with the legal requirements on environmental protection
2. Code	EMCUSH112A
3. Range	Comply with the legal requirements on environmental protection when working at electrical and mechanical work sites.
4. Level	1
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Environmental protection legislations</p> <ul style="list-style-type: none"> <li>◆ Understand the legal requirements for electrical and mechanical engineering work on environmental protection, such as: <ul style="list-style-type: none"> <li>• Noise Control Ordinance</li> <li>• Waste Disposal Ordinance</li> <li>• Water Pollution Control Ordinance</li> <li>• Ozone Layer Protection Ordinance</li> <li>• Dumping at Sea Ordinance</li> <li>• Air Pollution Control Ordinance</li> </ul> </li> </ul> <p>6.2 Application of environmental protection legislations</p> <ul style="list-style-type: none"> <li>◆ Capable to comply with the legal requirements on environmental protection to carry out routine, repetitive or clearly defined electrical and mechanical engineering work</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to comply with the legal requirements on environmental protection to carry out routine, repetitive or clearly defined electrical and mechanical engineering work with correct working procedures.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses general awareness of environmental protection.

1. Title	Handle general chemicals safely
2. Code	EMCUSH113A
3. Range	Capable to handle general chemicals safely in workshops or work sites, and understand the hazards and preventive measures for these chemicals so as to protect oneself and other people during daily operation or accident happened.
4. Level	1
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of handling general chemicals safely in workshops or work sites</p> <ul style="list-style-type: none"> <li>◆ Possess basic knowledge of handling chemicals safely, including: <ul style="list-style-type: none"> <li>• Hazards of chemicals</li> <li>• Labelling of chemicals</li> <li>• Ways of chemicals entering human bodies</li> <li>• Safety measures for handling chemicals</li> <li>• Personal protective equipment</li> <li>• Compliance of contingency measures</li> </ul> </li> <li>◆ Understand the classification of general chemical substances, including: <ul style="list-style-type: none"> <li>• Explosive substance</li> <li>• Flammable substance</li> <li>• Strong supporter of combustion</li> <li>• Gas</li> <li>• Harmful or poisonous substance</li> <li>• Organic solvent</li> <li>• Corrosive fluid</li> </ul> </li> </ul> <p>6.2 Way of handling general chemicals</p> <ul style="list-style-type: none"> <li>◆ Handle chemicals correctly and prevent chemical hazards, including making use of personal protection device</li> <li>◆ Capable to prevent occupational health hazards caused by chemicals</li> </ul>
7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: (i) Capable to handle general chemicals safely and prevent chemical hazards.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of occupational safety and health.

## **Competency Level 2**

1. Title	Select general electrical materials and electrical equipment	
2. Code	EMCUDE204A	
3. Range	Select general electrical materials and electrical equipment to perform electrical installation work.	
4. Level	2	
5. Credit	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Functions, properties and application conditions of general electrical materials and electrical equipment and devices</p> <ul style="list-style-type: none"> <li>◆ Understand the functions, properties and application conditions of general electrical materials and electrical equipment and devices, including: <ul style="list-style-type: none"> <li>• General electrical materials <ul style="list-style-type: none"> <li>▸ Basic configuration, colour code, types, nominal, current-carrying capacity and skin effect of different cables</li> <li>▸ Electrical materials generally used in wiring systems, such as switch, switch box, distribution board, metallic and non-metallic conduits, conduit accessories, trunking and trunking accessories, etc.</li> <li>▸ Electrical materials generally used for motor control, such as electromagnetic switch, relay, timer, push-button switch, travel switch, overload protector, limit switch and water level controller, etc.</li> <li>▸ Limitations of materials in voltage, current and temperature</li> </ul> </li> <li>• General electrical equipment and devices <ul style="list-style-type: none"> <li>▸ General power supply and distribution equipment such as transformer, distribution board, busbar system and rising main</li> <li>▸ General electrical equipment for buildings, such as electric pump and lighting, etc.</li> </ul> </li> </ul> </li> </ul> <p>6.2 Select general electrical materials and electrical equipment and devices</p> <ul style="list-style-type: none"> <li>◆ Capable to select general electrical materials and electrical equipment correctly for electrical installation work according to the application requirements as well as the functions, properties and limitations of the materials and equipment</li> <li>◆ Capable to select and check the materials and equipment in order to ensure that they comply with the safety standards and specifications</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is:  (i) Capable to select general electrical materials and electrical equipment and devices correctly for general power distribution systems for buildings and building services installations according to the application requirements and ensure that they comply with the safety specifications.
8. Remarks	This unit of competency is applicable to electrical and mechanical practitioners in general.

1. Title	Use computer to draw mechanical drawings
2. Code	EMCUDE212A
3. Range	Use typical computer software to draw mechanical drawings for electrical and mechanical work according to design.
4. Level	2
5. Credit	8
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Computer drawing techniques and methods</p> <ul style="list-style-type: none"> <li>◆ Understand the computer drawing techniques and methods, including the knowledge of drawing specifications, machinery to be drawn and pneumatic symbols</li> </ul> <p>6.2 Application of computer drawing</p> <ul style="list-style-type: none"> <li>◆ Use the computer to set the drawing specifications <ul style="list-style-type: none"> <li>• Set the drawing specifications</li> <li>• Use all types of lines, layers and typeface</li> <li>• Open and save file</li> </ul> </li> <li>◆ Use the computer to draw geometric figures, including mechanical and pneumatic symbols</li> <li>◆ Use the computer to draw mechanical drawings according to design <ul style="list-style-type: none"> <li>• Draw mechanical layouts</li> <li>• Draw projected mechanical parts</li> <li>• Draw sectional views for mechanical parts</li> </ul> </li> <li>◆ Use the computer to draw the pneumatic system according to design <ul style="list-style-type: none"> <li>• Draw the pneumatic system's layout according to the pneumatic design</li> <li>• Draw the electric control circuit of the pneumatic system according to the circuit design</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to use computer to draw mechanical layouts, projection and sectional views of mechanical equipment and parts according to design; and</p> <p>(ii) Capable to use computer to draw the pneumatic control layouts for a whole pneumatic system unit of an industrial plant with general requirements and specifications according to design.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic computer knowledge.

1. Title	Use computer to draw electrical drawings
2. Code	EMCUDE213A
3. Range	Use typical computer software to draw electrical drawings for electrical and mechanical work according to design.
4. Level	2
5. Credit	8
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Computer drawing techniques and methods</p> <ul style="list-style-type: none"> <li>◆ Understand the computer drawing techniques and methods, including the knowledge of drawing specifications, electrical wiring symbols and layout</li> </ul> <p>6.2 Application of computer drawing</p> <ul style="list-style-type: none"> <li>◆ Use the computer to lay down the drawing specifications <ul style="list-style-type: none"> <li>• Set the drawing specifications</li> <li>• Use all types of lines, layers and typeface</li> <li>• Open and save file</li> </ul> </li> <li>◆ Use the computer to draw geometric figures and electrical symbols</li> <li>◆ Use the computer to draw electrical drawings according to design <ul style="list-style-type: none"> <li>• Draw the main circuit layout according to the circuit design</li> <li>• Draw the wiring layout according to design</li> <li>• Draw the control circuit layout according to design</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to use computer to draw the main circuit, wiring and control circuit layouts for a whole power system unit of a multi-storey building with general requirements and specifications according to design.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic computer knowledge.

1. Title	Assemble power unit according to installation drawing
2. Code	EMCUIN205A
3. Range	Assemble the power unit in its installation venue according to the installation drawing as well as the actual situation of the work site.
4. Level	2
5. Credit	4
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Content of document and drawing for general power unit installation</p> <ul style="list-style-type: none"> <li>◆ Understand the content of drawing for general power unit installation, including the unit assembly drawing, guidelines for unit installation, acceptance specifications for the unit installation, etc.</li> </ul> <p>6.2 Perform general power unit assembly</p> <ul style="list-style-type: none"> <li>◆ Examine the actual restrictions of the work site and plan for the power unit installation procedures, including safety issues, according to the work site situation</li> <li>◆ Know how to use appropriate tools to perform general power unit assembly</li> <li>◆ Know how to use appropriate measuring tools to ensure that the power unit installation meets the specifications for acceptance</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to assemble general power units safely and efficiently according to specified installation specifications, manufacturer's assembly and design drawings as well as the actual situation of the site.</p>
8. Remarks	This unit of competency is applicable to electrical and mechanical practitioners in general.

1. Title	Perform routine wiring tasks	
2. Code	EMCUIN208A	
3. Range	Apply the techniques of electrical wiring and the understanding of relevant code of practice in routine wiring tasks for electrical and mechanical works.	
4. Level	2	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 General principles of electrical wiring ♦ Understand the basic requirements, code of practice and relevant standards for wiring, including:</p> <ul style="list-style-type: none"> <li>• Uses and installation methods of conduits and trunkings</li> <li>• Techniques for installation of low voltage sheathed cables and armoured cables</li> <li>• Code of practice for wiring, such as identification of markings</li> <li>• Insulation and continuity testing</li> <li>• Methods of circuit terminal connection</li> </ul> <p>6.2 Perform regular wiring tasks ♦ Make electrical wiring conduits according to instructions</p> <ul style="list-style-type: none"> <li>• Use relevant techniques and conduit cutting, bending and assembling tools to make metallic conduits for electrical wiring according to requirements</li> <li>• Make PVC wiring conduits</li> <li>• Install wiring conduits correctly</li> </ul> <p>♦ Make electrical wiring trunkings according to instructions</p> <ul style="list-style-type: none"> <li>• Use relevant techniques and trunking cutting and assembling tools to make metallic trunkings for electrical wiring, according to requirements</li> <li>• Make earthing arrangement correctly</li> <li>• Install wiring trunkings correctly</li> </ul> <p>♦ Make electrical wiring trunkings according to instructions</p> <ul style="list-style-type: none"> <li>• Install low voltage sheathed cables and armoured cables correctly</li> </ul> <p>♦ Undertake electrical wiring properly according to instructions</p> <ul style="list-style-type: none"> <li>• Classify electrical circuits properly according to wiring requirements and the code of practices</li> <li>• Apply relevant techniques in electrical wiring</li> <li>• Attach correct identification markings to cables</li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Perform insulation and continuity tests for circuits according to instructions <ul style="list-style-type: none"> <li>• Use an insulation tester and continuity tester to perform insulation and continuity tests for circuits according to relevant code of practice and standards</li> <li>• Undertake terminal connection of circuits</li> <li>• Use proper assembling tools and termination accessories to connect cables to electrical devices</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to install wiring for general electrical equipment and systems correctly and safely according to instructions, wiring requirements and the code of practice; make conduits and trunkings, undertake wiring work, install low voltage metal-sheathed cables and armoured cables; and carry out terminal connection and validity tests.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses basic electrical knowledge.</p>

1. Title	Use all kinds of machining equipment for electrical and mechanical engineering parts processing
2. Code	EMCUIN214A
3. Range	Capable to use general machining equipment independently for electrical and mechanical engineering part in plants according to the dimensions and tolerance required by the part drawing.
4. Level	2
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Operating principles and functions of different types of machining equipment</p> <ul style="list-style-type: none"> <li>◆ Understand the operating principles and functions of different types of machining equipment, including lathe, milling machine, drilling machine, slotting machine, grinding machine, etc., in order to perform more complex part manufacturing</li> <li>◆ Understand the limitations of precision of different types of machining equipment</li> <li>◆ Understand the dimension and tolerance requirements of the part drawing</li> </ul> <p>6.2 Electrical and mechanical engineering parts processing</p> <ul style="list-style-type: none"> <li>◆ Capable to perform machining the work piece safely and independently according to the tolerance requirements of the work piece processing drawing, including: <ul style="list-style-type: none"> <li>• Setting the conditions for cutting according to the characteristics of the work piece ( such as the type of material, hardness, etc)</li> <li>• Using appropriate fixtures for different machining procedures</li> <li>• Setting machining sequence according the requirements on the work piece</li> <li>• Using measuring tools to measure the precision of the work piece</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to use general machining equipment safely and independently for electrical and mechanical engineering part according to the dimensions and tolerance required by the part drawing.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses the competency of EMCUIN101A 'Use general machining equipment'.

1. Title	Install general plastic pipes and fittings
2. Code	EMCUIN216A
3. Range	Perform simple installation of general plastic (e.g. PVC,ABS and UPVC) pipes and fittings, and common parts at general industrial plants, power plants or premises/work sites where boat, fire fighting, water, gas or pipe works is involved.
4. Level	2
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Types of pipes and fitting materials</p> <ul style="list-style-type: none"> <li>◆ Know about the types of pipes, accessories and materials, including: <ul style="list-style-type: none"> <li>• Types of pipes</li> <li>• Bends and tees</li> <li>• Extension joints</li> <li>• Joint accessories</li> <li>• Fill materials</li> <li>• Bedding and coating materials</li> </ul> </li> <li>◆ Understand hazards of solvent cement to individuals and the environment</li> </ul> <p>6.2 Methods of installing and jointing pipes</p> <ul style="list-style-type: none"> <li>◆ Capable to apply general repairing and bench fitting techniques in pipe installation according to requirements</li> <li>◆ Capable to joint pipes by solvent cement, etc.</li> <li>◆ Capable to apply common methods of cold or thermal bending in simple installation of pipes</li> <li>◆ Place rubber gaskets or pads at proper positions to prevent leakage</li> </ul> <p>6.3 Professionalism in pipe overhaul and installation</p> <ul style="list-style-type: none"> <li>◆ Capable to use correct tools in simple installation of plastic pipes according to requirements</li> <li>◆ Perform pipe installation according to legal requirements and the code of safety; pass the leakage test</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to install common plastic pipes and fittings correctly and safely according to pipe-laying and legal requirements and the code of safety; pass the leakage test.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of mechanics and installation skills.

1. Title	Install metallic (steel/stainless steel/galvanized iron) pipes and fittings
2. Code	EMCUIN217A
3. Range	Perform simple installation of metallic (steel/stainless steel/galvanized iron) pipes and fittings, and common parts at general industrial plants, power plants or premises/work sites where boat, fire fighting, water, gas or pipe works is involved.
4. Level	2
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Types of pipes and fitting materials</p> <ul style="list-style-type: none"> <li>◆ Know about the types of pipes, accessories and materials, including: <ul style="list-style-type: none"> <li>• Types of pipes</li> <li>• Types of flanges</li> <li>• Bends and tees</li> <li>• Expansion joints</li> <li>• Joint accessories</li> <li>• Fill materials</li> <li>• Bedding and coating materials</li> <li>• Heat preservation materials</li> </ul> </li> </ul> <p>6.2 Methods of installing and jointing pipes</p> <ul style="list-style-type: none"> <li>◆ Capable to apply general repairing and bench fitting techniques, including marking, sawing, chiselling, drilling, scraping, grinding, jointing and sealing, in pipe installation according to requirements</li> <li>◆ Capable to joint pipes by argon arc welding, electric arc welding, compressing, threading, flanging, etc.</li> <li>◆ Capable to apply typical methods of cold or thermal bending in simple installation of pipes</li> <li>◆ Place rubber gaskets or pads at proper positions for prevent leakage</li> </ul> <p>6.3 Professionalism in pipe overhaul and installation</p> <ul style="list-style-type: none"> <li>◆ Capable to use correct tools in simple installation of metallic (steel/stainless steel/galvanized iron) pipes according to requirements</li> <li>◆ Perform pipe installation according to legal requirements and the code of safety; pass the leakage test</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to install common metallic (steel/stainless steel/galvanized iron) pipes and fittings correctly and safely according to pipe-laying and legal requirements and the code of safety; pass the leakage test.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of mechanics and installation skills.

1. Title	Install non-metallic (copper/aluminium) pipes and fittings
2. Code	EMCUIN218A
3. Range	Perform simple installation of typical copper or aluminum pipes and fittings, at general industrial plants, power plants, ship repair, fire & plumbing, gas engineering or work sites where installation work is involved.
4. Level	2
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Types of pipes and fitting materials</p> <ul style="list-style-type: none"> <li>◆ Know about the types of pipes, accessories and materials, including: <ul style="list-style-type: none"> <li>• Types of pipes</li> <li>• Bends and tees</li> <li>• Expansion joints</li> <li>• Joint accessories</li> <li>• Fill materials</li> <li>• Bedding and coating materials</li> <li>• Heat preservation materials</li> </ul> </li> </ul> <p>6.2 Methods of installing and jointing pipes</p> <ul style="list-style-type: none"> <li>◆ Capable to apply general repairing and bench fitting techniques, including marking, sawing, chiselling, drilling, scraping, grinding, jointing and sealing, in pipe installation according to requirements</li> <li>◆ Capable to joint pipes by silver soldering, copper brazing, tin soldering, compressing, etc.</li> <li>◆ Capable to apply common methods of cold or thermal bending in simple installation of pipes</li> <li>◆ Place rubber gaskets or pads at proper positions to prevent leakage</li> </ul> <p>6.3 Professionalism in pipe overhaul and installation</p> <ul style="list-style-type: none"> <li>◆ Capable to use correct tools in simple installation of copper or aluminium pipes according to requirements</li> <li>◆ Perform pipe installation according to legal requirements and the code of safety; pass the leakage test</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to install common copper or aluminum pipes and fittings correctly and safely according to pipe-laying and legal requirements and the code of safety; pass the leakage test.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of mechanics and installation skills.

1. Title	Install cast iron pipes and fittings
2. Code	EMCUIN219A
3. Range	<p>Perform simple installation of cast iron pipes and fittings, and common parts at general industrial plants, power plants or premises/work sites where boat, fire fighting, water, gas or pipe works is involved.</p> <p>Perform simple installation of typical copper or aluminum pipes and fittings, at general industrial plants, power plants, ship repair, fire &amp; plumbing, gas engineering or work sites where installation work is involved.</p>
4. Level	2
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Types of pipes and fitting materials</p> <ul style="list-style-type: none"> <li>◆ Know about the types of pipes, accessories and materials, including: <ul style="list-style-type: none"> <li>• Types of pipes</li> <li>• Types of flanges</li> <li>• Bends and tees</li> <li>• Expansion joints</li> <li>• Joint accessories</li> <li>• Fill materials</li> <li>• Bedding and coating materials</li> <li>• Heat preservation materials</li> </ul> </li> </ul> <p>6.2 Methods of installing and jointing pipes</p> <ul style="list-style-type: none"> <li>◆ Capable to apply general repairing and bench fitting techniques, including marking, sawing, chiselling, drilling, scraping, grinding, jointing and sealing, in pipe installation according to requirements</li> <li>◆ Capable to joint pipes by iron welding, tungsten gas electric arc welding, compressing, threading, flanging, etc</li> <li>◆ Place rubber gaskets or pads at proper positions to prevent leakage</li> </ul> <p>6.3 Professionalism in pipe overhaul and installation</p> <ul style="list-style-type: none"> <li>◆ Capable to use correct tools in simple installation of cast iron pipes according to requirements</li> <li>◆ Perform pipe installation according to legal requirements and the code of safety; pass leakage test.</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to install common cast iron pipes and fittings correctly and safely according to pipe-laying and legal requirements and the code of safety; pass the leakage test.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of mechanics and installation skills.

1. Title	Basic manual metal arc welding (MMAW)/shielded metal arc welding (SMAW)		
2. Code	EMCUIN225A		
3. Range	Perform basic MMAW/SMAW on typical carbon-steel metals at electrical and mechanical welding workshops or work sites.		
4. Level	2		
5. Credit	6		
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Code of practice and safety regulations for MMAW/SMAW</p> <ul style="list-style-type: none"> <li>◆ Understand relevant code of practice and safety regulations for MMAW/SMAW, including: <ul style="list-style-type: none"> <li>• Wearing proper personal protective gear</li> <li>• Protecting against electric shock</li> <li>• Protecting against fire and explosion</li> <li>• Protecting against harmful arc ray effectively</li> <li>• Protecting against harmful gases and poisonous fumes</li> </ul> </li> <li>◆ Know about the preparations for MMAW/ SMAW, including: <ul style="list-style-type: none"> <li>• Understanding the general application and their limitations of MMAW/SMAW</li> <li>• Understanding the types of MMAW/SMAW machines and their functions</li> <li>• Knowing about the specifications, applications, uses and storage of common mild-steel electrodes (such as E6013) for MMAW/SMAW</li> <li>• Knowing about the maintenance of MMAW/SMAW equipment</li> </ul> </li> </ul> <p>6.2 Methods and procedures for operating MMAW/SMAW</p> <ul style="list-style-type: none"> <li>◆ Apply MMAW/SMAW technique in welding <ul style="list-style-type: none"> <li>• Select proper parameters for welding, such as polarity, current, welding speed and angle of electrode</li> <li>• Perform tasks including: <ul style="list-style-type: none"> <li>▸ Performing linear surface buildup at flat position</li> <li>▸ Joining two or more work pieces together at flat position</li> <li>▸ Performing two sides square edge butt welding at flat position</li> <li>▸ Performing fillet weld at flat position</li> </ul> </li> </ul> </li> <li>◆ Maintenance of electric arc welding equipment <ul style="list-style-type: none"> <li>• Undertake maintenance of MMAW/SMAW equipment</li> <li>• Use and store common instruments and welding materials</li> </ul> </li> </ul> <p>6.3 Professionalism in MMAW/SMAW</p> <ul style="list-style-type: none"> <li>◆ Perform MMAW/SMAW tasks according to relevant safety guidelines and code of practice</li> </ul>		

7. Assessment Criteria	The integrated outcome requirements of this unit of competency are:  (i) Capable to complete basic MMAW/SMAW tasks without causing obvious surface weld defects; and  (ii) Capable to perform MMAW/SMAW tasks safely.
8. Remarks	This unit of competency is applicable to general electrical and mechanical welding practitioners.

1. Title	Basic oxy-acetylene welding(OAW) / oxyfuel and arc cutting(OAC)	
2. Code	EMCUIN226A	
3. Range	Perform OAW / OAC tasks for electrical and mechanical works at electrical and mechanical welding workshops or work sites.	
4. Level	2	
5. Credit	5	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Code of practice and preparations for OAW / OAC</p> <ul style="list-style-type: none"> <li>◆ Understand relevant code of practice and safety regulation for OAW / OAC, including: <ul style="list-style-type: none"> <li>• Operating OAW / OAC equipment and accessories, including handling of gaseous cylinder, correctly and safely</li> <li>• Wearing proper personal protective gear</li> <li>• Protecting against fire and explosion</li> <li>• Protecting against harmful arc ray effectively</li> <li>• Protecting against harmful gases and poisonous fumes</li> <li>• Following the legislations and safety guidelines on OAW / OAC</li> </ul> </li> <li>◆ Know about the preparations for OAW / OAC: <ul style="list-style-type: none"> <li>• Understand the general application and their limitations of OAW / OAC</li> <li>• Understand functions of various OAW / OAC equipment, including high pressure gaseous cylinder, pressure regulator, flashback arrestor, welding torch and cutting torch , etc.</li> <li>• Identify the requirements of welding materials for oxyacetylene welding and cutting such welding rods, welding flux, etc</li> </ul> </li> <li>◆ Perform quality inspection on weld profile <ul style="list-style-type: none"> <li>• Identify various types of common and simple surface weld defects at welded joints, such as undercut, overlap and porosities</li> <li>• Avoid causing the simple surface weld defects mentioned above</li> </ul> </li> </ul> <p>6.2 Methods and procedures for operating OAW / OAC</p> <ul style="list-style-type: none"> <li>◆ Apply OAW / OAC techniques <ul style="list-style-type: none"> <li>• Select proper parameters for welding, such as gas flowrate and pressure, angle of welding and cutting torch, welding or cutting speed, etc.</li> <li>• Perform following tasks: <ul style="list-style-type: none"> <li>▶ Perform linear surface buildup at flat position</li> <li>▶ Perform plate cutting at flat position</li> </ul> </li> </ul> </li> </ul>	

	<ul style="list-style-type: none"> <li>▶ Perform two sides square edge butt weld at flat position and horizontal position</li> <li>▶ Perform fillet weld at flat position and horizontal position</li> <li>▶ Perform plate cutting at horizontal position and vertical position</li> </ul>
	<p>6.3 Professionalism in OAW / OAC</p> <ul style="list-style-type: none"> <li>◆ Perform OAW / OAC tasks according to relevant safety guidelines and code of practice</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> <li>(i) Capable to complete basic OAW / OAC tasks without causing obvious surface weld defects; and</li> <li>(ii) Capable to perform OAW / OAC tasks safely.</li> </ul>
8. Remarks	<p>This unit of competency is applicable to general electrical and mechanical welding practitioners.</p>

1. Title	Basic weld joint edge production and assembly	
2. Code	EMCUIN227A	
3. Range	Produce and assemble weld joint edge in electrical and mechanical welding workshops or work sites	
4. Level	2	
5. Credit	15	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Weld joint</p> <ul style="list-style-type: none"> <li>◆ Understand the application of basic weld joint, such as butt joint, T joint, lap joint, fillet joint and edge joint, etc.</li> <li>◆ Understand the application of different types of basic weld joint edge, such as those in rectangular shape, single groove, single J shape, double groove, double J shape, V shape and U shape, etc.</li> <li>◆ Understand the impact of the main parts of weld joint on the weld metal</li> <li>◆ Understand the application of methods to produce weld joints in different shapes</li> <li>◆ Understand the code of safety for basic production and assembly of weld joint edge</li> </ul> <p>6.2 Basic weld joint edge production and assembly</p> <ul style="list-style-type: none"> <li>◆ Capable to produce different types of basic weld joint edge safely</li> <li>◆ Capable to use different types of assembling tools such as try square, ruler, feeler gauge, anchor plate, and different types of jigs and fixture, etc. for weld joint assembly</li> <li>◆ Master the method and procedures of cleaning the weld joint prior to and after the work</li> </ul> <p>6.3 Professionalism in weld joint edge production and assembly</p> <ul style="list-style-type: none"> <li>◆ Follow codes of safety and practice for weld joint edge production and assembly to perform basic weld joint edge production and assembly</li> </ul>	
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to follow codes of safety and practice for weld joint edge production and assembly to perform basic weld joint edge production and assembly.</p>	
8. Remarks	This unit of competency is applicable to electrical and mechanical welding practitioners in general.	

1. Title	Non-destructive test ( NDT ) - magnetic particle inspection
2. Code	EMCUMA201A
3. Range	Use magnetic particle inspection method, at servicing centres or locations with operating equipment, to inspect equipment or materials for surface and sub-surface cracks and weld defects.
4. Level	2
5. Credit	2
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Techniques and working principles of inspecting equipment or materials for cracks</p> <ul style="list-style-type: none"> <li>◆ Understand the principles of magnetic particle inspection used to inspect equipment or materials for surface and sub-surface cracks</li> <li>◆ Understand that the magnetic particle inspection method is applicable to magnetic metals or materials only</li> <li>◆ Understand the advantages and limitations of using dry particles, wet particles and fluorescent particles in magnetic particle inspection</li> </ul> <p>6.2 Methods and procedures of inspecting equipment and materials for cracks</p> <ul style="list-style-type: none"> <li>◆ Capable to apply the magnetic particle inspection method effectively to inspect the surface and sub-surface of equipment or materials for cracks and record the findings</li> <li>◆ Capable to use different magnetic particle inspection tools for testing according to work pieces and cracks</li> <li>◆ Capable to inspect different positions for surface and sub-surface cracks</li> <li>◆ Select dry particles, wet particles or fluorescent particles for inspection according to work pieces and required precision</li> <li>◆ Capable to mark the position with cracks clearly</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to use magnetic particle inspection method correctly to inspect equipment or materials for surface and sub-surface cracks; record and mark the positions and size of the cracks; and</p> <p>(ii) Capable to point out the advantages and limitations of dry particles, wet particles and fluorescent particles in magnetic particle inspection.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person is familiar with liquid penetration inspection.

1. Title	Non-destructive test ( NDT ) - ultrasonic testing
2. Code	EMCUMA202A
3. Range	Use ultrasonic testing instruments, at servicing centres or locations with operating equipment, to detect and examine internal damages of metallic equipment and material thickness.
4. Level	2
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Techniques and working principles of applying ultrasound to inspect internal damages of metallic equipment and material thickness</p> <ul style="list-style-type: none"> <li>◆ Understand the principles of ultrasonic detection and examination technology used to inspect internal damages of metallic equipment and material thickness</li> <li>◆ Understand the processing requirements for work piece surface before conducting ultrasonic inspection</li> </ul> <p>6.2 Methods and procedures of inspecting internal damages of metallic equipment and material thickness</p> <ul style="list-style-type: none"> <li>◆ Capable to process work piece surface properly according to work pieces that need ultrasonic inspection</li> <li>◆ Capable to use ultrasonic testing instruments to detect and examine internal damages of metallic equipment and material thickness</li> <li>◆ Capable to use ultrasonic testing instruments to measure and calculate crack positions and size</li> <li>◆ Capable to mark the position with cracks clearly</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to use ultrasonic testing technology correctly to inspect internal damages of metallic equipment and material thickness; measure and calculate crack positions and size; and record and mark the positions and size of the cracks.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person is familiar with liquid penetration inspection.

1. Title	Repair diesel engines
2. Code	EMCUMA203A
3. Range	Use typical or tailor-made mechanical tools to repair or maintain diesel engines at servicing workshops or locations with diesel engines according to servicing instructions and standards. This unit of competency is applicable to diesel engines of 2000kW or below.
4. Level	2
5. Credit	4
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Structure and basic working principles of diesel engine</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and basic working principles of various component systems of a diesel engine, including: <ul style="list-style-type: none"> <li>• The working principles of a diesel engine - suction, compression, power and exhaust</li> <li>• Engine cylinder and its mechanical devices</li> <li>• Fuel supply system</li> <li>• Fuel injector and fuel filter</li> <li>• Governor and its control devices</li> <li>• Supercharger and turbo-charger</li> <li>• Cooling system and equipment</li> <li>• Lubrication system and equipment</li> </ul> </li> </ul> <p>6.2 Methods and procedures of servicing diesel engines</p> <ul style="list-style-type: none"> <li>◆ Capable to assemble, dismantle, and align the mechanical jointing of a diesel engine and its loading equipment</li> <li>◆ Capable to service various component systems and fittings of a diesel engine effectively, including checking, cleaning, measurement, maintenance and commissioning, according to servicing instructions and standards</li> <li>◆ Capable to use common and tailor-made mechanical tools effectively</li> </ul> <p>6.3 Professionalism in diesel engine repair and maintenance</p> <ul style="list-style-type: none"> <li>◆ Capable to perform general repair and maintenance of diesel engines according to servicing instructions and standards</li> <li>◆ Understand the legal requirements on work safety and the code of practice when performing repair and maintenance of diesel engines</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to check and maintain the core systems of a diesel engine effectively and correctly according to servicing guidelines and standards; and</p> <p>(ii) Capable to commission various components of a diesel engine effectively.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of servicing mechanical equipment.

1. Title	Service protection and indicator of diesel engines
2. Code	EMCUMA204A
3. Range	Use common servicing and inspection instruments and tools to repair, maintain and set protection and indicator of diesel engines at servicing workshops or locations with diesel engines according to servicing instructions and standards.
4. Level	2
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of protection and indicator of diesel engines</p> <ul style="list-style-type: none"> <li>◆ Understand the uses and working principles of various types of protection and indicator of diesel engines, including: <ul style="list-style-type: none"> <li>• Engine speed indication and protection device</li> <li>• Engine temperature indication and protection device</li> <li>• Engine lubrication system protection device</li> <li>• Fuel filter system protection device</li> </ul> </li> </ul> <p>6.2 Methods and procedures of servicing protection and indicator of diesel engines</p> <ul style="list-style-type: none"> <li>◆ Capable to service protection and indicator of diesel engines effectively, including checking, cleaning, measurement, maintenance and commissioning, according to servicing instructions and standards</li> <li>◆ Capable to test and set various types of protection and indicator of diesel engines according to standards</li> <li>◆ Capable to use common servicing and inspection instruments and tools effectively</li> </ul> <p>6.3 Professionalism in repairing and maintaining protection and indicator of diesel engines</p> <ul style="list-style-type: none"> <li>◆ Capable to perform general repair and maintenance of protection and indicator of diesel engines according to servicing instructions and standards</li> <li>◆ Understand the code of practice when performing repair and maintenance of protection and indicator of diesel engines</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to check and maintain the core protection and indicator of diesel engines effectively and correctly according to servicing standards; and</p> <p>(ii) Capable to commission and set various protection and indicator effectively.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of servicing electrical and mechanical equipment.

1. Title	Service generators and accessories	
2. Code	EMCUMA205A	
3. Range	Use typical servicing and inspection instruments and tools or tailor-made mechanical tools to repair or maintain single-phase or three-phase AC and DC generators and accessories at generator and accessories servicing workshops or locations with generators.	
4. Level	2	
5. Credit	4	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Structure and working principles of generators and accessories</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of single-phase or three-phase AC and DC generators, including: <ul style="list-style-type: none"> <li>• Stator and winding</li> <li>• Rotor and winding</li> <li>• Exciter winding rectifier</li> <li>• Other kinds of winding e.g. interlope freed compensation</li> <li>• Mechanical parts e.g. bearing</li> <li>• Commutator</li> </ul> </li> <li>◆ Understand the structure and working principles of generator accessories, including: <ul style="list-style-type: none"> <li>• Charging device</li> <li>• Battery</li> </ul> </li> </ul> <p>6.2 Methods and procedures of servicing generators and accessories</p> <ul style="list-style-type: none"> <li>◆ Capable to service a generator effectively, including checking, cleaning, measurement, maintenance and commissioning, according to servicing instructions and standards</li> <li>◆ Capable to service generator accessories effectively, including checking, cleaning, measurement, maintenance and commissioning, according to servicing instructions and standards</li> <li>◆ Capable to test various devices of generator accessories according to standards</li> <li>◆ Capable to use typical servicing and inspection instruments and tools or tailor-made tools for generator installation and dismantling effectively</li> </ul> <p>6.3 Professionalism in repairing and maintaining generators and accessories</p> <ul style="list-style-type: none"> <li>◆ Capable to perform general repair and maintenance of generators and accessories according to servicing instructions and standards</li> <li>◆ Understand the legal requirements on work safety and the code of practice when performing repair and maintenance of generators and accessories</li> </ul>	

7. Assessment Criteria	The integrated outcome requirements of this unit of competency are:  (i) Capable to check and maintain a three-phase generator effectively and correctly according to servicing standards; and  (ii) Capable to commission and set various core accessories effectively.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of servicing electrical equipment.

1. Title	Service control, protection and indicator of generators	
2. Code	EMCUMA206A	
3. Range	Use typical servicing and inspection instruments and tools to repair, maintain and set control, protection and indicator of single-phase or three-phase AC and DC generators at servicing workshops or locations with generators according to servicing instructions and standards.	
4. Level	2	
5. Credit	4	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of control, protection and indicator of generators</p> <ul style="list-style-type: none"> <li>◆ Understand the working principles of control, protection and indicator of single-phase or three-phase AC and DC generators, including: <ul style="list-style-type: none"> <li>• Output voltage control</li> <li>• Load regulator</li> <li>• Speed regulator</li> </ul> </li> <li>◆ Understand the working principles of control, protection and indicator of generators, including: <ul style="list-style-type: none"> <li>• Output voltage protection</li> <li>• Short circuit protection</li> <li>• Leakage protection</li> <li>• Unbalanced load protection</li> <li>• Overspeed protection</li> <li>• Output voltage, current and frequency indication</li> <li>• Other relevant output data indication</li> </ul> </li> </ul> <p>6.2 Methods and procedures of servicing control, protection and indicator of generators</p> <ul style="list-style-type: none"> <li>◆ Capable to service control, protection and indicator of single-phase or three-phase AC and DC generators effectively, including checking, cleaning, measurement, maintenance and commissioning, according to servicing instructions and standards</li> <li>◆ Capable to test and set control, protection and indicator of generators according to standards</li> <li>◆ Capable to use typical servicing and inspection instruments and tools effectively</li> </ul> <p>6.3 Professionalism in repairing and maintaining control, protection and indicator of generators</p> <ul style="list-style-type: none"> <li>◆ Capable to perform general repair and maintenance of control, protection and indicator of generators according to servicing instructions and standards</li> <li>◆ Understand the legal requirements on work safety and the code of practice when performing repair and maintenance of control, protection and indicator of generators</li> </ul>	

7. Assessment Criteria	The integrated outcome requirements of this unit of competency are:  (i) Capable to check, maintain and set control, protection and indicator of three-phase generator effectively and correctly according to servicing standards; and  (ii) Capable to commission and set various control, protection and indicator effectively.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of servicing electrical equipment.

1. Title	Analysis of non-destructive test (NDT) – Liquid penetrant Testing	
2. Code	EMCUMA207A	
3. Range	Use liquid penetrant, at servicing centres or locations with operating equipment, to inspect equipment or materials for surface cracks and make a simple analysis.	
4. Level	2	
5. Credit	3	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Techniques and principles of inspecting mechanical equipment for cracks</p> <ul style="list-style-type: none"> <li>◆ Understand the advantages and limitations of liquid penetrant testing, especially in reference to those of magnetic particle inspection</li> <li>◆ Understand that liquid penetrant testing is applicable to various types of metals, and some plastic and ceramic materials</li> <li>◆ Know about the procedural adjustments to be made for inspecting different sizes of surface cracks</li> <li>◆ Understand that the tools (such as black light lamp) and working procedures used for coloured penetrant and fluorescent penetrant are different</li> <li>◆ Understand the chemical hazards caused by penetrant and developers, and relevant concerns for use</li> </ul> <p>6.2 Methods and procedures of analyzing and identifying cracks on metal equipment</p> <ul style="list-style-type: none"> <li>◆ Capable to use liquid penetrant and developers effectively; make a simple analysis of the surface cracks of equipment or materials</li> <li>◆ Capable to identify surface cracks, surface defects and various types of residues left on the surface</li> <li>◆ Capable to mark the position with cracks effectively</li> <li>◆ Capable to keep record of inspection and analysis effectively</li> </ul> <p>6.3 Professionalism in using penetrant and developers</p> <ul style="list-style-type: none"> <li>◆ Have adequate hands-on practice in liquid penetration inspection according to international standards or in-house guidelines; record and analyze detected surface cracks according to requirements</li> </ul>	
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to use liquid penetration and developer inspection method safely and correctly; identify equipment or materials for surface cracks and make a simple analysis.</p>	
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses the competency of EMCUMA102A “Analysis of non-destructive test (NDT) – Liquid penetrant Testing”.	

1. Title	Apply effective communication skills in discussions of electrical and mechanical issues
2. Code	EMCUOM204A
3. Range	With regard to electrical and mechanical operation management, apply effective communication skills to actively discuss, exchange ideas and respond to electrical and mechanical related issues (e.g. design, installation, inspection, commissioning, testing, running, repair, maintenance, occupational safety and health, project management, quality management, sales and marketing, etc.).
4. Level	2
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Effective communication skills</p> <ul style="list-style-type: none"> <li>◆ Understand effective communication skills, including speaking skill, listening skill, summarizing skill and interpersonal skill</li> <li>◆ Understand the functions of different communication media / tools <ul style="list-style-type: none"> <li>• Using email or fax</li> <li>• Using telephone for liaison and communication</li> <li>• Holding meetings, etc.</li> </ul> </li> <li>◆ Understand common terminology and technical terms used in the electrical and mechanical engineering services industry</li> </ul> <p>6.2 Understand work scope of the electrical and mechanical services, and apply effective communication skills to exchange ideas and foster discussion</p> <ul style="list-style-type: none"> <li>◆ Understand the work scope of the electrical and mechanical services, such as design, installation, inspection, commissioning, testing, running, repair, maintenance, occupational safety and health, project management, quality management, sales and marketing, etc.; and be capable to apply effective communication skills to exchange ideas and foster discussion so as to achieve the purpose of idea exchange and information delivery</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply effective communication skills and common terminology and technical terms used in the industry to take part in the discussion of electrical and mechanical issues.</p>
8. Remarks	This unit of competency is applicable to electrical and mechanical practitioners in general.

1. Title	Know about common Chinese terminologies of electrical and mechanical services
2. Code	EMCUOM207A
3. Range	Capable to identify common Chinese terminologies and basic technical terms of electrical and mechanical services to meet basic need of daily operation in order to communicate effectively and complete the specified tasks in electrical and mechanical workplaces.
4. Level	2
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Know about common Chinese terminologies of electrical and mechanical services</p> <ul style="list-style-type: none"> <li>◆ Know about common Chinese terminologies and basic technical terms of the following electrical and mechanical branches: <ul style="list-style-type: none"> <li>• Railway electrical and mechanical engineering</li> <li>• Electrical engineering</li> <li>• Air-conditioning and refrigeration engineering</li> <li>• Lift and escalator engineering</li> <li>• Gas engineering</li> <li>• Fire services</li> <li>• Plumbing services</li> <li>• Mechanical (plant) engineering</li> <li>• Ship repair engineering</li> <li>• Aircraft engineering</li> </ul> </li> </ul> <p>6.2 Apply common Chinese terminologies of electrical and mechanical services in daily work</p> <ul style="list-style-type: none"> <li>◆ Apply common Chinese terminologies of electrical and mechanical services in daily work to communicate effectively in order to complete the specified tasks</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to understand common Chinese terminologies and basic technical terms of electrical and mechanical services; and</p> <p>(ii) Capable to apply common Chinese terminologies of electrical and mechanical services in daily work to communicate effectively in order to complete the specified tasks.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of Chinese language.

1. Title	Apply basic risk assessment methods
2. Code	EMCUSH205A
3. Range	Capable to apply basic risk assessment methods to perform basic risk assessment related to electrical and mechanical engineering in electrical and mechanical work sites.
4. Level	2
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Basic risk assessment methods</p> <ul style="list-style-type: none"> <li>◆ Understand basic risk assessment methods, including <ul style="list-style-type: none"> <li>• Manual handling operation</li> <li>• Works in confined spaces</li> <li>• Work site hazards</li> <li>• Simple mechanism for risk grading</li> <li>• Risk assessment guidelines</li> <li>• Operating hazards analysis</li> </ul> </li> </ul> <p>6.2 Conduct basic risk assessment</p> <ul style="list-style-type: none"> <li>◆ Apply basic risk assessment methods to conduct simple risk assessment of the hazards and risks likely to occur in the electrical and mechanical work site, including the identification of hazards, the acceptability of risks, the clearance and minimization of risks, etc.</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply basic risk assessment methods to effectively conduct simple risk assessment related to electrical and mechanical engineering services.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses basic occupational safety knowledge and competency of the following units of competency:</p> <p>EMCUSH108A Use general personal protective equipment</p> <p>EMCUSH109A Implement manual handling operation</p> <p>EMCUSH110A Safety operation in confined spaces</p> <p>EMCUSH111A Comply with the legal requirements on electrical and mechanical occupational safety and health.</p>

1. Title	Implement work site occupational health and safety management
2. Code	EMCUSH206A
3. Range	Apply basic occupational health and safety management in electrical and mechanical workshops or work sites to assist in performing work site occupational health and safety management so as to minimize the risks in work sites.
4. Level	2
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Basic knowledge of occupational safety management</p> <ul style="list-style-type: none"> <li>◆ Understand general knowledge of occupational health and safety and its application</li> <li>◆ Understand the basic requirements on occupational health and safety for general work sites</li> </ul> <p>6.2 Application of basic occupational health and safety management</p> <ul style="list-style-type: none"> <li>◆ Capable to apply basic knowledge of occupational safety management to assist in performing occupational health and safety management in work sites so as to minimize the risks.</li> </ul> <p>Management items include:</p> <ul style="list-style-type: none"> <li>• Work site safety inspection</li> <li>• Follow-up of protective measures</li> <li>• Basic risk assessment</li> <li>• Follow-up investigation of accident</li> <li>• Assisting in safety promotion events</li> <li>• Assisting in the implementation of safety policy and management targets for the company or clients</li> <li>• Assisting in organizing group meetings</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to perform occupational health and safety management and implement management items correctly and effectively in electrical and mechanical workshops or work sites.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic occupational safety knowledge.

1. Title	Handle general industrial accidents
2. Code	EMCUSH208A
3. Range	Handle general industrial accidents in electrical and mechanical engineering workplaces according to the code of practice for industrial accidents.
4. Level	2
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Common industrial accidents</p> <ul style="list-style-type: none"> <li>◆ Understand types and causes of general industrial accidents, including: electric shock, fall of person, fire, burn, gas poisoning, explosion, contusion, etc.</li> <li>◆ Understand ways of handling and preventing general industrial accidents, such as preventive measures, working guidelines, working permit system, emergency handling measures, safety management system, occupational safety and health scheme, personal protection facilities, etc.</li> </ul> <p>6.2 Handle general industrial accidents</p> <ul style="list-style-type: none"> <li>◆ Capable to handle general industrial accidents on site, including adopting simple contingencies, according to the code of practice for accidents</li> </ul> <p>6.3 Professionalism in handling industrial accidents</p> <ul style="list-style-type: none"> <li>◆ Handle general industrial accidents properly according to the requirements of the code of practice for industrial accidents</li> <li>◆ Timely report to the supervisor</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to understand types and causes of general industrial accidents; and</p> <p>(ii) Capable to implement and complete measures on handling general industrial accidents, including adopting simple contingencies, according to the code of practice for accidents, and timely report to the supervisor.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic occupational safety knowledge.

1. Title	Obtain data and information of occupational safety and health and environmental protection to compile relevant statistics
2. Code	EMCUSH211A
3. Range	Obtain data and information of occupational safety and health and environmental protection, and use percentage and graphic data to make simple analysis and statistics.
4. Level	2
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Data and information of occupational safety and health and environmental protection</p> <ul style="list-style-type: none"> <li>◆ Understand how to use percentage and graphic data to make simple calculations and statistics for the performance of occupational safety and health and environmental protection</li> <li>• Analyze information and data of occupational safety and health and environmental protection; use percentage and graphs to make simple calculations and statistics based on the data obtained, and come up with simple conclusions</li> </ul> <p>6.2 Compile relevant statistics according to data and information of occupational safety and health and environmental protection</p> <ul style="list-style-type: none"> <li>◆ Use percentage and graphs to compile relevant statistics based on the data and information of occupational safety and health and environmental protection</li> <li>◆ Obtain data and information of occupational safety and health and environmental protection to compile relevant statistics, and come up with simple conclusions</li> <li>• Obtain data required from all kinds of engineering information including accident investigation report, risk assessment report, operational hazards analysis report, etc.</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to obtain data required from engineering information to make analysis for the performance of occupational safety and health and environmental protection; use percentage and graphs to compile statistics, and come up with simple conclusions</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic calculation knowledge.

1. Title	Implement preventive measures on general occupational safety and health
2. Code	EMCUSH212A
3. Range	Understand the characteristics and limitations of the workplace and take preventive measures on general occupational safety and health for occupational safety and avoid accidents in electrical and mechanical engineering workplaces.
4. Level	2
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Protection for general occupational safety and health</p> <ul style="list-style-type: none"> <li>◆ Understand ways for occupational safety and health, and hazards that may occur, and to prevent accidents</li> <li>◆ Understand the restrictions of electrical and mechanical engineering workplace, and follow the safety working procedures to take effective protection steps for the following: <ul style="list-style-type: none"> <li>• Work at height</li> <li>• Chemicals</li> <li>• Noisy environment</li> <li>• Biohazard</li> <li>• High humidity and temperature</li> <li>• Remote areas</li> </ul> </li> </ul> <p>6.2 Preventive measures on occupational safety and health</p> <ul style="list-style-type: none"> <li>◆ Implement preventive measures on general occupational safety and health according to safety legislations and working instructions for occupational safety and health and avoid accidents during electrical and mechanical engineering works. Preventive measures include: <ul style="list-style-type: none"> <li>• Eye protector</li> <li>• Ear protector</li> <li>• Safety belt</li> <li>• Chemical handling procedures</li> <li>• Environmental hygiene, etc.</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Under different conditions/environments, choose different working procedures and use appropriate preventive measures on occupational safety and health so as to comply with the legal requirements and work safety instructions.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic occupational safety knowledge.

1. Title	Gas test in confined spaces
2. Code	EMCUSH213A
3. Range	Conduct gas test in a confined electrical and mechanical engineering space according to work safety procedures, and decide whether the air condition of the confined space is safe to enter according to the test result.
4. Level	2
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of gas test</p> <ul style="list-style-type: none"> <li>◆ Understand the work safety procedures for gas test</li> <li>◆ Know about the harmful gases generally existing in confined spaces like sewage. These gases include carbon oxide(CO), hydrogen sulphide(H<sub>2</sub>S), methane(CH<sub>4</sub>) and other flammable gases</li> <li>◆ Know how to use appropriate test equipment and correct testing method</li> <li>◆ Know how to calibrate and maintain test instruments and devices as advised by the manufacturers</li> <li>◆ Know how to choose the location and way of obtaining samples from the confined space</li> </ul> <p>6.2 Gas test</p> <ul style="list-style-type: none"> <li>◆ Follow the work safety procedures to test the gas, including the oxygen content in the air, and whether the oxygen consists of flammable, poisonous or harmful gases, smoke or vapour</li> <li>◆ Use test instruments and devices correctly as advised by the manufacturers</li> <li>◆ Calibrate and maintain test instruments and devices</li> </ul> <p>6.3 Determine what types of gases need testing</p> <ul style="list-style-type: none"> <li>◆ Determine what types of gases need testing with reference to the characteristics of different confined spaces and items previously stored or now storing in these spaces</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to conduct gas test correctly with gas test instruments and devices in a confined electrical and mechanical engineering space according to work safety procedures to ensure that the environment is safe to enter.</p> <p>(ii) Capable to determine what types of gases need testing in different confined spaces.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of safety.

# **Competency Level 3**

1. Title	Design air-conditioning systems and equipment
2. Code	EMCUDE303A
3. Range	Understand the working principles of air-conditioning systems and equipment, and apply relevant knowledge and skills in air-conditioning and refrigeration engineering design.
4. Level	3
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Classification and working principles of air-conditioning systems</p> <ul style="list-style-type: none"> <li>◆ Understand the classification and working principles of air-conditioning systems and equipment <ul style="list-style-type: none"> <li>• Classification of air-conditioning systems according to the following: <ul style="list-style-type: none"> <li>▶ Application of air-conditioning</li> <li>▶ Degree of centralization of air handling equipment</li> <li>▶ Fluid media used in the thermal distribution system</li> <li>Method of adjusting air volume</li> <li>▶ Type of return air system</li> <li>▶ Air velocity in air ducts</li> </ul> </li> <li>• Understand the advantages and disadvantages of common air-conditioning systems</li> <li>• Understand the applicability of common air-conditioning systems</li> <li>• Understand the working principles of the component units of central air-conditioning system, including: <ul style="list-style-type: none"> <li>▶ Illustrating with diagrams the component units of a typical central air-conditioning system and its mode of operation</li> <li>▶ Construction and working principles of chiller plant</li> <li>▶ Construction and working principles of air handling equipment</li> <li>▶ Construction and working principles of air delivery system</li> <li>▶ Structure and working principles of chilled water system</li> <li>▶ Construction and working principles of automatic control equipment</li> </ul> </li> <li>• Working principles of unitary air-conditioning system, including: <ul style="list-style-type: none"> <li>▶ Construction and working principles of window type air-conditioner</li> <li>▶ Construction and working principles of split type air-conditioner</li> </ul> </li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>▸ Construction Structure and working principles of packaged type air-conditioner</li> </ul>
6.2 Design air-conditioning systems	<ul style="list-style-type: none"> <li>◆ Calculate parameters for comfort air-conditioning design according to design criteria</li> <li>◆ Calculate parameters for different types of industrial air-conditioning designs according to design criteria</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to calculate parameters for comfort air-conditioning design and different types of industrial air-conditioning designs according to design criteria.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses basic air-conditioning knowledge.</p>

1. Title	Use programmable logic controller (PLC) to write circuit control programme
2. Code	EMCUDE306A
3. Range	Use PLC high level programming commands to write circuit control programme for electrical and mechanical engineering design, and compare and upgrade the PLC control programme.
4. Level	3
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Principles of computing and concept of information coding</p> <ul style="list-style-type: none"> <li>◆ Understand the principles of computing, including the conversion and arithmetics of binary number, decimal number, hexadecimal number</li> <li>◆ Understand the concept of information coding, and the principles of binary coding (BCD code) and ASC II code</li> </ul> <p>6.2 Use PLC to write circuit control programme and test it</p> <ul style="list-style-type: none"> <li>◆ Use PLC basic and high level programming commands to write control programme for general electrical and mechanical work, e.g. control circuit of the carpark vehicle access management system, control circuit of the automatic switching system for several water pumps, etc.</li> <li>◆ Test, rectify and upgrade PLC control programme <ul style="list-style-type: none"> <li>• Test the circuit control programme written with basic and high level programmed commands</li> <li>• Debug and rectify the PLC control programme</li> <li>• Compare and upgrade the PLC control programme</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to use PLC basic and high level programming commands to write circuit control programme for general electrical and mechanical work according to the functional requirements, and test and debug the programme; and</p> <p>(ii) Capable to use PLC high level programming commands to upgrade the PLC control programme according to the functional requirements.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic computer knowledge.

1. Title	Apply diodes and transistors in electronic control circuits
2. Code	EMCUDE311A
3. Range	Understand the structure, properties and working principles of basic electronic components (diode and transistor); and use these components in rectifier, amplifying and logic circuits to meet the functional requirements of the control circuit design.
4. Level	3
5. Credit	8
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Structure, properties and working principles of diode and transistor</p> <ul style="list-style-type: none"> <li>◆ Understand the structure, properties and working principles of diode and transistor</li> <li>◆ Understand the working principles of rectifier circuit and stabilizing circuit</li> </ul> <p>6.2 Use diodes and transistors in electronic control circuits</p> <ul style="list-style-type: none"> <li>◆ Use diodes and related components to design the following electronic control circuits according to the functional requirements of the control circuit design <ul style="list-style-type: none"> <li>• Bridge type rectifier circuit</li> <li>• Stabilizing circuit</li> </ul> </li> <li>◆ Use transistors in amplifying circuit and switch circuits according to the functional requirements of the circuit design <ul style="list-style-type: none"> <li>• Use transistors and related components to connect as an amplifying circuit based on the understanding in the structure of transistor and working principles of amplifying circuit and</li> <li>• Apply the following connecting methods to achieve different amplifying effects and results <ul style="list-style-type: none"> <li>▶ Common base connection</li> <li>▶ Common emitter connection</li> <li>▶ Common collector connection</li> </ul> </li> <li>• Use transistors and related components to design a switch circuit according to the functional requirements of the circuit design</li> </ul> </li> <li>◆ Use diodes and transistors in logic circuits according to the functional requirements of the circuit design <ul style="list-style-type: none"> <li>• Use diodes, transistors and related components to connect in the following logic circuits <ul style="list-style-type: none"> <li>▶ 'OR' Gate</li> <li>▶ 'AND' Gate</li> <li>▶ 'Not' Gate</li> <li>▶ 'Exclusive OR' Circuit</li> <li>▶ 'NAND' Gate</li> <li>▶ 'NOR' Gate</li> </ul> </li> </ul> </li> </ul>

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is:  (i) Capable to design an electronic control circuit according to the functional requirements of the circuit design, with the functions of full wave rectification and stabilization, electronic control switch, logic control and signal amplification.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of electricity.

1. Title	Use computer to draw complicated mechanical engineering drawings
2. Code	EMCUDE315A
3. Range	Use computer to draw complicated mechanical engineering drawings in electrical and mechanical workplaces.
4. Level	3
5. Credit	5
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Computer engineering drawing techniques and methods</p> <ul style="list-style-type: none"> <li>◆ Understand the techniques and methods of using computer to draw complicated mechanical engineering drawings</li> </ul> <p>6.2 Application of computer in drawing electrical and mechanical drawings</p> <ul style="list-style-type: none"> <li>◆ Use the computer to draw complicated mechanical engineering drawings according to design <ul style="list-style-type: none"> <li>• Draw 3D drawings for mechanical parts <ul style="list-style-type: none"> <li>▸ Full 3D drawings</li> <li>▸ Sectional 3D drawings</li> <li>▸ Perspective 3D drawings</li> </ul> </li> <li>• Draw different shapes of air ducts <ul style="list-style-type: none"> <li>▸ Cylindrical pipe</li> <li>▸ Conical pipe</li> <li>▸ Irregular surface pipe</li> <li>▸ Air duct unit</li> </ul> </li> <li>• Draw mechanical equipment assembly drawings <ul style="list-style-type: none"> <li>▸ Weld joints of pipes with different diameters</li> <li>▸ Assembly of mechanical parts</li> </ul> </li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to draw a 3D mechanical equipment assembly drawings according to the design; and</p> <p>(ii) Capable to integrate several complicated mechanical components drawings into an integrated mechanical assembly drawing, including the developing drawings and assembly drawings, according to the design.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses the competency of drawing basic electrical and mechanical engineering drawings using computer.

1. Title	Use computer to draw for complicated electrical engineering drawings
2. Code	EMCUDE316A
3. Range	Use computer to draw complicated electrical engineering drawings in electrical and mechanical workplaces.
4. Level	3
5. Credit	5
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Techniques and methods of using computer to draw electrical engineering drawings</p> <ul style="list-style-type: none"> <li>◆ Understand the techniques and methods of using computer to draw complicated electrical engineering drawings</li> </ul> <p>6.2 Use computer to draw complicated mechanical engineering drawings</p> <ul style="list-style-type: none"> <li>◆ Use the computer to draw complicated electrical engineering drawings according to design <ul style="list-style-type: none"> <li>• Draw the main circuit layout of multi-layer power system and electrical installation with protection device according to design</li> <li>• Draw the circuit wiring layout of multi-layer power system and electrical installation with protective and control equipment according to design</li> <li>• Draw the complex control circuit layout according to design <ul style="list-style-type: none"> <li>▸ Logic electronic circuit</li> <li>▸ Electrical and electronic control equipment circuits</li> </ul> </li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to draw a main circuit layout, control circuit layout and wiring layout of an electrical installation, including the electrical and electronic control equipment, according to design; and</p> <p>(ii) Capable to integrate several electrical distribution and wiring layouts into a comprehensive power supply and wiring layout for a multi-storey building according to design.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses the competency of drawing basic electrical and mechanical drawings with computer.

1. Title	Use computer to draw combined services drawings of building services
2. Code	EMCUDE317A
3. Range	Use computer to draw combined services drawings of building services as electrical and mechanical engineering design is involved.
4. Level	3
5. Credit	5
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Computer engineering drawing techniques and methods</p> <ul style="list-style-type: none"> <li>◆ Understand the techniques and methods of using computer to draw combined services drawings of building services, including: <ul style="list-style-type: none"> <li>• Setting layer rules for combined services drawings of building services</li> <li>• Difference between drawing the equipment on layout plan directly and drawing on external reference drawings</li> <li>• Management and application of external reference drawings</li> <li>• Setting of configuration and drawing specifications</li> </ul> </li> </ul> <p>6.2 Application of computer in engineering drawing</p> <ul style="list-style-type: none"> <li>◆ Use the computer to draw combined services drawings of building services, including: <ul style="list-style-type: none"> <li>• Copy the electrical and mechanical drawing layer needed from an electrical and mechanical layout plan to another electrical and mechanical layout plan to form a combined services drawings of building services</li> <li>• Compile the drawing layer of electrical and mechanical facilities with reference to external sources</li> <li>• Use information saved in files or databank to improve the efficiency of drawing</li> </ul> </li> <li>◆ Retrieve, manage and apply external reference drawings efficiently</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to draw a combined services drawings of building services according to design by including and merging building services drawings of different floors of the building and form a comprehensive building services drawing ; and</p> <p>(ii) Capable to use information saved in files or databank, including the external reference drawings, to improve the efficiency of drawing.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses the competency of drawing basic electrical and mechanical drawings with computer.

1. Title	Choose typical materials for electrical and mechanical work
2. Code	EMCUDE318A
3. Range	Choose appropriate materials commonly used in electrical and mechanical work to perform the work of design, installation and repair.
4. Level	3
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Functions, properties and range of application of common electrical and mechanical materials</p> <ul style="list-style-type: none"> <li>◆ Understand the functions, properties and range of application of common metallic and non-metallic materials, including: <ul style="list-style-type: none"> <li>• Physical properties and chemical properties such as electric induction, thermal induction, expansion and contraction, anti-corrosion, solubility, etc.</li> <li>• Mechanical properties such as strength, hardness, resilience, fatigue limit, high-temperature strength, etc.</li> <li>• Processing properties such as casting, extension, welding, machining, heat treatment, etc.</li> <li>• Understand the functions and range of application of common metallic and non-metallic materials, such as their functions, application conditions and limitations for applying to the branches of electricity, air-conditioning, ship repair machinery and plant engineering, etc.</li> </ul> </li> </ul> <p>6.2 Choose electrical and mechanical materials needed</p> <ul style="list-style-type: none"> <li>◆ Capable to choose appropriate materials commonly used in electrical and mechanical work according to their properties and range of application as well as the engineering requirements and specifications in order to perform the work of electrical and mechanical design, installation and repair</li> <li>◆ Capable to choose and check the materials to ensure that they comply with the safety specifications</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to choose appropriate materials commonly used in electrical and mechanical work according to their functions, properties and range of applications as well as the safety specifications in order to perform the work of electrical and mechanical design, installation and repair.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of electrical and mechanical materials.

1. Title	Apply CAD standard and information technology to draw electrical and mechanical engineering drawings
2. Code	EMRADE303A
3. Range	Apply CAD standard for Works Projects (CSWP) of Hong Kong Government and information technology in drawing offices or other electrical and mechanical work sites as to enhance the quality of drawings.
4. Level	3
5. Credits	5
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Planning and requirements of CSWP</p> <ul style="list-style-type: none"> <li>◆ Understand planning and requirements of CSWP, including: <ul style="list-style-type: none"> <li>• Planning of CSWP folder and files</li> <li>• Layer format</li> <li>• Specifications of lines</li> <li>• Specifications of text</li> <li>• Specifications of colour control</li> <li>• Application of scale</li> <li>• Specifications of drawing paper</li> <li>• System planning</li> </ul> </li> </ul> <p>6.2 Methods and procedures of applying CSWP in electrical and mechanical engineering drawings</p> <ul style="list-style-type: none"> <li>◆ Apply computer software effectively in drawing electrical and mechanical engineering drawings with the following procedures to meet CSWP <ul style="list-style-type: none"> <li>• Establish CSWP standard drawing library and line library</li> <li>• Manage CSWP data</li> <li>• Implement data interchange</li> <li>• Apply CSWP interface functions</li> </ul> </li> <li>◆ Enhance the CSWP efficiency, including <ul style="list-style-type: none"> <li>• Establish a function menu for common computer softwares</li> <li>• Improve the CSWP drawing system functions</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply common computer softwares effectively in drawing electrical and mechanical engineering drawings to meet CSWP; and</p> <p>(ii) Capable to use the functions of computer software to improve the efficiency of CSWP.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses the competency of drawing electrical and mechanical engineering drawings with computer.

1. Title	Perform electrical and mechanical installation and testing according to the drawings and specifications of electrical devices and wiring
2. Code	EMCUIN306A
3. Range	Interpret the engineering drawings of electrical devices, circuits and wiring and able to apply relevant information for electrical and mechanical works.
4. Level	3
5. Credit	4
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Uses of the drawings of electrical devices, circuits and wiring</p> <ul style="list-style-type: none"> <li>◆ Understand the uses of various types of engineering drawings of electrical works</li> <li>◆ Identify different versions of engineering drawings of electrical works</li> <li>◆ Capable to apply electrical symbols, scaling calculations and relevant engineering drawings of electrical works</li> </ul> <p>6.2 Obtain relevant information of electrical devices, control circuits and wiring drawings to complete installation and testing of electrical systems</p> <ul style="list-style-type: none"> <li>◆ Obtain suitable electrical engineering drawings according to project requirements</li> <li>◆ Capable to obtain relevant information of the main circuit, including: <ul style="list-style-type: none"> <li>• Connection of the main circuit</li> <li>• Details of power distribution</li> <li>• Power switch interlock</li> </ul> </li> <li>◆ Capable to obtain relevant information of electrical equipment and control circuits, including: <ul style="list-style-type: none"> <li>• Principles of control</li> <li>• Control circuits</li> <li>• Control components, including circuit breakers, relays, push-buttons and their contacts</li> <li>• Electronic control circuits</li> </ul> </li> <li>◆ Capable to obtain information of control circuit and wiring drawings, including: <ul style="list-style-type: none"> <li>• Selection of cables</li> <li>• Classification of cables</li> <li>• Laying of cables</li> <li>• Wiring conduits</li> <li>• Wiring trunkings</li> <li>• Identification and marking of cables</li> <li>• Connection of cables</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>◆ Capable to obtain relevant information from drawings of electrical devices, circuits and wiring for performing an electrical and mechanical task, such as the information below for installation and testing of a starter circuit for a three-phase AC motor: <ul style="list-style-type: none"> <li>• Principles of control circuit interlock</li> <li>• Conduits and trunkings required</li> <li>• Laying of cables</li> <li>• Connection of cables</li> <li>• Identification and marking of cables</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to select suitable engineering drawings of electrical works, and obtain relevant information from drawings for completion of installation and testing of an electrical and mechanical system and equipment, such as the installation and testing of a power distribution system in a multi-storey building.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of electricity.</p>

1. Title	Use measuring tools and instruments to install, connect or measure overhead line installations
2. Code	EMCUIN309A
3. Range	Use measuring tools and instruments to measure accurately, install and connect overhead line onto overhead line poles.
4. Level	3
5. Credit	5
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Operating principles of overhead line measuring tools and instruments</p> <ul style="list-style-type: none"> <li>◆ Understand the operating principles of overhead line measuring tools and instruments</li> </ul> <p>6.2 Use measuring tools and instruments to install and connect overhead line</p> <ul style="list-style-type: none"> <li>◆ Use measuring tools and instruments for pre-installation positioning</li> <li>◆ Use measuring tools and instruments to install the overhead line according to the details of the drawing, including tension of the cable, insulation and isolation devices on the overhead line pole, etc.</li> <li>◆ Connect cables on the two sides of the overhead line support or pole and ensure the safety of the insulation</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to use measuring tools and instruments correctly and effectively to install and connect overhead line, and to connect cables on the two sides of the overhead line support with insulation and grounding devices for protection.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic electrical and mechanical knowledge.

1. Title	Install overhead line isolator control circuit
2. Code	EMCUIN310A
3. Range	Capable to perform disconnection switch installation on overhead line pole according to installation instructions and drawings, including installing control circuit of the isolator, so as to comply with the electricity safety requirements.
4. Level	3
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Content of installation drawing and operating principles of various types of isolator</p> <ul style="list-style-type: none"> <li>◆ Understand the installation drawing and instructions, all kinds of symbols and the control circuit of the isolator</li> <li>◆ Understand the operating principles of various types of isolators</li> </ul> <p>6.2 Methods of operating various types of isolators and their control circuits</p> <ul style="list-style-type: none"> <li>◆ Know all common types of isolators, and be capable to install overhead line isolators and ensure that they meet the requirements of the electricity legislations and code of practice for isolating high-voltage electrical equipment</li> <li>◆ Know the methods of operating the isolator control circuits</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to install typical isolators and their control circuits according to installation drawing instructions and requirements; and</p> <p>(ii) Capable to ensure that the safety of the isolators meet the requirements of the electricity legislations and code of practice for isolating high-voltage electrical equipment.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of electrical and mechanical drawings.

1. Title	Perform general lifting machinery and lifting equipment inspection						
2. Code	EMCUIN313A						
3. Range	Perform general lifting machinery and lifting equipment inspection, according to relevant legal requirements, in general industrial plants or electrical and mechanical workplaces where lifting and handling work is involved, and be capable to perform related inspection independently and assist the registered professional engineer in arranging trial loading test for large lifting machinery.						
4. Level	3						
5. Credit	3						
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <table border="0"> <tr> <td style="vertical-align: top;">6.1</td> <td style="vertical-align: top;">Operating principles of general lifting machinery and lifting equipment and legislations related to inspection</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> <li>◆ Understand the operating principles of general lifting machinery and lifting equipment</li> <li>◆ Understand the legal requirements on general lifting machinery and lifting equipment inspection</li> <li>◆ Understand the overhauling procedures for general lifting equipment, including the operation, repair, maintenance, inspection, complete check, testing and components of lifting machinery</li> </ul> </td> </tr> <tr> <td style="vertical-align: top;">6.2</td> <td style="vertical-align: top;">General lifting machinery and lifting equipment inspection</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> <li>◆ Perform regular inspection on general lifting machinery according to legal requirements and working instructions, including performing routine check, assisting the registered professional engineer to conduct the overhaul and loading test, etc.</li> <li>◆ Perform regular inspection on general lifting equipment according to legal requirements and working instructions</li> </ul> </td> </tr> </table>	6.1	Operating principles of general lifting machinery and lifting equipment and legislations related to inspection	<ul style="list-style-type: none"> <li>◆ Understand the operating principles of general lifting machinery and lifting equipment</li> <li>◆ Understand the legal requirements on general lifting machinery and lifting equipment inspection</li> <li>◆ Understand the overhauling procedures for general lifting equipment, including the operation, repair, maintenance, inspection, complete check, testing and components of lifting machinery</li> </ul>	6.2	General lifting machinery and lifting equipment inspection	<ul style="list-style-type: none"> <li>◆ Perform regular inspection on general lifting machinery according to legal requirements and working instructions, including performing routine check, assisting the registered professional engineer to conduct the overhaul and loading test, etc.</li> <li>◆ Perform regular inspection on general lifting equipment according to legal requirements and working instructions</li> </ul>
6.1	Operating principles of general lifting machinery and lifting equipment and legislations related to inspection	<ul style="list-style-type: none"> <li>◆ Understand the operating principles of general lifting machinery and lifting equipment</li> <li>◆ Understand the legal requirements on general lifting machinery and lifting equipment inspection</li> <li>◆ Understand the overhauling procedures for general lifting equipment, including the operation, repair, maintenance, inspection, complete check, testing and components of lifting machinery</li> </ul>					
6.2	General lifting machinery and lifting equipment inspection	<ul style="list-style-type: none"> <li>◆ Perform regular inspection on general lifting machinery according to legal requirements and working instructions, including performing routine check, assisting the registered professional engineer to conduct the overhaul and loading test, etc.</li> <li>◆ Perform regular inspection on general lifting equipment according to legal requirements and working instructions</li> </ul>					
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to perform routine check for general lifting machinery and lifting equipment according to legal requirements, and assist the registered professional engineer to conduct thorough inspection and loading test.</p>						
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses the competency of using general loading and lifting equipment.						

1. Title	Operate and maintain abrasive wheels safely
2. Code	EMCUIN315A
3. Range	Operate all kinds of abrasive wheels in workshops or work sites.
4. Level	3
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Methods of operating abrasive wheels</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the safe operation of abrasive wheels, including: <ul style="list-style-type: none"> <li>• Maximum permissible speed of abrasive wheel in different size (speed of abrasive wheel)</li> <li>• Speed of spindle</li> <li>• Protective guard for moving abrasive wheel</li> <li>• Gap between the cutter block and abrasive wheel</li> <li>• Ensure that the abrasive wheel has been fitted securely before use</li> <li>• Effective devices to connect and disconnect power supply must be available for the abrasive wheel used in the machinery</li> <li>• Suitable working environment e.g. no materials without tied</li> </ul> </li> </ul> <p>6.2 Maintenance of abrasive wheel</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the maintenance of abrasive wheel, including: <ul style="list-style-type: none"> <li>• Repair of the protective guard</li> <li>• Repair of the rest</li> <li>• Reconditioning of the abrasive wheel</li> </ul> </li> </ul> <p>6.3 Operation and maintenance procedures for abrasive wheel</p> <ul style="list-style-type: none"> <li>◆ Know how to choose suitable abrasive wheels for different kinds of work</li> <li>◆ Know the needs and principles of regularly repairing and maintaining abrasive wheel, including the procedures of inspection, maintenance and alignment</li> <li>◆ Use general repairing and checking instruments and tools effectively</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to operate abrasive wheels safely;</p> <p>(ii) Capable to choose suitable abrasive wheels for different kinds of work; and</p> <p>(iii) Capable to perform routine maintenance and fault repair of abrasive wheels effectively.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of occupational safety and machinery/materials.

1. Title	Perform manual metal arc welding (MMAW)/shielded metal arc welding (SMAW) at specified positions	
2. Code	EMCUIN316A	
3. Range	Perform MMAW/SMAW at specified positions of common carbon steel, high carbon steel or stainless steel, in electrical and mechanical welding workshops or work sites.	
4. Level	3	
5. Credit	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of MMAW/ SMAW</p> <ul style="list-style-type: none"> <li>◆ Understand the applications of electrodes of arc welding</li> <li>◆ Know about properties of different type of metals, such as carbon steel and stainless steel</li> <li>◆ Understand the technical requirements of different steels on different electrodes</li> <li>◆ Understand the impact of different parameters, such as current, welding speed, angle and size of electrode</li> <li>◆ Understand the type and functions of MMAW/SMAW and arc characteristics</li> <li>◆ Understand the importance of weld joint</li> <li>◆ Understand the classification, specifications and standards of different electrodes, such as high tensile steel and low alloy steel</li> <li>◆ Understand the welding residues stresses</li> <li>◆ Understand how to avoid weldment distortion</li> <li>◆ Understand relevant code of practice for MMAW/ SMAW</li> </ul> <p>6.2 Methods and procedures of operating MMAW/ SMAW</p> <ul style="list-style-type: none"> <li>◆ Capable to apply MMAW/SMAW in the following tasks: <ul style="list-style-type: none"> <li>• Perform two sides double V groove weld at flat position</li> <li>• Perform two sides double V groove weld at horizontal position</li> <li>• Perform two sides fillet weld at horizontal/vertical position</li> <li>• Perform two sides double V groove weld at vertical up position</li> <li>• Perform two sides fillet weld at vertical up position</li> <li>• Perform two sides double V groove weld at overhead position</li> <li>• Perform two sides fillet weld at overhead position</li> </ul> </li> </ul> <p>6.3 Professionalism in MMAW/ SMAW</p> <ul style="list-style-type: none"> <li>◆ Capable to perform MMAW/ SMAW according to relevant safety guidelines and code of practice</li> </ul>	

7. Assessment Criteria	The integrated outcome requirements of this unit of competency are: <ul style="list-style-type: none"><li>(i) Capable to complete MMAW/SMAW at specified positions by different jointing methods, without causing obvious surface weld defects;</li><li>(ii) Capable to identify the classification, specifications and applications of different electrodes; and</li><li>(iii) Capable to perform MMAW/SMAW safely.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses the competency of EMCUIN225A “Basic manual metal arc welding (MMAW)/shielded metal arc welding (SMAW)”.

1. Title	Perform tungsten inert gas(TIG) / gas tungsten arc welding (GTAW) at specified positions	
2. Code	EMCUIN317A	
3. Range	Perform TIG/GTAW tasks at specified positions for parent materials like carbon steel, stainless steel and aluminum alloy, in electrical and mechanical welding workshops or work sites.	
4. Level	3	
5. Credit	5	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Preparations for TIG/GTAW</p> <ul style="list-style-type: none"> <li>◆ Understand various functions of main TIG/GTAW equipment</li> <li>◆ Understand the classification, specifications and standards of tungsten electrode</li> <li>◆ Understand the impact of TIG/GTAW parameters such as current and gas flowrate, welding speed, end shape of tungsten electrode, protective gas and diameter of gas nozzle</li> <li>◆ Understand the weldability of aluminium, stainless steel and their alloys</li> <li>◆ Understand weld defects</li> <li>◆ Understand weld joints</li> <li>◆ Understand how to avoid weld distortion</li> <li>◆ Understand code of practice for TIG/GTAW</li> </ul> <p>6.2 Apply TIG/GTAW</p> <ul style="list-style-type: none"> <li>◆ Apply TIG/GTAW techniques in the following tasks: <ul style="list-style-type: none"> <li>• Perform square edge butt weld at horizontal positions and at vertical-up position</li> <li>• Perform lap weld at horizontal position and at vertical-up position</li> <li>• Perform fillet weld at horizontal position and at vertical-up position</li> <li>• Perform butt weld for aluminium and stainless steel at horizontal position and at flat position</li> <li>• Perform lap weld for aluminium and stainless steel at horizontal position and at flat position</li> <li>• Perform fillet weld for aluminium and stainless steel at horizontal position and at flat position</li> <li>• Perform square edge butt weld at vertical-up position and at overhead position</li> <li>• Perform lap weld at vertical-up position and at overhead position</li> <li>• Perform fillet weld at vertical-up position and at overhead position</li> <li>• Perform one side full-penetration butt weld on pipe at fixed position of 45 degrees to horizontal</li> </ul> </li> </ul>	

7. Assessment Criteria	The integrated outcome requirements of this unit of competency are:  (i) Capable to complete TIG/GTAW tasks for parent materials like carbon steel, stainless steel and aluminum alloy, at specified positions by different jointing methods, without causing obvious surface weld defects; and  (ii) Capable to perform TIG/GTAW tasks safely.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses the competency of EMCUIN212A “Basic tungsten inert gas (TIG) / gas tungsten arc welding(GTAW)”.

1. Title	Perform oxy-acetylene welding(OAW) / oxyfuel and arc cutting(OAC) at specified positions
2. Code	EMCUIN318A
3. Range	Perform oxy-acetylene welding (OAW) / oxyfuel and arc cutting (OAC) at specified positions in electrical and mechanical welding workshops or work sites.
4. Level	3
5. Credit	20
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Preparations for OAW</p> <ul style="list-style-type: none"> <li>◆ Understand the classification of weld joint in oxy-acetylene welding</li> <li>◆ Understand the application and adjustment of oxy-acetylene flame</li> <li>◆ Understand OAW defects such as: <ul style="list-style-type: none"> <li>• surface porosities</li> <li>• surface cracks</li> <li>• undercut, etc</li> </ul> </li> <li>◆ Understand types of steel and formulate the cutting procedures</li> <li>◆ Understand the basic working principles of oxy-acetylene brazing</li> <li>◆ know about the classification, specification and standard of oxy-acetylene brazed filler metals</li> <li>◆ Understand code of practice for OAW / OAC</li> </ul> <p>6.2 Apply OAW / OAC</p> <ul style="list-style-type: none"> <li>◆ Apply OAW/OAC techniques safely <ul style="list-style-type: none"> <li>• Perform two sides square edge butt weld at vertical-up position and at overhead position</li> <li>• Perform fillet weld at vertical-up position and at overhead position</li> <li>• Perform plate cutting by hand-held cutting torch at overhead position</li> </ul> </li> </ul> <p>6.3 Professionalism in OAW</p> <ul style="list-style-type: none"> <li>◆ Capable to perform OAW tasks according to relevant guidelines and code of practice</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to complete OAW / OAC tasks at specified positions by different jointing methods, without causing obvious surface weld defects; and</p> <p>(ii) Capable to perform OAW / OAC tasks safely.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses the competency of EMCUIN226A ‘Basic oxy-acetylene welding(OAW) / oxyfuel and arc cutting(OAC)’

1. Title	Perform metal inert gas(MIG) / gas metal arc welding (GMAW) at specified positions	
2. Code	EMCUIN319A	
3. Range	Perform MIG/GMAW tasks for parent materials like carbon steel and aluminum alloy at specified positions in electrical and mechanical welding workshops or work sites.	
4. Level	3	
5. Credit	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Preparations for MIG/GMAW</p> <ul style="list-style-type: none"> <li>◆ Understand various functions of main MIG/GMAW equipment</li> <li>◆ Understand the classification of welding wire for MIG/GMAW</li> <li>◆ Understand the impact of MIG/GMAW parameters on weld profile, such as welding current, welding voltage, gas flowrate, welding speed and angle of welding gun, etc</li> <li>◆ Understand the weldability of aluminium and its alloy</li> <li>◆ Understand weld defects</li> <li>◆ Understand weld joints</li> <li>◆ Understand how to avoid weldment distortion</li> <li>◆ Understand code of practice for MIG/GMAW</li> </ul> <p>6.2 Apply MIG/GMAW</p> <ul style="list-style-type: none"> <li>◆ Apply techniques of MIG/GMAW in the following areas: <ul style="list-style-type: none"> <li>• Perform square edge butt weld for aluminium alloy at horizontal position and at flat position</li> <li>• Perform lap weld for aluminium alloys at horizontal position and at flat position</li> <li>• Perform fillet weld for aluminium alloys at horizontal position and at flat position</li> <li>• Perform square edge butt weld at vertical-up position and at overhead position</li> <li>• Perform lap welding at vertical-up position and at overhead position</li> <li>• Perform fillet welding at vertical-up position and at overhead position</li> <li>• Perform one-side full-penetration butt weld on pipe at fixed position of 45 degrees to horizontal</li> </ul> </li> </ul> <p>6.3 Professionalism in MIG/GMAW</p> <ul style="list-style-type: none"> <li>◆ Capable to perform MIG/GMAW tasks according to relevant guidelines and code of practice</li> </ul>	

7. Assessment Criteria	The integrated outcome requirements of this unit of competency are: <ul style="list-style-type: none"><li>(i) Capable to complete MIG/GMAW tasks for different parent materials at specified positions by different jointing methods, without causing obvious surface weld defects; and</li><li>(ii) Capable to perform MIG/GMAW tasks safely.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses the competency of EMCUIN211A “Basic metal inert gas(MIG) / gas metal arc welding (GMAW)”.

1. Title	Perform weld joint edge production and assembly according to drawings	
2. Code	EMCUIN320A	
3. Range	Perform weld joint edge production and assembly according to drawings in electrical and mechanical welding workshops or work sites.	
4. Level	3	
5. Credit	15	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Weld joint</p> <ul style="list-style-type: none"> <li>◆ Understand the effects of different weld joint parameters on weld profile, such as the bevel angle, groove angle, radius of root, land, depth of bevel, groove face, root face, etc., especially the effect of additional backing plate on the weld quality</li> <li>◆ Understand basic classification of weld e.g. groove weld, fillet weld, plug weld, slot weld, etc.</li> <li>◆ Understand the methods of production of weld joint and choose appropriate cutting tools for joint edge preparation, such as oxyacetylene cutting, plasma arc cutting, air-carbon arc cutting, etc.</li> <li>◆ Understand the code of safety for weld joint edge production and assembly</li> </ul> <p>6.2 Perform weld joint edge production and assembly according to drawings</p> <ul style="list-style-type: none"> <li>◆ Use joint edge production methods and techniques safely to perform weld joint edge production and assembly according to drawings</li> <li>◆ Use all checking and measuring tools to check the quality and dimensions of major parts of weld joints according to the details of drawings to see if they meet the engineering requirements</li> </ul> <p>6.3 Professionalism in weld joint edge production and assembly according to drawings</p> <ul style="list-style-type: none"> <li>◆ Follow the safety instructions and code of practice for weld joint edge production and assembly to perform basic weld joint edge production and assembly according to drawings</li> </ul>	
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to follow the safety instructions and code of practice for weld joint edge production and assembly to perform weld joint edge production and assembly according to drawings.</p>	
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses the competency of EMCUIN227A “Basic weld joint edge production and assembly”.	

1. Title	Perform manual metal arc welding (MMAW) / shielded metal arc welding (SMAW) on different kinds of steel according to drawings	
2. Code	EMCUIN321A	
3. Range	Perform general MMAW/SMAW tasks for common carbon steel, high carbon steel or stainless steel, according to drawings, at electrical and mechanical welding workshops or work sites.	
4. Level	3	
5. Credit	4	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Preparations for MMAW/SMAW</p> <ul style="list-style-type: none"> <li>◆ Read the drawings correctly (including symbolisation of welding symbols and welding processes)</li> <li>◆ Understand the code of safety for MMAW/SMAW</li> <li>◆ Understand the application of different electrodes</li> <li>◆ Understand technical requirements of different kinds of steel on different electrodes</li> <li>◆ Understand the classification of weld examination</li> <li>◆ Understand the mechanical properties of metals</li> <li>◆ Understand weld defects such as undercut, overlap, porosities, cracks and slag inclusions</li> </ul> <p>6.2 Perform MMAW/SMAW according to drawings</p> <ul style="list-style-type: none"> <li>◆ Estimate the impact of welding procedure on the dimensions of work piece</li> <li>◆ Perform assembly ( including root opening, tack weld and anti-distortion procedure) according to the drawing</li> <li>◆ Inspect the dimensions of weld and surface weld defects</li> <li>◆ Select electrodes according to the properties of steels</li> <li>◆ Use different electrodes for welding</li> <li>◆ Perform welding tasks according to the properties of different kinds of steel</li> </ul> <p>6.3 Professionalism in MMAW/ SMAW</p> <ul style="list-style-type: none"> <li>◆ Perform MMAW/ SMAW tasks according to relevant safety guidelines and code of practice</li> </ul>	

7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> <li>(i) Capable to follow the safety instructions and code of practice to apply MMAW/ SMAW in one-side full-penetration welding at flat position, at horizontal position, at vertical up position and at overhead position, according to drawings, on different kinds of steel;</li> <li>(ii) Capable to apply MMAW/ SMAW in fillet welding at flat position, at horizontal position, at vertical up position, at vertical down position and at overhead position, according to drawings, on different kinds of steel; and</li> <li>(iii) Capable to point out the classification, specification and application of different electrodes and to select proper electrodes according to the properties of different kinds of steel.</li> </ul>
8. Remarks	<p>This unit of competency is suitable for enhancing the competency of electrical and mechanical welding practitioners. The credit value of this unit of competency is set on the presumption that the person already possesses the competency of EMCUIN225A “Basic manual metal arc welding (MMAW) / shielded metal arc welding (SMAW)”.</p>

1. Title	Perform metal inert gas(MIG) / gas metal arc welding (GMAW) according to drawings
2. Code	EMCUIN322A
3. Range	Perform general MIG/GMAW on parent materials like carbon steel and aluminium alloy according to drawings, at electrical and mechanical welding workshops or work sites.
4. Level	3
5. Credit	4
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Preparations for MIG/GMAW</p> <ul style="list-style-type: none"> <li>◆ Understand the types of MIG/GMAW machines, their functions and properties, including the wire feeding system and arc characteristics</li> <li>◆ Understand the MIG/GMAW requirements on welding materials (e.g. welding wire)</li> <li>◆ Read the drawings correctly (including symbolisation of welding symbols and welding processes)</li> <li>◆ Understand the code of safety for MIG/GMAW</li> </ul> <p>6.2 Perform MIG/GMAW according to drawings</p> <ul style="list-style-type: none"> <li>◆ Estimate the impact of welding procedure on the dimensions of work piece</li> <li>◆ Perform assembly ( including root opening, tack weld and anti-distortion procedure) and groove preparation (including preparing and cleaning the groove before welding) according to the drawings</li> <li>◆ Inspect the dimensions of weld and surface weld defects</li> <li>◆ Understand the weldability of the joint design</li> </ul> <p>6.3 Professionalism in MIG/GMAW</p> <ul style="list-style-type: none"> <li>◆ Perform MIG/GMAW tasks according to relevant safety guidelines and code of practice</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to follow the safety instructions and code of practice to apply MIG/GMAW in one-side full-penetration welding at flat position, at horizontal position, at vertical up position , at vertical down position and at overhead positions, according to drawings, on different parent materials; and</p> <p>(ii) Capable to apply MIG/GMAW in fillet welding at flat position, at horizontal position, at vertical up position, at vertical down position and at overhead positions, according to drawings, on different parent materials.</p>
8. Remarks	This unit of competency is suitable for enhancing the competency of electrical and mechanical welding practitioners. The credit value of this unit of competency is set on the presumption that the person already possesses the competency of EMCUIN211A “Basic metal inert gas(MIG) / gas metal arc welding (GMAW)”.

1. Title	Perform oxy-acetylene welding(OAW) / oxyfuel and arc cutting(OAC) according to drawings
2. Code	EMCUIN323A
3. Range	Perform OAW / OAC tasks according to drawings at electrical and mechanical welding workshops or work sites.
4. Level	3
5. Credit	4
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Code of safety and preparations for OAW / OAC</p> <ul style="list-style-type: none"> <li>◆ Understand the code of safety for OAW / OAC</li> <li>◆ Know about the preparations for OAW / OAC</li> <li>◆ Understand functions of various OAW / OAC equipment, including high pressure cylinder, pressure regulator, flashback arrestor, welding torch and cutting torch, etc.</li> <li>◆ Understand the OAW / OAC technical requirements on welding materials (e.g. welding rods, welding flux etc.)</li> <li>◆ Read the drawings correctly (including symbolisation of welding symbol and welding processes)</li> </ul> <p>6.2 Perform OAW / OAC according to drawings</p> <ul style="list-style-type: none"> <li>◆ Estimate the impact of welding procedures on the dimensions of work piece</li> <li>◆ Perform assembly ( including root opening, tack weld and anti-distortion procedure) according to the drawing</li> <li>◆ Perform visual examination on weld profile</li> </ul> <p>6.3 Professionalism in handling OAW / OAC</p> <ul style="list-style-type: none"> <li>◆ Perform OAW / OAC tasks according to relevant safety guidelines and code of practice</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to perform OAW / OAC at flat position, at horizontal position, at vertical up position and at overhead positions according to drawings.</p>
8. Remarks	<p>This unit of competency is suitable for enhancing the competency of electrical and mechanical welding practitioners. The credit value of this unit of competency is set on the presumption that the person already possesses the competency of EMCUIN226A “Basic oxy-acetylene welding (OAW) / oxyfuel and arc cutting (OAC)”.</p>

1. Title	Perform tungsten inert gas(TIG) / gas tungsten arc welding(GTAW) according to drawings
2. Code	EMCUIN324A
3. Range	Perform general TIG /GTAW on parent materials like carbon steel, stainless steel and aluminum alloy according to drawings, at electrical and mechanical welding workshops or work sites.
4. Level	3
5. Credit	4
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Preparations for TIG /GTAW</p> <ul style="list-style-type: none"> <li>◆ Understand the types of TIG /GTAW machines, their functions, arc characteristic and polarity</li> <li>◆ Understand the TIG /GTAW requirements on welding consumable (e.g. tungsten electrode, welding wire, welding rod, shielding gas)</li> <li>◆ Read the drawings correctly (including symbolisation of welding symbol and welding processes)</li> <li>◆ Understand the code of safety for TIG /GTAW</li> </ul> <p>6.2 Perform TIG /GTAW according to drawings</p> <ul style="list-style-type: none"> <li>◆ Estimate the impact of welding procedures on the dimensions of work piece</li> <li>◆ Perform assembly ( including root opening, tack weld and anti-distortion procedure) and groove preparation (including preparing and cleaning the groove before welding) according to the drawing</li> <li>◆ Perform visual examination on weld profile</li> </ul> <p>6.3 Professionalism in TIG /GTAW</p> <ul style="list-style-type: none"> <li>◆ Perform TIG /GTAW tasks according to relevant safety guidelines and code of practice</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to follow the safety instructions and code of practice to apply TIG /GTAW in one-side full-penetration butt welding at flat position, at horizontal position, at vertical-up position and at vertical-down positions, according to drawings, on different parent materials; and</p> <p>(ii) Capable to apply TIG /GTAW in fillet welding at flat position, at horizontal position, at vertical-up position, at vertical-down position and at overhead positions, according to drawings, on different parent materials.</p>
8. Remarks	This unit of competency is suitable for enhancing the competency of electrical and mechanical welding practitioners. The credit value of this unit of competency is set on the presumption that the person already possesses the competency of EMCUIN212A “Basic tungsten inert gas(TIG) / gas tungsten arc welding(GTAW)”.

1. Title	Install mechanical equipment of trains
2. Code	EMRAIN302A
3. Range	Install mechanical equipment of trains according to installation instructions and drawings, and adjust and set such equipment.
4. Level	3
5. Credits	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Construction and basic working principles of mechanical equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Understand the construction and basic working principles of mechanical equipment of trains, including <ul style="list-style-type: none"> <li>• Bogies</li> <li>• Gangways</li> <li>• Couplers</li> <li>• Brake system devices</li> <li>• Wheel slide protection devices</li> <li>• Train door and door loop protection devices</li> </ul> </li> </ul> <p>6.2 Methods and procedures of installing and adjusting mechanical equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Able to read installation instructions and mechanical engineering drawings and select suitable information for use</li> <li>◆ Install and align major mechanical equipment of trains according to the installation instructions and drawings</li> <li>◆ Adjust and test major mechanical equipment of trains according to the installation instructions and drawings</li> <li>◆ Use typical tools and instruments for installing and checking mechanical equipment of trains effectively</li> </ul> <p>6.3 Professionalism in installing mechanical equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Capable to follow the requirements of installation instructions to ensure that the procedures and quality of installation are up to standard</li> <li>◆ Understand the safety guidelines and codes of practice for railway engineering in handling installation and adjustment for mechanical equipment of trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to install, align and adjust the train bogies, gangways and couplers correctly;</p> <p>(ii) Capable to install and align the frictional brake systems of trains correctly; and</p> <p>(iii) Capable to install the train door equipment and adjust and test the train door loop protection devices correctly.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic bench fitting techniques and knowledge of installation.

1. Title	Install pneumatic equipment of trains	
2. Code	EMRAIN303A	
3. Range	Install pneumatic equipment of trains according to installation instructions and drawings, and adjust and set such equipment.	
4. Level	3	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Construction and basic working principles of pneumatic equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Understand the construction and basic working principles of pneumatic system of trains, including <ul style="list-style-type: none"> <li>• Compressed air generation system</li> <li>• Compressed air pipe line system</li> <li>• Pipe line network</li> </ul> </li> <li>◆ Understand the construction and basic working principles of pneumatic equipment of trains, including <ul style="list-style-type: none"> <li>• Air compressor and control devices</li> <li>• Various kinds of pipe line valves</li> <li>• Pneumatic system protection devices</li> <li>• Pipe line gauges</li> </ul> </li> </ul> <p>6.2 Methods and procedures of installing and adjusting pneumatic system and equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Able to read installation instructions and pneumatic system engineering drawings and select suitable information for use</li> <li>◆ Install pneumatic system and equipment of trains according to the installation instructions and drawings</li> <li>◆ Adjust, test and set pneumatic system and equipment of trains according to the installation instructions and drawings</li> <li>◆ Perform pressure and leak tests for the entire pneumatic system and fix the leakage</li> <li>◆ Use typical tools and instruments for installing and checking pneumatic equipment and pipes of trains effectively</li> </ul> <p>6.3 Professionalism in installing pneumatic equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Capable to follow the requirements of installation instructions to ensure that the procedures and quality of installation are up to standard</li> <li>◆ Understand the safety guidelines and codes of practice in handling installation and adjustment for pneumatic system and equipment of trains</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: <ul style="list-style-type: none"><li>(i) Capable to install all kinds of valves, pipes and multiple joints correctly;</li><li>(ii) Capable to adjust the pressure switches and safety limit valves to control the pressure range of the pneumatic system correctly; and</li><li>(iii) Capable to perform pressure and leak tests for the entire pneumatic system.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic bench and pipe fitting techniques.

1. Title	Install electrical equipment and wiring of trains	
2. Code	EMRAIN304A	
3. Range	Install electrical equipment and wiring of trains according to installation instructions and drawings, and test, adjust and set such equipment and wiring.	
4. Level	3	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Construction and basic working principles of electrical system and equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and basic working principles of electrical system of trains</li> <li>◆ Understand the basic working principles of major electrical equipment of trains</li> </ul> <p>6.2 Methods and procedures of installing and adjusting electrical system and equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Able to read installation instructions and electrical engineering drawings and select suitable information for use</li> <li>◆ Install the following electrical system equipment of trains according to the installation instructions and drawings <ul style="list-style-type: none"> <li>• Pantograph</li> <li>• Lightning arrestors</li> <li>• Main power cables</li> <li>• Vacuum circuit breakers / air circuit breakers</li> <li>• Transformers</li> <li>• Electricity return brushes</li> </ul> </li> <li>◆ Test and adjust the following electrical traction control system equipment of trains according to the installation instructions and drawings <ul style="list-style-type: none"> <li>• Traction motors</li> <li>• Electronic control units</li> <li>• Circuit protection devices</li> <li>• Gearbox</li> </ul> </li> <li>◆ Install and adjust the following inverter system and equipment of trains according to the installation instructions and drawings <ul style="list-style-type: none"> <li>• Main inverters</li> <li>• Motor-alternators</li> <li>• Electronic control units</li> <li>• Circuits and equipment protection devices</li> </ul> </li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Install and test the following loop protection circuits of trains according to the installation instructions and drawings <ul style="list-style-type: none"> <li>• Train door loop protection circuits</li> <li>• Brake loop protection circuits</li> </ul> </li> <li>◆ Use typical tools and instruments for installing and checking electrical system of trains effectively</li> </ul>
6.3	<p>Professionalism in installing electrical system and equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Capable to follow the requirements of installation instructions to ensure that the procedures and quality of installation are up to standard</li> <li>◆ Understand the safety guidelines and codes of practice in handling installation and testing of electrical system and equipment of trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to install a pantograph correctly and adjust the upthrust of the carbon brush of the pantograph as required;</li> <li>(ii) Capable to install the main inverter or motor-alternator correctly and adjust its output voltage and frequency as required; and</li> <li>(iii) Capable to test the continuity, insulation and performance of the train door loop protection circuit.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses basic electrical knowledge and electrical wiring techniques.</p>

1. Title	Install trackside equipment of the railway signalling and control system	
2. Code	EMRAIN308A	
3. Range	Install trackside equipment of the railway signalling and control system at railway premises, signal switch rooms and control rooms according to installation instructions and drawings, and test, adjust and set such equipment and wiring.	
4. Level	3	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Structure and working principles of railway signalling and control system</p> <ul style="list-style-type: none"> <li>◆ Understand the working principles of railway signalling and control system</li> <li>◆ Understand the structure and working principles of railway signalling interlock system</li> <li>◆ Understand the structure and working principles of the following trackside equipment of the railway signalling and control system <ul style="list-style-type: none"> <li>• PLC and control units</li> <li>• Train location detecting devices</li> <li>• Platform screen door control devices</li> <li>• Railway signal display devices</li> <li>• Electronic interface devices</li> <li>• Points switches</li> </ul> </li> </ul> <p>6.2 Methods and procedures of installing and testing trackside equipment of the railway signalling and control system</p> <ul style="list-style-type: none"> <li>◆ Able to read installation instructions and circuit drawings and select suitable information for use</li> <li>◆ Install the trackside equipment of the railway signalling and control system according to the installation instructions and drawings</li> <li>◆ Adjust, test and set the trackside equipment of the railway signalling and control system according to the installation instructions and drawings</li> <li>◆ Use typical tools and instruments for installing and checking electronic and electrical equipment effectively</li> </ul> <p>6.3 Professionalism in installing trackside equipment of the railway signalling and control system</p> <ul style="list-style-type: none"> <li>◆ Capable to follow the requirements of installation instructions to ensure that the procedures and quality of installation are up to standard</li> <li>◆ Understand the safety guidelines and codes of practice for railway signalling works in handling installation and testing of trackside equipment of the railway signalling and control system</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: <ul style="list-style-type: none"><li>(i) Capable to install and adjust the trackside equipment of the railway signalling and control system correctly as required; and</li><li>(ii) Capable to test the operation of the trackside equipment of the railway signalling and control system effectively when working with train receivers.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic electronic and electrical knowledge.

1. Title	Install train air-conditioning system and equipment	
2. Code	EMRAIN309A	
3. Range	Install train air-conditioning system and equipment according to installation instructions and drawings, and adjust and set such equipment.	
4. Level	3	
5. Credits	5	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Construction and working principles of train air-conditioning system and equipment</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of train air-conditioning systems</li> <li>◆ Understand the construction and working principles of train air-conditioners</li> <li>◆ Understand the working principles of the control and protection devices for train air-conditioning systems</li> </ul> <p>6.2 Methods and procedures of installing and testing train air-conditioning system and equipment</p> <ul style="list-style-type: none"> <li>◆ Able to read installation instructions and mechanical and electrical drawings and select suitable information for use</li> <li>◆ Install and align the air-conditioners and mechanical devices of trains according to the installation instructions and drawings</li> <li>◆ Install the control circuits and protection devices for the train air-conditioning systems according to the installation instructions and drawings</li> <li>◆ Adjust and test the train air-conditioning systems according to the installation instructions and drawings</li> <li>◆ Charge and recover refrigerant correctly and effectively</li> <li>◆ Use typical instruments and tools for checking and installing medium-scale air-conditioning and refrigeration systems and tools for charging and recovering refrigerant effectively</li> </ul> <p>6.3 Professionalism in installing train air-conditioning system and equipment</p> <ul style="list-style-type: none"> <li>◆ Capable to follow the requirements of installation instructions to ensure that the procedures and quality of installation are up to standard</li> <li>◆ Understand the safety and environment protection guidelines and codes of practice in handling installation and testing of train air-conditioning system and equipment</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: <ul style="list-style-type: none"><li>(i) Capable to install and adjust the air-conditioners of trains and their control devices correctly; and</li><li>(ii) Capable to undertake the whole process of charging and recovering refrigerant for the air-conditioner correctly.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic techniques of bench fitting and knowledge of air-conditioning and refrigeration engineering.

1. Title	Apply fault finding techniques to find the root causes of fault
2. Code	EMCUOR301A
3. Range	Analyze the fault and performance information on the maintenance records of the electrical and mechanical equipment, and apply the fault finding techniques to find out the root causes of fault.
4. Level	3
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Analyze the fault and record of the electrical and mechanical equipment</p> <ul style="list-style-type: none"> <li>◆ Understand the classification and techniques to retrieve fault information on the maintenance of the electrical and mechanical equipment</li> </ul> <p>6.2 Apply fault finding techniques to find the root of fault</p> <ul style="list-style-type: none"> <li>◆ Analyze the fault information and performance record of the equipment, and enhance the effectiveness of fault finding with the help of the following : <ul style="list-style-type: none"> <li>• Bathtub curve</li> <li>• The failure of similar equipment</li> </ul> </li> <li>◆ Apply the following fault finding techniques to enhance the effectiveness detecting the electrical and mechanical faults <ul style="list-style-type: none"> <li>• Middle point tracing technique</li> <li>• Input signals injection technique for tracing fault origin</li> <li>• Use potential divider method to calculate the location of fault</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to retrieve and analyze the fault information effectively on maintenance record of the electrical and mechanical equipment, and apply the fault finding techniques to find out the root cause of fault effectively.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic electrical and mechanical knowledge.

1. Title	Repair overhead line and related equipment
2. Code	EMCUOR302A
3. Range	Find and locate the faults in the overhead line and related equipment of the overhead line system, and repair them.
4. Level	3
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Operating principles of overhead line system ♦ Understand the structure and operating principles of overhead line system</p> <p>6.2 Repair overhead line systems ♦ Use instruments to find and locate the faults in the overhead line and related equipment, and understand the causes and repairing method of the faults ♦ Repair the faults in the overhead line and related equipment</p> <p>6.3 Professionalism in repairing overhead line systems ♦ Understand the potential hazards of overhead line, and follow the safety regulations and code of practice to carry out overhead line system and equipment repair and replacement</p>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to use instruments to find and locate the faults in the overhead line and related equipment, and follow the safety regulations and code of practice to carry out overhead line system and equipment repair and replacement.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of electricity.

1. Title	Repair faults in current transformers and control equipment
2. Code	EMCUOR304A
3. Range	Repair the faults in current transformers and control equipment at servicing stations or external sites.
4. Level	3
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of current transformer ♦ Understand the structure and working principles of current transformer</p> <p>6.2 Repair current transformer ♦ Repair main circuit of current transformer</p> <ul style="list-style-type: none"> <li>• Measure and check the main circuit of current transformer to find out the root causes of fault according to the fault symptoms and the working principles of current transformer</li> <li>• Repair the identified fault of faulty equipment or components</li> </ul> <p>♦ Repair the power electronic control equipment of the current transformer</p> <ul style="list-style-type: none"> <li>• Measure and check the control unit of current transformer to find out the origin of fault according to the fault symptoms as well as the structure and working principles of current transformer control system</li> <li>• Repair the fault after finding out the fault equipment or component</li> </ul> <p>♦ Use the information stored in the data logging device to enhance the efficiency of fault finding</p> <ul style="list-style-type: none"> <li>• Access and use the information of the data logging device to enhance the efficiency of finding the fault in the current transformer</li> </ul> <p>6.3 Professionalism in repairing current transformer and its control equipment ♦ Repair current transformer and its control equipment according to the safety instructions and code of practice</p>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to find out the fault in the main circuit of a current transformer within a reasonable period of time according to the signs of fault; and</p> <p>(ii) Capable to find out the fault in the electronic power control equipment of a current transformer within a reasonable period of time according to the symptoms of fault.</p>
8. Remarks	This unit of competency is suitable for training electrical engineering personnel. The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of electrical installation.

1. Title	Repair air-conditioning system and control equipment
2. Code	EMCUOR305A
3. Range	Perform fault repair for air-conditioning systems and control equipment at servicing stations or worksites.
4. Level	3
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Construction and working principles of air-conditioning system and control equipment</p> <ul style="list-style-type: none"> <li>◆ Understand the construction and working principles of air-conditioning system and control equipment; including: <ul style="list-style-type: none"> <li>• Refrigeration system of unitary air-conditioner</li> <li>• Air distribution equipment such as damper</li> <li>• Electric control equipment and circuit of air-conditioning system</li> </ul> </li> </ul> <p>6.2 Typical faults in air-conditioning system and control equipment and their repairing methods</p> <ul style="list-style-type: none"> <li>◆ Troubleshoot and repair refrigeration system of a unitary air-conditioner, including the following components <ul style="list-style-type: none"> <li>• compressor</li> <li>• evaporator</li> <li>• condenser</li> <li>• refrigeration pipe</li> <li>• valves and related equipment</li> </ul> </li> <li>◆ Troubleshoot and repair air distribution equipment, such as damper of an air-conditioner</li> <li>◆ Troubleshoot and repair control equipment and circuit of an air-conditioning system</li> <li>◆ Use common repairing and testing instruments effectively</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to Troubleshoot and repair correctly and effectively the equipment in a unitary air-conditioning and refrigerating system.</p>
8. Remarks	This unit of competency is suitable for training air-conditioning engineering personnel. The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of electrical services.

1. Title	Repair faults in generator and its accessories
2. Code	EMCUOR307A
3. Range	Repair the faults in generator and its accessories at servicing stations or external sites.
4. Level	3
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Structure and working principles of generator and its accessories      ♦ Understand the structure and working principles of generator and its accessories</p> <p>6.2 Find and repair faults in generator and its accessories      ♦ Repair the fault in a generator</p> <ul style="list-style-type: none"> <li>• Check the following generator components and accessories to find out the root of fault according to the signs of fault and based on the understanding of the working principles of generator: <ul style="list-style-type: none"> <li>▸ All magnetic coils in the generator</li> <li>▸ Magnetic circuit and equipment</li> <li>▸ Overspeed mechanical protector</li> <li>▸ Auxiliary generator</li> <li>▸ Battery unit</li> </ul> </li> <li>• Repair the fault after finding out the fault equipment or component</li> </ul> <p>6.3 Professionalism in repairing generator and its accessories      ♦ Repair the generator and its accessories according to the safety regulations and code of practice</p> <p>♦ Write a simple repair report according to the damage of the generator and its accessories</p>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to find out the faults in generator and its accessories within a reasonable period of time according to the symptoms of fault;</p> <p>(ii) Capable to handle and eliminate the fault in generator and its accessories effectively; and</p> <p>(iii) Capable to write simple repair reports.</p>
8. Remarks	This unit of competency is suitable for training electrical and mechanical engineering personnel involving in the work of generators. The credit value of this unit of competency is set on the presumption that the person already possesses basic competency of repairing generator and its accessories.

1. Title	Repair faults in diesel engines
2. Code	EMCUOR308A
3. Range	Repair the faults in diesel engines at servicing stations or external sites.
4. Level	3
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Structure and working principles of diesel engine</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of diesel engine</li> </ul> <p>6.2 Find and repair faults in diesel engines</p> <ul style="list-style-type: none"> <li>◆ Repair the fault in diesel engine <ul style="list-style-type: none"> <li>• Check the diesel engine and its control equipment, including the following equipment and systems, to find out the root of fault according to the signs of fault by applying the working principles of diesel engine and its control equipment: <ul style="list-style-type: none"> <li>▶ Engine cylinder and its mechanism</li> <li>▶ Fuel supply system</li> <li>▶ Fuel injector and filter</li> <li>▶ Governor</li> <li>▶ Supercharger and turbo-charger</li> <li>▶ Cooling system and equipment</li> <li>▶ Lubricating system and equipment</li> <li>▶ Initial acceleration mechanical protection</li> </ul> </li> <li>• Repair the fault after finding out the fault equipment or component</li> </ul> </li> </ul> <p>6.3 Professionalism in repairing diesel engines</p> <ul style="list-style-type: none"> <li>◆ Repair the diesel engine according to the safety regulations and code of practice</li> <li>◆ Write a simple repair report according to the damage of the diesel engine</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to find out the fault in the diesel engine within a reasonable period of time according to the symptoms of fault;</p> <p>(ii) Capable to handle and eliminate effectively the fault in the diesel engine; and</p> <p>(iii) Capable to write simple repair reports.</p>
8. Remarks	<p>This unit of competency is suitable for training electrical and mechanical engineering personnel involving in the work of diesel engine. The credit value of this unit of competency is set on the presumption that the person already possesses basic competency of repairing diesel engines.</p>

1. Title	Repair faults in control and protection device of diesel engines and generators	
2. Code	EMCUOR309A	
3. Range	Repair faults in control and protection device of diesel engines and generators in servicing stations or external sites.	
4. Level	3	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Composition and working principles of control and protection device of diesel engines and generators</p> <ul style="list-style-type: none"> <li>◆ Understand the composition and working principles of control and protection device of diesel engines and generators</li> </ul> <p>6.2 Find and repair faults in control and protection device of diesel engines and generators</p> <ul style="list-style-type: none"> <li>◆ Repair faults in control equipment of diesel engines and generators <ul style="list-style-type: none"> <li>• Check the control equipment of diesel engines and generators, including the following, to find out the root of fault according to the signs of fault by applying the working principles of control equipment of diesel engines and generators: <ul style="list-style-type: none"> <li>▶ Speed controller of the diesel engine</li> <li>▶ Magnetic field control circuit and equipment of the generator</li> <li>▶ Load regulator of the generator and its control circuit</li> <li>▶ Control circuit of the auxiliary generator</li> <li>▶ Control circuit of the battery unit</li> <li>▶ Circuit breaker and relay</li> </ul> </li> <li>• Repair the fault after finding out the faulty equipment or component</li> </ul> </li> <li>◆ Repair the fault in protection device of diesel engines and generators <ul style="list-style-type: none"> <li>• Repair the protection device of diesel engines and generators, including: <ul style="list-style-type: none"> <li>▶ Engine and generator overspeed protection circuit</li> <li>▶ Engine overheat alarm</li> <li>▶ Water thermometer</li> <li>▶ Generator overload protector</li> </ul> </li> <li>• Measure data output of the generator</li> <li>• Repair the fault after finding out the faulty equipment or component</li> </ul> </li> </ul>	

	<p>6.3 Professionalism in repairing control and protection device of diesel engines and generators</p> <ul style="list-style-type: none"> <li>◆ Repair the control and protection device of diesel engines and generators according to the safety regulations and code of practice</li> <li>◆ Write a simple repair report according to the damage of the control and protection device of diesel engines and generators</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> <li>(i) Capable to find out the fault in the control and protection device of a diesel engine within a reasonable period of time according to the symptoms of fault;</li> <li>(ii) Capable to find out the fault in the control and protection device of a generator within a reasonable period of time according to the symptoms of fault;</li> <li>(iii) Capable to handle and eliminate effectively the fault in the control and protection device of diesel engines and generators; and</li> <li>(iv) Capable to write simple repair reports.</li> </ul>
8. Remarks	<p>This unit of competency is suitable for training electrical and mechanical engineering personnel involving in the work of diesel generator. The credit value of this unit of competency is set on the presumption that the person already possesses basic competency of repairing control and protection device of diesel engines and generators.</p>

1. Title	Repair the faults in electrical systems of electric trains	
2. Code	EMRAOR301A	
3. Range	Identify and repair the faults in electrical systems of electric trains at train maintenance centres or during operation of trains.	
4. Level	3	
5. Credits	5	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of electrical systems and equipment of electric trains and basic fault finding techniques</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the electrical systems and equipment of electric trains</li> <li>◆ Be familiar with the circuits and pipe lines of the electrical systems and equipment of electric trains</li> <li>◆ Master the basic fault finding techniques</li> </ul> <p>6.2 Methods and procedures of finding and repairing the faults in electrical systems and control circuits of electric trains</p> <ul style="list-style-type: none"> <li>◆ Able to read the electrical and pneumatic engineering drawings and check the circuits and pipe lines systematically and efficiently</li> <li>◆ Check the circuits of the following electrical systems and equipment of electric trains to find the root causes of faults according to the fault symptoms <ul style="list-style-type: none"> <li>• Pantograph</li> <li>• Lightning arrestors</li> <li>• Circuit breakers</li> <li>• Main power lines</li> <li>• Main inverters</li> <li>• Electricity return brushes</li> <li>• System control circuits</li> </ul> </li> <li>◆ Check the pipe lines of the pantographs and circuit breakers to find the roots of faults according to the fault symptoms</li> <li>◆ Repair the faults after identifying the fault equipment or components</li> <li>◆ Use general electrical and pneumatic device repairing and testing instruments and tools efficiently</li> </ul> <p>6.3 Professionalism in repairing faults in electrical systems of electric trains</p> <ul style="list-style-type: none"> <li>◆ Understand the safety guidelines as required by the law and codes of practice in removing faults in electrical systems of electric trains</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: <ul style="list-style-type: none"><li>(i) Capable to identify the faults in the electrical system control circuits of electric trains within a reasonable period of time according to the fault symptoms;</li><li>(ii) Capable to identify the pneumatic faults in the electrical system equipment of electric trains within a reasonable period of time according to the fault symptoms; and</li><li>(iii) Capable to identify the system faults in the electrical system equipment of electric trains within a reasonable period of time according to the fault symptoms.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of electrical and pneumatic equipment.

1. Title	Repair the faults in electric traction control systems of trains	
2. Code	EMRAOR302A	
3. Range	Identify and repair the faults in electric traction control systems and equipment of trains at train maintenance centres or during operation of trains.	
4. Level	3	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of electric traction control systems and equipment of trains and basic fault finding techniques</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the electric traction control systems and equipment of trains</li> <li>◆ Be familiar with the main circuits and control circuits of the electric traction control systems of trains</li> <li>◆ Master the basic fault finding techniques</li> </ul> <p>6.2 Methods and procedures of finding and repairing the faults in electric traction control systems of trains</p> <ul style="list-style-type: none"> <li>◆ Able to read the electrical engineering drawings and check the circuits systematically and efficiently</li> <li>◆ Check the circuits and equipment of the electric traction control systems of trains to find the root causes of faults according to the fault symptoms <ul style="list-style-type: none"> <li>• Main circuits</li> <li>• Control circuits and equipment</li> <li>• Electronic control equipment</li> <li>• Protection equipment</li> <li>• Regenerative braking devices</li> </ul> </li> <li>◆ Repair the faults effectively after identifying the fault in equipment or components</li> <li>◆ Use general electrical repairing and testing instruments and tools efficiently</li> </ul> <p>6.3 Professionalism in repairing faults in electric traction control systems of trains</p> <ul style="list-style-type: none"> <li>◆ Understand the safety guidelines as required by the law and codes of practice in removing faults in electric traction control systems of trains</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: <ul style="list-style-type: none"><li>(i) Capable to identify the faults in the control circuits of the electric traction control systems of trains within a reasonable period of time according to the fault symptoms;</li><li>(ii) Capable to identify the faults in the electronic control equipment of the electric traction control systems of trains within a reasonable period of time according to the fault symptoms; and</li><li>(iii) Capable to identify the faults in the protection equipment of the electric traction control systems of trains within a reasonable period of time according to the fault symptoms.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of electricity.

1. Title	Repair the faults in pneumatic friction brake systems of trains
2. Code	EMRAOR303A
3. Range	Identify and repair the faults in pneumatic friction brake systems and control equipment at train maintenance centres or during operation of trains.
4. Level	3
5. Credits	7
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Structure and working principles of pneumatic friction brake systems and equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the pneumatic friction brake systems and equipment of trains</li> <li>◆ Be familiar with the control circuits and pipe lines of the pneumatic friction brake systems of trains</li> </ul> <p>6.2 Methods and procedures of finding and repairing the faults in pneumatic brake systems and equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Able to read the electrical and pneumatic engineering drawings and check the circuits and pneumatic pipe lines systematically and efficiently</li> <li>◆ Check the pneumatic friction brake systems and equipment of trains to find the root causes of faults according to the fault symptoms, including <ul style="list-style-type: none"> <li>• Electric-controlled pneumatic brake circuits</li> <li>• Control brake pneumatic pipe lines</li> <li>• Emergency brakes and protection brake loops</li> <li>• Pneumatic brake and anti-magnetic / regenerative brake interface devices</li> </ul> </li> <li>◆ Check and test the mechanical devices of train brakes to find the root causes of faults according to the fault symptoms, including <ul style="list-style-type: none"> <li>• Brake actuators</li> <li>• Brake control pneumatic pipe lines</li> <li>• Brake pads and brake pad hangers</li> </ul> </li> <li>◆ Check and test the train wheel slide protection devices to find the root causes of faults according to the fault symptoms, including <ul style="list-style-type: none"> <li>• Electronic control equipment</li> <li>• Control circuits and equipment</li> <li>• Control pneumatic pipe lines and equipment</li> </ul> </li> <li>◆ Check the parking brake equipment to find the root causes of faults according to the fault symptoms, including <ul style="list-style-type: none"> <li>• Parking brake actuators</li> <li>• Parking brake control circuits and equipment</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>◆ Repair the faults after identifying the fault equipment or components</li> <li>◆ Use general electrical and pneumatic device repairing and testing instruments and tools efficiently</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in removing faults in pneumatic friction brake systems of trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to identify the faults in the pneumatic brake system control circuits within a reasonable period of time according to the fault symptoms;</li> <li>(ii) Capable to identify the faults in the control equipment of pneumatic brake systems within a reasonable period of time according to the signs of faults; and</li> <li>(iii) Capable to identify the faults in the train wheel slide protection devices within a reasonable period of time according to the fault symptoms.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of electrical, mechanical and pneumatic equipment.</p>

1. Title	Repair the faults in pneumatic systems of trains	
2. Code	EMRAOR304A	
3. Range	Identify and repair the faults in pneumatic systems and equipment at train maintenance centres or during operation of trains.	
4. Level	3	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of pneumatic systems and equipment of trains and basic fault finding techniques</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the pneumatic systems of trains</li> <li>◆ Understand the structure and working principles of the pneumatic equipment of trains, including <ul style="list-style-type: none"> <li>• Air compressors and control circuits</li> <li>• Pipe network and fittings</li> <li>• Various kinds of valves</li> <li>• Pressure regulators</li> <li>• Pressure gauges</li> <li>• Pneumatic-operated equipment</li> <li>• Equipment to maintain the compressed air quality</li> </ul> </li> <li>◆ Be familiar with the control circuits and pneumatic pipe lines of the pneumatic systems of trains</li> <li>◆ Master the basic fault finding techniques</li> </ul> <p>6.2 Methods and procedures of identifying and repairing the faults in pneumatic systems and equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Able to read the electrical and pneumatic engineering drawings and check the circuits and pneumatic pipe lines systematically and efficiently</li> <li>◆ Check the air compressing systems and control circuits to find the root causes of faults according to the fault symptoms</li> <li>◆ Check the various pneumatic pipe line regulating equipment and fittings to find the root causes of faults according to the fault symptoms</li> <li>◆ Check the pneumatic control equipment to find the root causes of faults according to the fault symptoms</li> <li>◆ Check the equipment to maintain the compressed air quality to find the root causes of faults according to the fault symptoms, including <ul style="list-style-type: none"> <li>• Dryers</li> <li>• Filters</li> <li>• Automatic drain valves</li> </ul> </li> <li>◆ Repair the faults after identifying the fault equipment or components</li> <li>◆ Use general electrical and pneumatic device repairing and testing instruments and tools efficiently</li> </ul>	

	<p>6.3 Professionalism in repairing faults in pneumatic systems and equipment of trains</p> <p>◆ Understand the safety guidelines as required by the law and codes of practice in removing faults in pneumatic systems and equipment of trains</p>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to identify the faults in the air compressor control circuits within a reasonable period of time according to the fault symptoms;</p> <p>(ii) Capable to identify the faults in the pipe line network of pneumatic systems within a reasonable period of time according to the fault symptoms; and</p> <p>(iii) Capable to identify the faults in the equipment to maintain the compressed air quality within a reasonable period of time according to the fault symptoms.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of pneumatic and electrical equipment.</p>

1. Title	Repair the faults in electric multi-car train door systems
2. Code	EMRAOR305A
3. Range	Check the circuits and pneumatic pipe lines, and test the train door system performance according to the fault report and fault symptoms to identify the fault parts; handle and remove the faults in the actual situation at train maintenance centres or during train operations.
4. Level	3
5. Credits	5
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of electric multi-car train door systems and equipment and basic fault finding techniques</p> <ul style="list-style-type: none"> <li>◆ Understand the working principles of the electric multi-car train door systems and equipment, including <ul style="list-style-type: none"> <li>• Train door control circuits</li> <li>• Train door electric, pneumatic and mechanical equipment</li> <li>• Train door closing status confirmation and interlock devices</li> </ul> </li> <li>◆ Master the basic fault finding techniques</li> </ul> <p>6.2 Methods and procedures of identifying and repairing the faults in electric multi-car train door systems and equipment</p> <ul style="list-style-type: none"> <li>◆ Able to read the electrical, mechanical and pneumatic engineering drawings and check the circuits, pneumatic pipe lines and mechanical devices systematically and efficiently</li> <li>◆ Identify, remove and handle the faults in train door systems and equipment according to the information and fault symptoms</li> <li>◆ Use general electrical, pneumatic and mechanical device repairing and testing instruments and tools efficiently</li> </ul> <p>6.3 Professionalism in repairing faults in electric multi-car train door systems and equipment</p> <ul style="list-style-type: none"> <li>◆ Understand the safety guidelines as required by the law and codes of practice in eliminating faults in electric multi-car train door systems and equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to identify and remove the faults in train door control circuits systematically and efficiently according to the fault symptoms;</p> <p>(ii) Capable to identify and remove the faults in train door closing status according to the fault symptoms.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic electrical and mechanical knowledge.

1. Title	Repair the faults in train bogies, gangways and couplings
2. Code	EMRAOR306A
3. Range	Check and test the performance of train bogies, gangways and couplers according to the fault report and fault symptoms to identify the fault parts; handle and remove the faults according to the actual situation at train maintenance centres or during train operations.
4. Level	3
5. Credits	5
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of train bogies, gangways and couplings and basic fault finding techniques</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the train bogies, gangways and couplers, including <ul style="list-style-type: none"> <li>• Mechanical structure of bogies</li> <li>• Suspension and shock absorption equipment</li> <li>• Devices inside and outside gangways</li> <li>• Automatic couplers</li> <li>• Bar couplers</li> </ul> </li> <li>◆ Master the basic fault finding techniques</li> </ul> <p>6.2 Methods and procedures of finding and repairing the faults in train bogies, gangways and couplings</p> <ul style="list-style-type: none"> <li>◆ Able to read the mechanical engineering drawings and check the mechanical devices systematically and efficiently</li> <li>◆ Check the train bogies to find the root causes of faults according to the information and fault symptoms</li> <li>◆ Check the train gangways to find the root causes of faults according to the information and fault symptoms</li> <li>◆ Check the train couplers to find the root causes of faults according to the information and fault symptoms</li> <li>◆ Capable to perform fault findings on equipment or component and subsequently remove the faults</li> <li>◆ Use general mechanical device repairing and testing instruments and tools efficiently</li> </ul> <p>6.3 Professionalism in repairing faults in train bogies, gangways and couplers</p> <ul style="list-style-type: none"> <li>◆ Understand the safety guidelines as required by the law and codes of practice in repairing faults in train bogies, gangways and couplers</li> </ul>

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: <ul style="list-style-type: none"><li>(i) Capable to identify a decoupling fault in an automatic couplers systematically and efficiently according to the fault symptoms;</li><li>(ii) Capable to identify the root cause of fault of having some noise near the train bogie according to the fault symptoms.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic mechanical knowledge.

1. Title	Repair the faults in the train line and pneumatic pipe line controlling the whole train
2. Code	EMRAOR307A
3. Range	Identify and repair the faults in the train line and pipe line according to the fault report and fault symptoms at train maintenance centres or during of train operations.
4. Level	3
5. Credits	4
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of the control and protection system of the train line and pneumatic pipe line controlling the whole train and basic fault finding techniques</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the train line control and protection system for the whole train</li> <li>◆ Understand the structure and working principles of the pneumatic pipe line control and protection system for the whole train</li> <li>◆ Master the basic fault finding techniques</li> </ul> <p>6.2 Methods and procedures of finding and repairing the faults in the train line and pneumatic pipe line controlling and protecting the whole train</p> <ul style="list-style-type: none"> <li>◆ Able to read the electrical and pneumatic engineering drawings and check the train line and pneumatic pipe line systematically and efficiently</li> <li>◆ Check and test the control and protection train line running through the whole train and relevant equipment to find the root causes of faults according to the information and fault symptoms</li> <li>◆ Use general electrical and pneumatic device repairing and testing instruments and tools efficiently</li> <li>◆ Check the protection pneumatic pipe line running through the whole train and relevant equipment to find the root causes of faults according to the information and fault symptoms</li> <li>◆ Remove and handle the faults after identifying the fault train line, pipe line, equipment or component</li> </ul> <p>6.3 Professionalism in repairing faults in the train line and pneumatic pipe line controlling the whole train</p> <ul style="list-style-type: none"> <li>◆ Understand the safety guidelines as required by the law and codes of practice in removing faults in the control and protection loops of train line and pneumatic pipe line</li> </ul>

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is:  (i) Capable to identify a fault in a train door protection loop systematically and efficiently according to the fault symptoms;  (ii) Capable to identify, remove and handle a fault in a train protection brake loop (including train line loop and pneumatic pipe line loop) systematically and efficiently according to the fault symptoms.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of electrical and pneumatic equipment.

1. Title	Repair the faults in railway overhead feeder systems	
2. Code	EMRAOR308A	
3. Range	Identify and repair the faults in railway overhead feeder systems and protection devices in areas with railway overhead lines or power control rooms.	
4. Level	3	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of railway overhead feeder systems and equipment and basic fault finding techniques</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the railway overhead feeder systems, including <ul style="list-style-type: none"> <li>• Contact wire</li> <li>• Catenary wire</li> <li>• Insulator</li> <li>• Isolator</li> </ul> </li> <li>◆ Understand the structure and working principles of the switching devices and electricity quality improvement devices of overhead feeder systems, including: <ul style="list-style-type: none"> <li>• Power switching devices</li> <li>• Circuit breakers</li> <li>• Interlock devices</li> <li>• Electricity quality improvement devices</li> </ul> </li> <li>◆ Understand the structure and working principles of the control and protection devices of overhead feeder systems, including <ul style="list-style-type: none"> <li>• PLC control unit</li> <li>• Distance and district overcurrent protection devices</li> <li>• Earth fault protection devices</li> </ul> </li> <li>◆ Master the basic fault finding techniques</li> </ul> <p>6.2 Methods and procedures of identifying and repairing the faults in railway overhead feeder systems and equipment</p> <ul style="list-style-type: none"> <li>◆ Able to read the electrical engineering drawings and check the circuits systematically and efficiently</li> <li>◆ Check the main line system, the switching and isolation devices and electricity quality improvement device of the overhead feeder system according to the information and fault symptoms so as to identify the fault equipment or components</li> <li>◆ Check the control and protection devices of the overhead feeder system according to the information and fault symptoms so as to identify the fault equipment or components</li> <li>◆ Remove the faults after identifying the fault equipment or components</li> <li>◆ Use general electrical and overhead line repairing and testing instruments and tools efficiently</li> </ul>	

	<p>6.3 Professionalism in repairing faults in railway overhead feeder systems and equipment</p> <p>◆ Understand the safety guidelines as required by the law and codes of practice in removing faults in railway overhead feeder systems and equipment</p>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to identify the faults in the railway overhead feeder system safely and efficiently according to the information and fault symptoms;</p> <p>(ii) Capable to identify the faults in the control and protection devices of the railway overhead feeder system safely and efficiently according to the information and fault symptoms.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of electricity.</p>

1. Title	Repair electrical devices for electric traction control system	
2. Code	EMCUMA302A	
3. Range	Repair devices for electric traction control system, with the use of electrical and pneumatic equipment, at servicing stations or work sites.	
4. Level	3	
5. Credit	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Principles of devices for electric traction control system</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and principles of devices for electric traction control system</li> </ul> <p>6.2 Methods of repairing electrical devices for electric traction control system</p> <ul style="list-style-type: none"> <li>◆ Repair DC traction motor <ul style="list-style-type: none"> <li>• Apply repairing techniques in maintenance of DC traction motors, including commutators, brushes and brush holders, winding, bearing and insulation devices, according to instructions</li> <li>• Measure and replace brushes; grind brush springs and adjust their strength</li> <li>• Test the performance of DC motors</li> </ul> </li> <li>◆ Repair AC traction motors <ul style="list-style-type: none"> <li>• Apply repairing techniques in maintenance of AC traction motors, including checking and repairing winding, bearing and insulation devices, according to instructions</li> <li>• Test the performance of AC motors</li> </ul> </li> <li>◆ Repair the control circuit and equipment of traction motors <ul style="list-style-type: none"> <li>• Check and maintain control equipment, including forward/reverse switches, contactors and relays, according to repairing instructions</li> <li>• Perform visual inspection of the control circuit of a traction motor</li> <li>• Check and maintain transmission gear and gearboxes according to repairing instructions</li> </ul> </li> </ul>	

7. Assessment Criteria	The integrated outcome requirements of this unit of competency are:  (i) Capable to repair DC traction motors and adjust the strength of their brush springs correctly and effectively according to instructions;  (ii) Capable to repair DC motors, measure the resistance of winding and test the motor performance correctly and effectively according to repairing instructions; and  (iii) Capable to repair the control circuits and equipment of traction motors correctly and effectively according to instructions.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic electrical and mechanical knowledge.

1. Title	Repair electronic control equipment for traction control system and main current transformer	
2. Code	EMCUMA303A	
3. Range	Use electronic control equipment repairing techniques to service electronic control equipment for traction control system and main current transformer at servicing stations or work sites.	
4. Level	3	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Basic principles of operating control equipment for traction control system and main current transformer</p> <ul style="list-style-type: none"> <li>◆ Understand the basic principles of operating control equipment for traction control system and main current transformer, including: <ul style="list-style-type: none"> <li>• Main electronic power circuit equipment for traction control system</li> <li>• Electronic power control circuit equipment for traction control system</li> <li>• Main electronic power circuit equipment for main current transformer</li> <li>• Electronic power control circuit equipment for main current transformer</li> </ul> </li> </ul> <p>6.2 Methods of repairing traction control system and main current transformer</p> <ul style="list-style-type: none"> <li>◆ Use electronic power control equipment repairing techniques to repair main electronic power circuit equipment for traction control system, including: <ul style="list-style-type: none"> <li>• Power control components</li> <li>• Reactor</li> <li>• Main circuit</li> </ul> </li> <li>◆ Use electronic control equipment repairing techniques to repair electronic power control circuit equipment for traction control system, including: <ul style="list-style-type: none"> <li>• Testing electronic power protection devices</li> <li>• Set various electronic control units</li> </ul> </li> <li>◆ Use inverter repairing techniques to repair service main electronic power circuit equipment for main current transformer, including: <ul style="list-style-type: none"> <li>• Power control components</li> <li>• Reactor</li> <li>• Main circuit</li> </ul> </li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Use electronic control equipment repairing techniques to repair electronic power control circuit equipment for main current transformer, including: <ul style="list-style-type: none"> <li>• Testing electronic power protection devices</li> <li>• Set various electronic control units</li> <li>• Check and test data logging functions</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> <li>(i) Capable to repair, test and set all electronic power control units for traction control system correctly and effectively; and</li> <li>(ii) Capable to repair, test and set all electronic power control units for main current transformer correctly and effectively.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of electronic control equipment for traction control system and main current transformer.</p>

1. Title	Repair air-conditioning and refrigeration systems	
2. Code	EMCUMA304A	
3. Range	Repair air-conditioning and refrigeration systems in servicing stations or external sites	
4. Level	3	
5. Credit	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Construction and operating principles of air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> <li>◆ Understand the construction and operating principles of air-conditioning and refrigeration systems, including the refrigerant piping, condenser, filter and evaporator, etc.</li> </ul> <p>6.2 Method of repairing air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> <li>◆ Clean and wash the air-conditioning and refrigeration systems, including: <ul style="list-style-type: none"> <li>• Air filter</li> <li>• Using nitrogen to flush the refrigerant piping</li> <li>• Water-cooled condenser and defouling</li> <li>• Air-cooled condenser</li> <li>• Evaporator</li> </ul> </li> <li>◆ Pressure leak check and vacuuming of refrigeration system <ul style="list-style-type: none"> <li>• Use nitrogen to perform pressure leak check for the refrigeration system</li> <li>• Vacuum the refrigeration system with the compressor</li> <li>• Vacuum the refrigeration system with the vacuum pump</li> </ul> </li> <li>◆ Charge the refrigeration system with refrigerant <ul style="list-style-type: none"> <li>• Determine the correct amount of refrigerant to be charged</li> <li>• Understand the advantages and disadvantages of charging refrigerant</li> <li>• Charge a large refrigeration system with refrigerant at the charging valve</li> <li>• Charge liquid refrigerant at the discharge valve of compressor</li> <li>• Charge vapour refrigerant at the suction valve of compressor</li> <li>• Charge refrigerant to a hermetic compressor</li> <li>• Know the methods of liquid charging and vapour charging of refrigerant</li> <li>• Understand the safety precautions for charging liquid refrigerant</li> </ul> </li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Evacuate air and water from the refrigeration system <ul style="list-style-type: none"> <li>• Understand the harm of air and water in the refrigeration system</li> <li>• Determine whether there is air and water in the refrigeration system</li> <li>• Evacuate the air from the refrigeration system</li> <li>• Evacuate the water from the refrigeration system</li> </ul> </li> <li>◆ Pump down and recover refrigerant from the refrigeration system <ul style="list-style-type: none"> <li>• Understand the purpose of pumping down and recovering the refrigerant</li> <li>• Pump down the refrigerant from the refrigeration system to the liquid receiver or condenser</li> <li>• Use a refrigerant recovering machine to recover the refrigerant from the refrigeration system to the refrigerant recovery cylinder</li> </ul> </li> <li>◆ Add and remove refrigerant oil <ul style="list-style-type: none"> <li>• Choose suitable refrigerant oil</li> <li>• Remove refrigerant oil from and add it to the hermetic reciprocating compressor</li> <li>• Remove refrigerant oil from and add it to the hermetic rotary compressor</li> <li>• Remove refrigerant oil from and add it to the open-type compressor</li> </ul> </li> </ul> <p>6.3 Professionalism in repairing air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> <li>◆ Perform air-conditioning and refrigeration systems repairing according to safety regulations and code of practice as required by the law</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to repair air-conditioning and refrigeration systems properly and efficiently, including filling and recovering refrigerant and filling and exhausting coolant oil, according to safety regulations and code of practice.</p>
8. Remarks	<p>This unit of competency is suitable for training air-conditioning and refrigeration engineering personnel. The credit value of this unit of competency is set on the presumption that the person already possesses basic air-conditioning and refrigeration knowledge.</p>

1. Title	Repair overhead line equipment (feeder, insulation, suspension and earthed systems)
2. Code	EMCUMA305A
3. Range	Use repairing and checking instruments and tools to repair overhead line equipment along the railway lines.
4. Level	3
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Uses and functions of different kinds of overhead line equipment ♦ Understand the uses, structure and working principles of different kinds of overhead line equipment including feeder, insulation, suspension and earthed systems</p> <p>6.2 Way of servicing overhead line equipment (feeder, insulation, suspension and earthed systems) ♦ Perform checking and regular replacement needed for overhead line system (including feeder, insulation, suspension and earthed systems) according to the maintenance procedures ♦ Perform overhead line system servicing according to the safety regulations and code of practice</p> <p>6.3 Professionalism in servicing overhead line equipment (feeder, insulation, suspension and earthed systems) ♦ Carry out overhead line equipment (feeder, insulation, suspension and earthed systems) servicing according to the safety regulations and code of practice</p>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to carry out regular servicing for overhead line system (including feeder, insulation, suspension and earthed systems) according to the servicing procedures, safety regulations and code of practice.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic electrical and mechanical knowledge.

1. Title	Service overhead power system equipment (isolator, power supply system switchboard and control circuit)
2. Code	EMCUMA306A
3. Range	Use servicing and checking instruments and tools to maintain and repair overhead power system equipment (isolator, power supply system switchboard and control circuit) along the railway lines and in switch rooms.
4. Level	3
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Uses and functions of overhead power system equipment (isolator, power supply system switchboard and control circuit) ♦ Understand the uses, structure and working principles of overhead power system equipment including isolator, power supply system switchboard and control circuit</p> <p>6.2 Servicing and maintenance of overhead power system equipment (isolator, power supply system switchboard and control circuit) ♦ Perform checking and servicing for overhead power system equipment (isolator, power supply system switchboard and control circuit) according to maintenance schedule and procedures</p> <p>6.3 Professionalism in servicing overhead power system equipment (isolator, power supply system switchboard and control circuit) ♦ Carry out overhead power system equipment (isolator, power supply system switchboard and control circuit) servicing according to the safety regulations and code of practice</p>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to implement maintenance procedures correctly and efficiently according to the safety regulations and code of practice to repair overhead power system equipment (isolator, power supply system switchboard and control circuit).</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of power system.

1. Title	Analysis of non-destructive test (NDT) – Ultrasonic Testing	
2. Code	EMCUMA311A	
3. Range	Use ultrasonic testing instruments, at servicing centres or locations with operating equipment, to detect, analyze and examine internal damages of metallic equipment.	
4. Level	3	
5. Credit	3	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Techniques and principles of ultrasonic testing for internal damages of metallic equipment</p> <ul style="list-style-type: none"> <li>◆ Understand techniques and principles of ultrasonic testing and examination for internal damages of metallic equipment</li> <li>◆ Understand the advantages and limitations of ultrasonic testing, especially with reference to those of liquid penetrant testing, magnetic particle testing and x-ray testing</li> </ul> <p>6.2 Methods and procedures of analyzing and examining damages on metal equipment</p> <ul style="list-style-type: none"> <li>◆ Understand the influence of the metallic internal structure on damage examination and analysis</li> <li>◆ Use ultrasonic testing instruments effectively to analyze and examine internal damages or structure defects such as voids and pores on the metal equipment</li> <li>◆ Use ultrasonic instruments to measure and calculate crack positions and size</li> <li>◆ Mark the position with cracks effectively</li> <li>◆ Base on the pros and cons of various types of NDTs to recommend on and conduct ultrasonic testing so as to confirm the positions and degree of work piece damages or structure defects</li> <li>◆ Keep record of testing effectively</li> </ul> <p>6.3 Professionalism in inspecting and examining damages on metal equipment</p> <ul style="list-style-type: none"> <li>◆ Have adequate hands-on practice in ultrasonic testing for internal damages according to professional qualification requirements, and record and analyze damages</li> <li>◆ Inspect and analyze damages on metal equipment or structure defects safely according to guidelines on the use of materials and code of practice</li> <li>◆ Understand international standards or in-house guidelines, and report the positions and size of damages or structure defects identified according to requirements</li> </ul>	

7. Assessment Criteria	The integrated outcome requirements of this unit of competency are: <ul style="list-style-type: none"><li>(i) Capable to use ultrasonic testing effectively to detect, examine and analyze internal damages or structure defects of the metallic equipment; to measure and calculate crack positions and size and to record and mark properly; and</li><li>(ii) Capable to point out the pros and cons of ultrasonic testing with reference to those of liquid penetrant testing, magnetic particle testing and x-ray testing</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses the competency of EMCUMA202A “Non-destructive test (NDT) –ultrasonic testing”.

1. Title	Test diesel engines
2. Code	EMCUMA314A
3. Range	Use typical or tailor-made mechanical tools to test diesel engines at servicing workshops or locations with diesel engines according to testing instructions and standards.
4. Level	3
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of diesel engines</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of various component systems of diesel engine</li> </ul> <p>6.2 Methods and procedures of testing diesel engines</p> <ul style="list-style-type: none"> <li>◆ Test various component systems and fittings of a diesel engine effectively according to testing instructions and standards</li> <li>◆ Test the overall performance of a diesel engine</li> <li>◆ Use common and tailor-made mechanical tools effectively</li> <li>◆ Keep record of data effectively</li> </ul> <p>6.3 Professionalism in diesel engine test</p> <ul style="list-style-type: none"> <li>◆ Perform general tests on diesel engines independently according to testing instructions and standards</li> <li>◆ Use instruments to measure air and noise pollution caused by the diesel engine</li> <li>◆ Understand the legal requirements on work safety and the code of practice when performing tests on diesel engines</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to test the core systems of a diesel engine effectively and correctly according to testing instructions and standards as well as the requirements on work safety and the code of practice, to keep record of data effectively and check the performance of the diesel engine.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of mechanical equipment servicing.

1. Title	Light repair and performance tests for electric trains
2. Code	EMRAMA301A
3. Range	Use correct procedures and methods to perform light repair for electric trains by referring to repairing instructions at train maintenance centres and capable to test the performance of electric trains after light repair.
4. Level	3
5. Credits	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of the main system and equipment of electric trains and their light repair standards</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of different main systems and equipment of electric trains</li> <li>◆ Understand the scope and standards for different levels of light repair</li> </ul> <p>6.2 Method and procedures of performing light repair and performance tests for electric trains</p> <ul style="list-style-type: none"> <li>◆ Able to read repairing instructions and select suitable information for use</li> <li>◆ By referring to different levels of light repair instructions for trains, capable to perform light repair for mechanical equipment like train bogies, gangways, couplers, brake system devices, train door equipment and air-conditioning equipment, etc. including the following work procedures: <ul style="list-style-type: none"> <li>• Visual inspection</li> <li>• Measure and replace worn-out parts</li> <li>• Replace strainer</li> </ul> </li> <li>◆ Add or refill lubricating oil</li> <li>◆ Capable to perform light repair for the electrical equipment of trains including power system equipment, traction control system equipment and main transformer equipment, etc. by referring to different levels of light repair instructions for trains</li> <li>◆ Capable to perform light repair for the pneumatic equipment of trains including air compressor, pipeline device and pneumatic device, etc. by referring to different levels of light repair instructions for trains</li> <li>◆ By referring to light repair instructions for electric trains, capable to test the performance and operation of trains to appraise their functional performance after performing light repair for trains</li> <li>◆ Capable to make effective use of tools and instruments for repairing and checking general electrical and mechanical equipment</li> </ul>

	<p>6.3 Professionalism in handling light repair and performance tests for electric trains</p> <ul style="list-style-type: none"> <li>◆ Capable to follow the requirements of repairing instructions to ensure that the procedures and quality of light repair are up to standard</li> <li>◆ Capable to understand the safety guidelines as required by the law and codes of practice in handling light repair and performance tests for electric trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to perform light repair for the mechanical, electrical or pneumatic systems of trains correctly and efficiently by referring to light repair instructions; and</li> <li>(ii) Capable to test the performance of trains effectively after light repair.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses basic electrical, mechanical, pneumatic and air-conditioning knowledge.</p>

1. Title	Light repair and performance tests for diesel locomotive
2. Code	EMRAMA302A
3. Range	Use correct procedures and methods to perform light repair for diesel locomotive by referring to repairing instructions at train servicing centres and capable to test the performance of diesel locomotive after light repair.
4. Level	3
5. Credits	5
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of the main system and equipment of diesel locomotive and their light repair standards</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of different main systems and equipment of diesel locomotive</li> <li>◆ Understand the scope and standards for different levels of light repair</li> </ul> <p>6.2 Method and procedures of performing light repair and performance tests for diesel locomotive</p> <ul style="list-style-type: none"> <li>◆ Able to read repairing instructions and select suitable information for use</li> <li>◆ By referring to different levels of light repair instructions for diesel locomotive, capable to perform light repair for the diesel engine and control equipment of diesel locomotive including the following work procedures: <ul style="list-style-type: none"> <li>• Visual inspection</li> <li>• Measure and replace worn-out parts</li> <li>• Replace strainers</li> </ul> </li> <li>◆ Add or refill lubricating oil</li> <li>◆ Capable to perform light repair for the mechanical equipment of diesel locomotive including bogie, coupler, brake system device, etc. by referring to different levels of light repair instructions for diesel locomotive</li> <li>◆ Capable to perform light repair for the electrical equipment of diesel locomotive including generator, traction control system, auxiliary generator, control circuit equipment and protection devices, etc. by referring to different levels of light repair instructions for diesel locomotive</li> <li>◆ Capable to perform light repair for the pneumatic equipment of diesel locomotive including air compressor, pipeline device and pneumatic device, etc. by referring to different levels of light repair instructions for diesel locomotive</li> </ul>

	<ul style="list-style-type: none"> <li>◆ By referring to light repair instructions for diesel locomotive, capable to test the performance and operation of diesel locomotive to appraise its functional performance after performing light repair for diesel locomotive</li> <li>◆ Capable to make effective use of tools and instruments commonly used for repairing and checking electrical and mechanical equipment</li> <li>◆ Capable to follow the requirements of repairing instructions to ensure that the procedures and quality of light repair are up to standard</li> <li>◆ Capable to understand the safety guidelines as required by the law and codes of practice in handling light repair and performance tests for diesel locomotive</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to perform light repair for the engine, mechanical, electrical or pneumatic systems of diesel locomotive correctly and efficiently by referring to light repair instructions; and</li> <li>(ii) Capable to test the performance of diesel locomotive effectively after light repair.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses basic electrical, mechanical and pneumatic knowledge.</p>

1. Title	Maintain electrical systems for electric trains
2. Code	EMRAMA303A
3. Range	Maintain electrical systems for electric trains at train maintenance centres according to maintenance instructions by applying maintenance techniques for electrical and pneumatic equipment.
4. Level	3
5. Credits	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of electrical systems and equipment of electric trains and their maintenance standards</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the electrical systems and equipment of electric trains</li> <li>◆ Understand the scope and standards for different levels of maintenance</li> </ul> <p>6.2 Method and procedures of maintaining electrical systems and equipment of electric trains</p> <ul style="list-style-type: none"> <li>◆ Able to read maintenance instructions and select suitable information for use</li> <li>◆ Capable to maintain power collecting devices such as pantographs, lighting arrestors and sparking gaps, etc. according to maintenance instructions by applying maintenance techniques for electrical and pneumatic equipment</li> <li>◆ Capable to maintain circuit breakers and relays according to maintenance instructions by applying maintenance techniques for electrical and pneumatic equipment</li> <li>◆ Capable to filter insulating oil of main transformer and test the dielectric strength and gas content of insulating oil</li> <li>◆ Capable to make effective use of tools and instruments commonly used for maintaining electrical, mechanical, pneumatic and air-conditioning equipment</li> </ul> <p>6.3 Professionalism in maintaining the electrical systems and equipment of electric trains</p> <ul style="list-style-type: none"> <li>◆ Capable to follow the requirements of maintenance instructions to ensure that the procedures and quality of maintenance are up to standard</li> <li>◆ Understand the safety guidelines and codes of practice for railway engineering in handling maintenance for the electrical systems and equipment of electric trains</li> </ul>

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is:  (i) Capable to service, adjust and test the electrical systems of trains correctly and efficiently according to maintenance instructions and using methods in compliance with the safety guidelines and codes of practice.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic electrical, mechanical and pneumatic knowledge.

1. Title	Maintenance brake systems and equipment for trains
2. Code	EMRAMA304A
3. Range	Maintain brake systems for trains at train maintenance centres according to repairing instructions by applying maintenance techniques for mechanical, pneumatic and electrical equipment.
4. Level	3
5. Credits	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of brake systems and equipment of trains and their maintenance standards</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the brake systems and equipment of trains including <ul style="list-style-type: none"> <li>• Brake actuators and associated mechanical devices</li> <li>• Parking brakes</li> <li>• Pneumatic brake systems</li> <li>• Brake control devices</li> <li>• Wheel slide protection devices</li> </ul> </li> <li>◆ Understand the scope and standards for different levels of maintenance</li> </ul> <p>6.2 Method and procedures of maintaining brake systems and equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Able to read maintenance instructions and select suitable information for use</li> <li>◆ Capable to maintain mechanical devices of brake systems according to maintenance instructions by applying maintenance techniques for mechanical and pneumatic equipment</li> <li>◆ Capable to maintain and test the pipe line control equipment and pipes of pneumatic brake systems according to repairing instructions by applying repairing techniques for pneumatic equipment</li> <li>◆ Capable to maintain electrical equipment and circuits of pneumatic brake systems according to maintenance instructions by applying maintenance techniques for electrical equipment and circuits</li> <li>◆ Capable to make effective use of typical tools and instruments for maintaining electrical, mechanical, and pneumatic equipment</li> </ul> <p>6.3 Professionalism in maintaining the brake systems and equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Capable to follow the requirements of maintenance instructions to ensure that the procedures and quality of maintenance are up to standard</li> <li>◆ Understand the safety guidelines and codes of practice for train engineering in handling maintenance for the brake systems and equipment of trains</li> </ul>

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: <ul style="list-style-type: none"><li>(i) Capable to service and test the brakes and parking brake correctly and efficiently and align the brake lining to the right position according to maintenance instructions; and</li><li>(ii) Capable to service and test the pipe line control equipment and wheel slide protection devices of pneumatic brake systems correctly and efficiently according to repairing instructions.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic electrical, mechanical and pneumatic knowledge.

1. Title	Maintain electric multi-car door systems
2. Code	EMRAMA305A
3. Range	Maintain electric multi-car door system and devices at train maintenance centres according to maintenance instructions by applying maintenance techniques for mechanical, electrical and pneumatic equipment.
4. Level	3
5. Credits	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of electric multi-car door systems and equipment and their maintenance standards</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the electric multi-car door systems and equipment</li> <li>◆ Understand the scope and standards for different levels of maintenance</li> </ul> <p>6.2 Method and procedures of maintaining electric multi-car door systems and equipment</p> <ul style="list-style-type: none"> <li>◆ Able to read maintenance instructions and select suitable information for use</li> <li>◆ Capable to maintain and adjust train door mechanical devices including the door frames and connecting components, isolator and locking devices according to maintenance instructions by applying maintenance techniques for mechanical equipment</li> <li>◆ Capable to maintain and test the electric door actuator or pneumatic door actuator according to maintenance instructions by applying maintenance techniques for electrical and pneumatic equipment</li> <li>◆ Capable to maintain train door circuit devices including door open/close circuit, door loop protection device, relay, door status indication circuit and isolating switch according to maintenance instructions by applying maintenance techniques for electrical equipment and wiring</li> <li>◆ Capable to make effective use of typical tools and instruments for maintaining electrical, mechanical, and pneumatic equipment</li> </ul> <p>6.3 Professionalism in maintaining the electric multi-car door systems and equipment</p> <ul style="list-style-type: none"> <li>◆ Capable to follow the requirements of maintenance instructions to ensure that the procedures and quality of maintenance are up to standard</li> <li>◆ Understand the safety guidelines and codes of practice for train engineering in handling maintenance for the electric multi-car door systems and equipment</li> </ul>

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: <ul style="list-style-type: none"><li>(i) Capable to install and adjust the train door mechanical devices correctly and efficiently according to maintenance instructions;</li><li>(ii) Capable to service and test the electrical and pneumatic equipment of electric train doors correctly and efficiently according to maintenance instructions; and</li><li>(iii) Capable to test the train door loop protection devices correctly and efficiently.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic electrical, mechanical and pneumatic knowledge.

1. Title	Maintain train bogies, gangways and couplers
2. Code	EMRAMA306A
3. Range	Maintain train bogies, gangways and couplers at train maintenance centres according to maintenance instructions by applying maintenance techniques for mechanical equipment.
4. Level	3
5. Credits	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of train bogies, gangways and couplers and their maintenance standards</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the train bogies, gangways and couplers</li> <li>◆ Understand the scope and standards for different levels of maintenance</li> </ul> <p>6.2 Method and procedures of maintaining train bogies, gangways and couplers</p> <ul style="list-style-type: none"> <li>◆ Able to read maintenance instructions and select suitable information for use</li> <li>◆ Capable to maintain and adjust train bogies including power car bogies and trailer car bogies; and bogie components including the mechanical structure of bogie, bearing and axle, primary suspension system, secondary suspension system and shock absorption device according to maintenance instructions by applying maintenance techniques for mechanical equipment</li> <li>◆ Capable to maintain and adjust the following train gangway components according to maintenance instructions by applying maintenance techniques for mechanical equipment <ul style="list-style-type: none"> <li>• Gangway mechanical locking devices</li> <li>• Gangway internal installations</li> <li>• Gangway coupling devices</li> </ul> </li> <li>◆ Capable to maintain and adjust automatic couplers and bar couplers according to maintenance instructions by applying maintenance techniques for mechanical equipment</li> <li>◆ Capable to make effective use of typical tools and instruments for maintaining electrical and mechanical equipment</li> </ul> <p>6.3 Professionalism in maintaining the train bogies, gangways and couplers</p> <ul style="list-style-type: none"> <li>◆ Capable to follow the requirements of maintenance instructions to ensure that the procedures and quality of maintenance are up to standard</li> <li>◆ Understand the safety guidelines and codes of practice for railway engineering in handling maintenance for the train bogies, gangways and couplers</li> </ul>

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: <ul style="list-style-type: none"><li>(i) Capable to check bogie bearing, measure and record the outlook of wheels and adjust the primary and secondary suspension systems correctly and efficiently according to maintenance instructions;</li><li>(ii) Capable to adjust the height of gangways correctly and efficiently correctly and efficiently according to maintenance instructions; and</li><li>(iii) Capable to adjust the height of automatic couplers and test their locking devices correctly and efficiently according to maintenance instructions.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic mechanical knowledge and fitting techniques.

1. Title	Maintain the trackside equipment of the railway signal and control system and interlock
2. Code	EMRAMA308A
3. Range	Maintain the trackside equipment of the railway signal and control system and interlock at railway premises, railway traffic control rooms and signal switch rooms according to maintenance instructions by applying maintenance techniques for electronic and electrical equipment.
4. Level	3
5. Credits	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Structure and working principles of the railway signal and control system and interlock devices</p> <ul style="list-style-type: none"> <li>◆ Understand the working principles of the railway signal and control system</li> <li>◆ Understand the structure and working principles of the railway signal interlock system, including: <ul style="list-style-type: none"> <li>• PLC equipment</li> <li>• Solid-state interlock equipment</li> <li>• Relay interlock equipment</li> <li>• Electronic control circuits</li> </ul> </li> <li>◆ Understand the structure and working principles of the trackside equipment of the railway signal and control system, including: <ul style="list-style-type: none"> <li>• PLC and control components</li> <li>• Train location detecting devices</li> <li>• Platform screen door control devices</li> <li>• Railway signal display devices</li> <li>• Electronic interface devices</li> <li>• Point machines</li> <li>• Supervisory, Control and Data Acquisition System (SCADA)</li> </ul> </li> <li>◆ Understand the scope and standards for maintenance</li> </ul> <p>6.2 Methods and procedures of maintaining the trackside equipment of the railway signal and control system and interlock devices</p> <ul style="list-style-type: none"> <li>◆ Able to read the maintenance instructions and relevant information of the railway signal and control system and select suitable information for use</li> <li>◆ Capable to maintain and test the trackside signal and control equipment according to maintenance instructions by applying maintenance techniques for electronic and PLC equipment</li> <li>◆ Capable to maintain point machines and their control and protection equipment according to maintenance instructions by applying maintenance techniques for electric motors and mechanical devices</li> <li>◆ Capable to test the SCADA functions according to maintenance instructions</li> </ul>

	<ul style="list-style-type: none"> <li>◆ Capable to maintain signal interlock systems and equipment according to maintenance instructions by applying maintenance techniques for processors, PLC and electronic control circuits</li> <li>◆ Capable to make effective use of typical tools and instruments for maintaining general electrical, electronic and signal system equipment</li> </ul> <p>6.3 Professionalism in maintaining the trackside equipment of railway signal and control system and interlock devices</p> <ul style="list-style-type: none"> <li>◆ Capable to follow the requirements of maintenance instructions to ensure that the procedures and quality of repair are up to standard</li> <li>◆ Understand the safety guidelines and codes of practice for railway engineering in handling maintenance for the trackside equipment of railway signal and control system and interlock devices</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to test the trackside equipment of the railway signal and control system correctly and efficiently in compliance with maintenance standards and the code of safety;</li> <li>(ii) Capable to test the railway point machines correctly and efficiently in compliance with maintenance standards and the code of safety; and</li> <li>(iii) Capable to test the central interlock components of the interlock system correctly and efficiently in compliance with maintenance standards and the code of safety.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses basic electrical and electronic knowledge.</p>

1. Title	Maintain pneumatic systems of trains
2. Code	EMRAMA309A
3. Range	Maintain pneumatic systems and equipment of trains at train maintenance centres according to maintenance instructions by applying maintenance techniques for mechanical, pneumatic and electrical equipment.
4. Level	3
5. Credits	5
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of pneumatic systems and equipment of trains and their maintenance standards</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the pneumatic systems and equipment of trains including <ul style="list-style-type: none"> <li>• Air compressors and control circuits</li> <li>• Pneumatic pipe network and fittings</li> <li>• Various kinds of valves</li> <li>• Pressure regulators</li> <li>• Pressure gauges</li> <li>• Pneumatic-operated equipment</li> <li>• Equipment to maintain the compressed air quality</li> </ul> </li> <li>◆ Understand the scope and standards for different levels of maintenance</li> </ul> <p>6.2 Method and procedures of maintaining pneumatic systems and equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Able to read maintenance instructions and select suitable information for use</li> <li>◆ Capable to maintain air compressing systems and control circuits according to maintenance instructions by applying maintenance techniques for electrical and pneumatic equipment</li> <li>◆ Capable to maintain pipe line adjusting equipment, pipe line network and fittings, pneumatic control equipment and equipment to maintain the compressed air quality according to maintenance instructions by applying maintenance techniques for pneumatic equipment</li> <li>◆ Capable to make effective use of typical tools and instruments for maintaining electrical, mechanical and pneumatic equipment</li> </ul> <p>6.3 Professionalism in maintaining the pneumatic systems and equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Capable to follow the requirements of maintenance instructions to ensure that the procedures and quality of maintenance are up to standard</li> <li>◆ Understand the safety guidelines and codes of practice for railway engineering in handling maintenance for the pneumatic systems and equipment of trains</li> </ul>

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: <ul style="list-style-type: none"><li>(i) Capable to maintain and test the pressure regulators, non-return valves, safety valves, dryers, filters and automatic drain valves systematically and efficiently according to maintenance instructions; and</li><li>(ii) Capable to maintain and adjust the air compressors efficiently according to maintenance instructions and the code of safety.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic electrical, mechanical and pneumatic knowledge.

1. Title	Investigate general industrial accidents
2. Code	EMCUSH305A
3. Range	Investigate industrial accidents related to electrical and mechanical services and propose solutions to improve occupational safety and health, and be capable to write accident investigation reports.
4. Level	3
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 General industrial accident investigation</p> <ul style="list-style-type: none"> <li>◆ Understand procedures for industrial accident investigation, including investigating by accident type, recording the happening of accident, collecting information and reporting the accident to relevant departments</li> </ul> <p>6.2 Handle industrial accidents</p> <ul style="list-style-type: none"> <li>◆ Investigate industrial accidents related to electrical and mechanical services <ul style="list-style-type: none"> <li>• Be capable to handle and investigate industrial accidents related to electrical and mechanical services according to the code of practice required for handling industrial accidents, including informing employers concerned, the Labour Department, the police and the families of the victims; filling in declaration form; investigating and recording the people, place, time and date, the machinery involved, the course of the accident, causes for it, etc.</li> <li>• Use objective methods and techniques to investigate and collect information. The investigation work includes on-the-spot investigation, interviewing the victims/witnesses in person or on the phone, using questionnaire, etc.</li> </ul> </li> <li>◆ Report the accident to relevant departments</li> <li>◆ Assist relevant departments to investigate the accident</li> <li>◆ Improvement plans <ul style="list-style-type: none"> <li>• Make improvement plans to reduce similar industrial accidents</li> <li>• Understand the causes of industrial accidents and ways of prevention</li> </ul> </li> <li>◆ Write accident investigation reports <ul style="list-style-type: none"> <li>• Understand the document format and wording required and write accident investigation reports</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to handle and investigate industrial accidents related to electrical and mechanical services according to the code of practice required for handling industrial accidents, to make improvement plans and write accident investigation reports.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic occupational safety knowledge.

1. Title	Perform occupational safety and health supervision
2. Code	EMCUSH308A
3. Range	Master safety management techniques and occupational safety and health knowledge to perform occupational safety and health supervision in electrical and mechanical workplaces in order to comply with relevant safety legislations and the engineering contract requirements.
4. Level	3
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Concepts and techniques of occupational safety and health supervision</p> <ul style="list-style-type: none"> <li>◆ Understand the concepts and techniques of safety management in order to perform safety supervision, including: <ul style="list-style-type: none"> <li>• Work safety requirements of the electrical and mechanical engineering contract</li> <li>• Safety inspection</li> <li>• Accident investigation</li> <li>• Safety audit and check</li> <li>• Work site tidiness and hygiene</li> <li>• Safety promotion</li> <li>• Risk assessment</li> <li>• Safety committee</li> <li>• Knowledge of latest safety legislations and their recent amendments</li> </ul> </li> </ul> <p>6.2 Occupational safety and health supervision</p> <ul style="list-style-type: none"> <li>◆ Apply knowledge and techniques of occupational safety and health supervision to perform occupational safety and health supervision for electrical and mechanical work in order to comply with relevant safety legislations and the engineering contract requirements</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply safety management techniques and occupational safety and health knowledge to perform occupational safety and health supervision for electrical and mechanical work according to relevant safety legislations and contract requirements.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic occupational safety and health knowledge.

1. Title	Implement quality control and quality assurance
2. Code	EMCUQM303A
3. Range	Implement quality control and quality assurance according to engineering procedures for electrical and mechanical services to achieve high quality engineering performance.
4. Level	3
5. Credit	4
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Engineering procedures and quality control points of electrical and mechanical services</p> <ul style="list-style-type: none"> <li>◆ Understand the engineering procedures for electrical and mechanical services</li> <li>◆ Understand quality monitoring points of each engineering procedure, including the electrical and mechanical installation procedure, inspection procedure, debugging procedure, commissioning procedure and servicing procedure</li> <li>◆ Understand the quality control system of the organization and ensure that the service quality meet the requirements, including: <ul style="list-style-type: none"> <li>• Ensuring that the engineering procedures meet the quality requirements and performance indicators</li> <li>• Confirming and rectifying procedures not complying with regulations</li> <li>• Organize teams to formulate quality improvement plans</li> </ul> </li> </ul> <p>6.2 Implement quality control and quality assurance</p> <ul style="list-style-type: none"> <li>◆ Follow the quality management scheme, quality assurance procedures and verification specifications to implement quality assurance</li> <li>◆ Strictly examine the major monitoring points of each engineering procedure to ensure the quality performance of procedures</li> <li>◆ Record various engineering quality problems and report to the management through the communication mechanism</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to implement quality control and quality assurance system, master the verification specifications and examine the major monitoring points of each engineering procedure to ensure the quality performance.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of quality management.

1. Title	Record quality issues on electrical and mechanical services
2. Code	EMCUQM306A
3. Range	With regard to quality management of electrical and mechanical services, record all the quality main points of each engineering process, quality issues and problems to provide information for the management to formulate quality assurance reports.
4. Level	3
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Format and key points of quality assurance report on electrical and mechanical services</p> <ul style="list-style-type: none"> <li>◆ Understand format, key points and record required of quality assurance report on electrical and mechanical services</li> </ul> <p>6.2 Record all kinds of engineering quality issues and problems</p> <ul style="list-style-type: none"> <li>◆ Strictly examine the major quality main points of each engineering process and record all kinds of engineering quality issues and problems <ul style="list-style-type: none"> <li>• Follow the quality plan in order to execute quality assurance system, master the verification specifications, strictly examine the major control points of each engineering process, record all quality related issues, such as quality level for each action, non-compliance with regulations, errors, defects, deviation, excesses or shortfalls, etc.</li> </ul> </li> <li>◆ Quantify issues and problems on quality management so as to provide sufficient data or information for the management to produce the quality assurance reports</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to examine each engineering process; quantify quality management issues and problems so as to provide sufficient data or information for the management to produce the quality assurance reports.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic concepts of quality management.

# **Competency Level 4**

1. Title	Formulate effective storage and updating system for drawings
2. Code	EMCUDE405A
3. Range	Formulate effective storage and updating systems for drawings to support electrical and mechanical services for electrical and mechanical organization.
4. Level	4
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Storage system for electrical and mechanical engineering documents</p> <ul style="list-style-type: none"> <li>◆ Understand the entire storage system for electrical and mechanical engineering documents, including the correlational series and classification of typical drawings, and document storage system</li> </ul> <p>6.2 Processing of electrical and mechanical engineering documents</p> <ul style="list-style-type: none"> <li>◆ Arrange drawings and classification of information <ul style="list-style-type: none"> <li>• With engineering senses, classify the correlational series of typical drawings and information effectively for easy management</li> </ul> </li> <li>◆ Formulate system for the issuance of drawings and information, including: <ul style="list-style-type: none"> <li>• Record of drawings and information issued</li> <li>• Marking of versions and dates issued</li> </ul> </li> <li>◆ Formulate retrieval mechanism for old drawings and information <ul style="list-style-type: none"> <li>• Trace the locations of old drawings and information according to the issuance record, and be able to issue the most updated versions of drawings and information</li> <li>• Establish effective communication channels with users of the drawings and information</li> </ul> </li> <li>◆ Make use of information technology to enhance the efficiency of the storage and updating system for drawings and information <ul style="list-style-type: none"> <li>• Use information technology and techniques to formulate systems to enhance the efficiency of storing, issuing, tracing and updating drawings and information</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to formulate an effective storage and updating system for drawings and information to effectively support the electrical and mechanical services.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of electrical and mechanical drawing plans.

1. Title	Supervise the drafting of engineering drawings
2. Code	EMRADE401A
3. Range	Supervise the drafting of engineering drawings for E & M design so as to ensure quality and efficiency of work and to improve the efficiency of drafting with the application of information technology.
4. Level	4
5. Credits	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Procedures, operation modes of units and supervisory skills of supervising the drafting of engineering drawings</p> <ul style="list-style-type: none"> <li>◆ Master the drafting procedures and processes of all kinds of engineering drawings, relevant quality requirements, and check point selection techniques</li> <li>◆ Understand the operation modes and culture of units involved in the drafting of engineering drawings</li> <li>◆ Possess the knowledge and skills of supervising and supporting the drafting work</li> </ul> <p>6.2 Methods and procedures of supervising the drafting of engineering drawings and improving the efficiency of drafting with the application of information technology</p> <ul style="list-style-type: none"> <li>◆ Supervise and support the drafting of engineering drawings to ensure that it complies with the prescribed standards and customer's requirements. Supervisory procedures include: <ul style="list-style-type: none"> <li>• Selecting and monitoring quality check points</li> <li>• Analyzing the causes of non-compliance with standard and formulating improvement measures</li> <li>• Maintaining adequate coordination and communication in the drafting processes</li> </ul> </li> <li>◆ Improve the efficiency of drafting by making use of the databank information, including: <ul style="list-style-type: none"> <li>• Arranging the listing of drawings in accordance with the specifications of the storage and updating system for drawings</li> <li>• Using the information network to obtain outside information to improve the efficiency of drafting</li> <li>• Using the intranet for division of work so as to improve efficiency</li> </ul> </li> <li>◆ Formulate plans for maintaining persistently the quality of drafting work and for improving its efficiency, including: <ul style="list-style-type: none"> <li>• Providing adequate training for staff</li> <li>• Establishing effective communication channels</li> <li>• Planning for updating and upgrading of equipment</li> </ul> </li> </ul>

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is:  (i) Capable to supervise and support efficiently the drafting of engineering drawings to ensure that the work complies with the standard and requirements; to formulate plans for maintaining persistently the quality of drafting work and for improving its efficiency by using information technology.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of drafting engineering drawings and basic knowledge and skills of supervision.

1. Title	Supervise the installation of train equipment
2. Code	EMRAIN401A
3. Range	Supervise the installation of the train equipment so as to ensure quality, standard and efficiency of work.
4. Level	4
5. Credits	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Procedures, operation modes of units and supervisory skills of installing train equipment</p> <ul style="list-style-type: none"> <li>◆ Master the installation methods and processes of the major train equipment, relevant quality requirements, and check point selection techniques</li> <li>◆ Understand the operation modes and culture of units involved in the installation of train equipment</li> <li>◆ Possess the knowledge and skills of supervising and supporting electrical and mechanical works</li> </ul> <p>6.2 Methods and procedures of supervising the installation of train equipment</p> <ul style="list-style-type: none"> <li>◆ Supervise and support the installation of train equipment to ensure quality, standard and efficiency of work. Supervisory procedures include: <ul style="list-style-type: none"> <li>• Selecting and monitoring quality check points</li> <li>• Analyzing the causes of non-compliance with standard and formulating improvement measures</li> <li>• Maintaining adequate coordination and communication in the installation processes</li> <li>• Ensure smooth supply of materials in the installation processes</li> </ul> </li> <li>◆ Formulate plans for maintaining persistently the quality of installation work and for improving its efficiency, including: <ul style="list-style-type: none"> <li>• Providing adequate training for staff</li> <li>• Establishing effective communication channels</li> <li>• Planning for updating and upgrading of equipment</li> </ul> </li> </ul> <p>6.3 Professionalism in supervising the installation of train equipment</p> <ul style="list-style-type: none"> <li>◆ Supervise the installation of train equipment according to the standards and requirements for work safety, health, environmental protection and quality management of train engineering work</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to supervise and support efficiently the installation of the major train equipment to ensure the safety, quality, standard and efficiency of work; to formulate plans for maintaining persistently the quality and safety of installation work and for improving its efficiency.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of train equipment installation and basic knowledge and skills of supervision.

1. Title	Undertake component function tests for trains after installation	
2. Code	EMRAIN402A	
3. Range	Undertake component function tests for trains after installation according to installation instructions and equipment functions, and record the data as reference for testing.	
4. Level	4	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles and function test standards for the major systems and equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Understand the working principles of the major systems and equipment of trains, including: <ul style="list-style-type: none"> <li>• Power system</li> <li>• Traction supply system</li> <li>• Brake system</li> <li>• Pneumatic system</li> <li>• Auxiliary system</li> <li>• Protection system</li> </ul> </li> <li>◆ Understand the scope and standards of component function tests for the major systems and equipment of trains</li> </ul> <p>6.2 Methods and procedures of function tests for the major systems and equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Able to read the installation instructions of the major systems and equipment of trains and select information for component function tests</li> <li>◆ Make preparations for undertaking function tests for the major systems and equipment of trains, such as visual inspection and insulation tests for electrical equipment</li> <li>◆ Undertake component function tests for the major systems and equipment of trains according to installation instructions and relevant information</li> <li>◆ Maintain a proper and accurate record of certain component function tests and measurements</li> <li>◆ Enforce sufficient safety and protective measures for undertaking train equipment function tests</li> <li>◆ Use general E&amp;M and pneumatic equipment checking instruments and certain dedicated instruments for train function tests efficiently</li> </ul> <p>6.3 Professionalism in component function tests for the major systems and equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Undertake component tests for trains after installation according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in handling component function tests for train equipment</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is:  (i) Capable to undertake safely and efficiently component function tests for the major equipment of trains according to the standards based on installation instructions and equipment functions, and to measure the data from such tests and maintain an accurate record.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of electrical, mechanical and train equipment.

1. Title	Supervise the installation of railway overhead feeder systems	
2. Code	EMRAIN404A	
3. Range	Supervise the installation of the railway overhead feeder systems at power control rooms, switch rooms and areas with such systems so as to ensure quality, standard and efficiency of work.	
4. Level	4	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Procedures, operation modes of units and supervisory skills of installing railway overhead feeder systems and equipment</p> <ul style="list-style-type: none"> <li>◆ Master the installation methods and procedures of railway overhead feeder systems and equipment, relevant quality requirements, and check point selection techniques</li> <li>◆ Understand the operation modes and culture of units involved in the installation of railway overhead feeder systems and equipment</li> <li>◆ Possess the knowledge and skills of supervising and supporting electrical and mechanical works</li> </ul> <p>6.2 Methods and procedures of supervising the installation of railway overhead feeder systems</p> <ul style="list-style-type: none"> <li>◆ Supervise and support the installation of railway overhead feeder systems to ensure quality, standard and efficiency of work. Supervisory procedures include: <ul style="list-style-type: none"> <li>• Selecting and monitoring quality check points</li> <li>• Analyzing the causes of non-compliance with standard and formulating improvement measures</li> <li>• Maintaining adequate coordination and communication in the installation processes</li> <li>• Ensure smooth supply of materials in the installation processes</li> </ul> </li> <li>◆ Formulate plans for maintaining persistently the quality of installation work and for improving its efficiency, including: <ul style="list-style-type: none"> <li>• Providing adequate training for staff</li> <li>• Establishing effective communication channels</li> <li>• Planning for updating and upgrading of equipment</li> </ul> </li> </ul> <p>6.3 Professionalism in supervising the installation of railway overhead feeder systems and equipment</p> <ul style="list-style-type: none"> <li>◆ Supervise the installation of railway overhead feeder systems and equipment according to the standards and requirements for work safety, health, environmental protection and quality management of train engineering work</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in installing railway overhead feeder systems and equipment</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is:  (i) Capable to supervise and support efficiently the installation of the railway overhead feeder systems and equipment to ensure the safety, quality, standard and efficiency of work; to formulate plans for maintaining persistently the quality and safety of installation work and for improving its efficiency.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of the installation of railway overhead feeder systems and equipment and basic knowledge and skills of supervision.

1. Title	Undertake component function tests for railway overhead feeder systems after installation
2. Code	EMRAIN405A
3. Range	Undertake preliminary inspection and function tests for railway overhead feeder system components after installation at power control rooms, switch rooms and railway premises with overhead lines according to installation instructions, and record the data as reference for testing.
4. Level	4
5. Credits	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles and function test standards for railway overhead feeder system and equipment</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of railway overhead feeder system, including <ul style="list-style-type: none"> <li>• Main line system</li> <li>• Feeder switch device</li> <li>• Electricity quality improvement device</li> <li>• Controlling device</li> <li>• Protecting device</li> </ul> </li> <li>◆ Understand the scope and standards of component function tests for railway overhead feeder system and equipment</li> </ul> <p>6.2 Methods and procedures of function tests for railway overhead feeder system and equipment</p> <ul style="list-style-type: none"> <li>◆ Able to read the installation instructions of railway overhead feeder system and equipment and select information for component function tests</li> <li>◆ Undertake component function tests for railway overhead feeder system according to installation instructions and relevant information including standards and operational guidelines for equipment</li> <li>◆ Maintain a proper and accurate record of certain component function tests and measurements</li> <li>◆ Use general E&amp;M equipment checking instruments and certain dedicated instruments for function tests of railway overhead feeder system efficiently</li> <li>◆ Enforce sufficient safety and protective measures for undertaking railway overhead feeder equipment function tests</li> </ul> <p>6.3 Professionalism in component function tests for railway overhead feeder system and equipment</p> <ul style="list-style-type: none"> <li>◆ Undertake component tests for railway overhead feeder system after installation according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in handling component function tests for railway overhead feeder system and equipment</li> </ul>

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is:  (i) Capable to undertake safely and efficiently preliminary inspection and function tests for railway overhead feeder system after installation according to installation instructions and relevant information, and to measure the data from such tests and maintain an accurate record.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of overhead power supply system and equipment.

1. Title	Install computer control equipment and information network equipment of railway traffic management system	
2. Code	EMRAIN406A	
3. Range	Install traffic management system for the railway signal and control system at railway premises, railway traffic control rooms and signal switch rooms, including computer control equipment and information network equipment, and test, adjust and set such equipment.	
4. Level	4	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Structure and working principles of railway traffic management system</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the control programming system of the railway traffic management system, including: <ul style="list-style-type: none"> <li>• Signal and control monitor system</li> <li>• Train route and programming control system</li> <li>• Train location indication and communication system</li> <li>• Train operation control system</li> <li>• Data collection and management reporting system</li> <li>• Interface devices</li> </ul> </li> <li>◆ Understand the structure and working principles of the network system of the railway traffic control system, including: <ul style="list-style-type: none"> <li>• LAN</li> <li>• WAN</li> <li>• Signal transmission equipment</li> <li>• Interface devices</li> </ul> </li> </ul> <p>6.2 Installation methods and procedures of railway traffic management system and equipment</p> <ul style="list-style-type: none"> <li>◆ Able to read the installation guidelines and circuit diagrams and select useful information</li> <li>◆ Install the control programming system and relevant equipment of the railway traffic management system according to installation guidelines and diagrams, and perform suitable adjustments and tests</li> <li>◆ Install the network system and relevant equipment of the railway traffic management system according to installation guidelines and diagrams, and perform suitable adjustment and testing</li> <li>◆ Use installation and checking instruments and tools for general electrical, electronic, computer and communication equipment efficiently</li> </ul>	

	<p>6.3 Professionalism in installing railway traffic management system and equipment</p> <ul style="list-style-type: none"> <li>◆ Install the railway traffic control system and equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in installing railway traffic management system and equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to install computer control equipment and information network equipment of railway traffic management system safely and efficiently according to installation requirements, and perform testing and adjustment in coordination with the terminals at different stations so as to ensure the safety of the entire railway traffic management system.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of electronics, computer and communication.</p>

1. Title	Install railway signal interlock system	
2. Code	EMRAIN407A	
3. Range	Install interlock system for the railway signal and control system, including trackside equipment, interlock system and chain system devices, at railway premises, railway traffic control rooms and signal switch rooms.	
4. Level	4	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Structure and working principles of the railway signal and control system</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the railway signal and control system</li> <li>◆ Understand the structure and working principles of the central interlock units, including: <ul style="list-style-type: none"> <li>• PLC units</li> <li>• Electronic circuit units</li> </ul> </li> <li>◆ Understand the structure and working principles of the trackside functional units of the railway signal and control system, including: <ul style="list-style-type: none"> <li>• Trackside units</li> <li>• Interface devices</li> <li>• Signal and information transmission equipment</li> </ul> </li> </ul> <p>6.2 Installation Methods and procedures of railway signal interlock system devices</p> <ul style="list-style-type: none"> <li>◆ Able to read the installation guidelines and circuit diagrams and select useful information</li> <li>◆ Install and test the central interlock units of the railway signal interlock system according to the installation guidelines and diagrams</li> <li>◆ Install and test the trackside functional units of the railway signal interlock system according to the installation guidelines and diagrams</li> <li>◆ Use installation and checking instruments and tools for general electrical and electronic equipment efficiently</li> </ul> <p>6.3 Professionalism in installing railway signal interlock system devices</p> <ul style="list-style-type: none"> <li>◆ Install railway signal interlock system devices according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in installing railway signal interlock system devices</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is:  (i) Capable to install the interlock system devices of railway signal and control system safely and efficiently according to installation requirements, and perform testing effectively so as to ensure that the entire signal system operates properly.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of electronics and communication.

1. Title	Supervise the installation of railway signal and control systems	
2. Code	EMRAIN408A	
3. Range	Supervise the installation of the railway signal and control systems at railway premises, control rooms and signal switch rooms so as to ensure quality, standard and efficiency of work.	
4. Level	4	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Procedures, operation modes of units and supervisory skills of installing railway signal and control systems</p> <ul style="list-style-type: none"> <li>◆ Master the installation procedures and processes of railway signal and control systems, relevant quality requirements, and control point selection techniques</li> <li>◆ Understand the operation modes and culture of units involved in the installation of railway signal and control systems</li> <li>◆ Possess the knowledge and skills of supervising and supporting the installation of railway signal and control systems</li> </ul> <p>6.2 Methods and procedures of supervising the installation of railway signal and control systems</p> <ul style="list-style-type: none"> <li>◆ Supervise and support the installation of railway signal and control systems to ensure quality, standard and efficiency of work. Supervisory procedures include: <ul style="list-style-type: none"> <li>• Selecting and monitoring quality control points</li> <li>• Analyzing the causes of non-compliance with standard and formulating improvement measures</li> <li>• Maintaining adequate coordination and communication in the installation processes</li> <li>• Ensure smooth supply of materials in the installation processes</li> </ul> </li> <li>◆ Formulate plans for maintaining persistently the quality of installation work and for improving its efficiency, including: <ul style="list-style-type: none"> <li>• Providing adequate training for staff</li> <li>• Establishing effective communication channels</li> <li>• Planning for updating and upgrading of equipment</li> </ul> </li> </ul> <p>6.3 Professionalism in supervising the installation of railway signal and control systems</p> <ul style="list-style-type: none"> <li>◆ Supervise the installation of railway signal and control systems according to the standards and requirements for work safety, health, environmental protection and quality management of train engineering work</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in installing railway signal and control systems</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is:  (i) Capable to supervise and support efficiently the installation of the railway signal and control systems to ensure the safety, quality, standard and efficiency of work; to formulate plans for maintaining persistently the quality and safety of installation work and for improving its efficiency.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of railway signal and control system and basic knowledge and skills of supervision.

1. Title	Inspect, test and commission overhead line equipment and related suspension and earthed installations
2. Code	EMCUIT401A
3. Range	Inspect, test and commission overhead line equipment and related suspension and earthed installations, including inspections on live and / or dead condition, according to instructions and standards for inspection, testing and commissioning of electrical and mechanical services.
4. Level	4
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Operating principles and functions of different kinds of overhead line equipment</p> <p>◆ Understand the operating principles and functions of different equipment of the overhead line system, including the suspension and earthed installations</p> <p>6.2 Inspect, test and commission overhead line equipment and related suspension and earthed installations</p> <p>◆ Perform the inspection, testing and commissioning of different equipment of the overhead line system, including inspections on live and / or dead condition; and the testing of suspension, isolation and earthed installations should meet the performance required by the specified standards</p>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency are:</p> <p>(i) Capable to inspect, test and commission the functions of different equipment of the overhead line system, including conducting inspections on live and / or dead condition, according to guidelines, drawings and standards; and</p> <p>(ii) Capable to inspect, test and commission suspension, isolation and earthed installations to ensure that they meet the performance required by the specified standards.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of electrical installations.

1. Title	Inspect, test and commission the mechanical equipment of trains
2. Code	EMRAIT402A
3. Range	Perform visual inspection, measure and function tests, and adjust and set the mechanical equipment of trains for train installation work according to guidelines and standards for inspection, testing and commissioning.
4. Level	4
5. Credits	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of and standards for inspecting, testing and commissioning the mechanical equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the mechanical equipment of trains, including: <ul style="list-style-type: none"> <li>• Train bogies, gangways and couplers</li> <li>• Brake system devices</li> <li>• Train door system</li> </ul> </li> <li>◆ Understand the scope and standards for inspection, testing and commissioning of the mechanical equipment of trains</li> </ul> <p>6.2 Methods and procedures of inspecting, testing and commissioning the mechanical equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Able to read the inspection, testing and commissioning guidelines and select useful information</li> <li>◆ Calculate and compile the details for testing and commissioning according to relevant information</li> <li>◆ Inspect components of train bogies, gangways and couplers according to guidelines and standards, and record the data</li> <li>◆ Adjust and set the train bogies, gangways and couplers according to guidelines and standards</li> <li>◆ Check whether the data of train bogies, gangways and couplers meet the commissioning standard according to specified standards</li> <li>◆ Inspect and adjust the brake system's mechanical devices according to guidelines and standards</li> <li>◆ Set the pressure of different brake levels for the brake system according to standards</li> <li>◆ Inspect train door mechanical devices, their locations and alignment according to guidelines and standards</li> <li>◆ Adjust the mechanical, interlocking and isolation devices according to standards</li> <li>◆ Use efficiently general electrical and mechanical equipment repairing and testing instruments and a range of instruments and tools specialized for testing mechanical devices of trains</li> </ul>

	<p>6.3 Professionalism in inspecting, testing and commissioning the mechanical equipment of trains</p> <p>◆ Inspect, test and commission the mechanical equipment of trains according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</p>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to inspect and test efficiently the train bogies, gangways and couplers, and set the train height according to the standards;</p> <p>(ii) Capable to test efficiently the friction brake system and wheel slide protection devices of trains and set the pneumatic pressure of different brake levels of the brake system according to the standards; and</p> <p>(iii) Capable to test efficiently the train door system and set the train door loop protection according to the standards.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of electrical and mechanical engineering.</p>

1. Title	Inspect, test and commission the electrical system equipment of trains
2. Code	EMRAIT403A
3. Range	Perform visual inspection, insulation and function tests, and measure, adjust and set the electrical system and equipment of trains for train installation work according to guidelines and standards for inspection, testing and commissioning.
4. Level	4
5. Credits	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of and standards for inspecting, testing and commissioning the electrical system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the electrical system equipment of trains, including: <ul style="list-style-type: none"> <li>• Train power system equipment</li> <li>• Train traction control system equipment</li> <li>• Inverter / motor-alternator system</li> <li>• Train loop protection circuit</li> </ul> </li> <li>◆ Understand the scope and standards for inspection, testing and commissioning of the electrical system equipment of trains</li> </ul> <p>6.2 Methods and procedures of inspecting, testing and commissioning the electrical system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Able to read the inspection, testing and commissioning guidelines and select useful information</li> <li>◆ Calculate and compile the details for testing and commissioning according to relevant information</li> <li>◆ Inspect, test and commission the electrical system equipment of trains and controlling and protecting devices according to guidelines and standards</li> <li>◆ Inspect, test and commission the electric traction control system equipment of trains according to guidelines and standards, and record the data</li> <li>◆ Inspect, test and commission the transformer system equipment of trains according to guidelines and standards, and record the data</li> <li>◆ Inspect, test and commission the motor-alternator system equipment of trains according to guidelines and standards, and record the data</li> <li>◆ Perform inspection, insulation test, continuity test and function test according to guidelines and standards for the following circuits <ul style="list-style-type: none"> <li>• Train door loop protection circuit</li> <li>• Brake loop protection circuit</li> </ul> </li> </ul>

	<p>6.3 Professionalism in inspecting, testing and commissioning the electrical system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Inspect, test and commission the electrical system equipment of trains according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in inspecting, testing and commissioning the electrical system equipment of trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to inspect and test efficiently the electrical system equipment of trains and set the protection devices according to the standards;</li> <li>(ii) Capable to inspect and test efficiently the electric traction control system equipment of trains; and</li> <li>(iii) Capable to inspect and test efficiently the inverter and motor-alternator system equipment of trains and set the control and protection devices according to the standards.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of electrical and mechanical engineering and electrical equipment.</p>

1. Title	Inspect, test and commission the pneumatic system equipment of trains
2. Code	EMRAIT404A
3. Range	Perform visual inspection, function test, pressure and leak tests, and measure, adjust and set the pneumatic systems of trains for train installation work according to guidelines and standards for inspection, testing and commissioning.
4. Level	4
5. Credits	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of and standards for inspecting, testing and commissioning the pneumatic system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the pneumatic system equipment of trains, including: <ul style="list-style-type: none"> <li>• Air compressor unit</li> <li>• Air pipe network</li> <li>• Valve and pressure regulator</li> <li>• Pressure gauge</li> <li>• Pneumatic-operated equipment</li> <li>• Equipment to maintain the compressed air quality</li> </ul> </li> <li>◆ Understand the scope and standards for inspection, testing and commissioning of the pneumatic system equipment of trains</li> </ul> <p>6.2 Methods and procedures of inspecting, testing and commissioning the pneumatic system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Able to read the inspection, testing and commissioning guidelines and select useful information</li> <li>◆ Calculate and compile the details for testing and commissioning according to relevant information</li> <li>◆ Inspect, test and commission the pneumatic system equipment of trains and controlling and protecting devices according to guidelines and standards</li> <li>◆ Perform pressure and leak tests for the entire pneumatic system according to guidelines and standards</li> <li>◆ Use general electrical and mechanical and pneumatic equipment repairing and testing instruments and tools efficiently</li> </ul> <p>6.3 Professionalism in inspecting, testing and commissioning the pneumatic system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Inspect, test and commission the pneumatic system equipment of trains according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in inspecting, testing and commissioning the pneumatic system equipment of trains</li> </ul>

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: <ul style="list-style-type: none"><li>(i) Capable to inspect and test efficiently the air compressors of trains and test and set the circuit and pneumatic protection devices according to the standards; and</li><li>(ii) Capable to perform pressure and leak tests efficiently for the entire pneumatic system according to the standards.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of electrical and mechanical engineering and pneumatic equipment.

1. Title	Inspect, test and commission the air-conditioning system equipment of trains
2. Code	EMRAIT405A
3. Range	Perform visual inspection, insulation and function tests, and measure, adjust and set the train air-conditioning systems and controlling and protecting devices for train installation work according to guidelines and standards for inspection, testing and commissioning.
4. Level	4
5. Credits	4
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of and standards for inspecting, testing and commissioning the air-conditioning system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the air-conditioning system equipment of trains, including: <ul style="list-style-type: none"> <li>• Air-conditioner</li> <li>• Air duct</li> <li>• Train air-conditioning control device</li> <li>• Train air-conditioning protecting device</li> </ul> </li> <li>◆ Understand the scope and standards for inspection, testing and commissioning of the air-conditioning system equipment of trains</li> </ul> <p>6.2 Methods and procedures of inspecting, testing and commissioning the air-conditioning system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Able to read the inspection, testing and commissioning guidelines and select useful information</li> <li>◆ Calculate and compile the details for testing and commissioning according to relevant information</li> <li>◆ Inspect, test and commission the air-conditioning system equipment of trains, and controlling and protecting devices according to guidelines and standards</li> <li>◆ Conduct air leak test for the air duct system</li> <li>◆ Measure and record the overall operating parameters of the air-conditioning system of train, including the temperature, humidity, air velocity and volume, pressure and noise level at all measuring points</li> <li>◆ Analyze the performance of air-conditioners according to guidelines and standards</li> <li>◆ Perform leak checking, with electronic leak detector and halogen lamp, etc., for air-conditioning and refrigeration system</li> <li>◆ Use general electrical and mechanical and air-conditioning equipment repairing and testing instruments and tools efficiently</li> </ul>

	<p>6.3 Professionalism in inspecting, testing and commissioning the air-conditioning system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Inspect, test and commission the air-conditioning system equipment of trains according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in inspecting, testing and commissioning the air-conditioning system equipment of trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to inspect and test efficiently the air-conditioners and air ducts of trains according to guidelines and standards;</li> <li>(ii) Capable to inspect and test efficiently the functions and settings of the air-conditioning control system and protection system according to guidelines and standards;</li> <li>(iii) Capable to measure and record efficiently the overall operating parameters of the air-conditioning system, including the electric current, temperature, humidity, air velocity, pressure and noise; and</li> <li>(iv) Capable to use electronic leak detector, halogen lamp and soap solution to perform leak checking for the air-conditioning and refrigeration system efficiently.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of air-conditioning equipment and control circuit.</p>

1. Title	Inspect, test and commission the railway overhead feeder system equipment	
2. Code	EMRAIT407A	
3. Range	Inspect, test and commission the railway overhead feeder system equipment and control circuits and protecting devices at power control rooms, switch rooms and railway premises with overhead lines according to guidelines and standards, and test whether they function properly, including conducting inspections on live and/or isolated condition.	
4. Level	4	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of and standards for inspecting, testing and commissioning the railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the railway overhead feeder system equipment, including: <ul style="list-style-type: none"> <li>• Main line system</li> <li>• Feeder switch device</li> <li>• Electricity quality improvement device</li> <li>• Controlling device</li> <li>• Protecting device</li> </ul> </li> <li>◆ Understand the scope and standards for inspection, testing and commissioning of the feeder system equipment</li> </ul> <p>6.2 Methods and procedures of inspecting, testing and commissioning the railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ Able to read the inspection, testing and commissioning guidelines and select useful information</li> <li>◆ Calculate and compile the details for testing and commissioning according to relevant information</li> <li>◆ Inspect, test and commission the railway overhead feeder system equipment, including conducting inspections on live and/or isolated condition, according to guidelines and standards</li> <li>◆ Analyze data collected according to specified standards to ensure the equipment meet the standard for commissioning</li> <li>◆ Use efficiently general electrical and mechanical equipment repairing and testing instruments and a range of instruments and tools specialized for overhead feeder testing</li> </ul> <p>6.3 Professionalism in inspecting, testing and commissioning the railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ Inspect, test and commission the railway overhead feeder system equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in inspecting, testing and commissioning the railway overhead feeder system equipment</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is:  (i) Capable to inspect, test and commission safely and efficiently the main line system, control circuits and protecting devices of the railway overhead feeder system, including conducting inspections on live and/or isolated condition, according to guidelines, drawings and standards, and ensure that the system equipment performance meet the specified standards.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of overhead feeder system and equipment.

1. Title	Supervise the inspection, commissioning and testing of railway overhead feeder system	
2. Code	EMRAIT408A	
3. Range	Supervise the inspection, commissioning and testing of the railway overhead feeder system at power control rooms, switch rooms and areas with such system so as to ensure quality, standard and efficiency of work.	
4. Level	4	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Procedures, operation modes of units and supervisory skills of inspecting, commissioning and testing railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ Master the inspection, commissioning and testing methods and processes of the major equipment of railway overhead feeder system, relevant quality requirements, and check point selection techniques</li> <li>◆ Understand the operation modes and culture of units involved in the inspection, commissioning and testing of railway overhead feeder system</li> <li>◆ Possess the knowledge and skills of supervising and supporting electrical and mechanical works</li> </ul> <p>6.2 Methods and procedures of supervising the inspection, commissioning and testing of railway overhead feeder system and equipment</p> <ul style="list-style-type: none"> <li>◆ Supervise and support the inspection, commissioning and testing of railway overhead feeder system equipment to ensure quality, standard and efficiency of work. Supervisory procedures include: <ul style="list-style-type: none"> <li>• Selecting and monitoring quality check points</li> <li>• Analyzing the causes of non-compliance with standard and formulating improvement measures</li> <li>• Maintaining adequate coordination and communication in the inspection, commissioning and testing processes</li> </ul> </li> <li>◆ Formulate plans for maintaining persistently the quality of inspection, commissioning and testing work and for improving its efficiency, including: <ul style="list-style-type: none"> <li>• Providing adequate training for staff</li> <li>• Establishing effective communication channels</li> <li>• Planning for updating and upgrading of equipment</li> </ul> </li> </ul> <p>6.3 Professionalism in supervising the inspection, commissioning and testing of railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ Supervise the inspection, commissioning and testing of railway overhead feeder system equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in supervising the inspection, commissioning and testing of railway overhead feeder system equipment</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is:  (i) Capable to supervise and support efficiently the inspection, commissioning and testing of the railway overhead feeder system to ensure compliance with safety codes and standards, and quality and efficiency requirements; to formulate plans for maintaining persistently the quality of inspection, commissioning and testing work and for improving its efficiency.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of the overhead feeder system and equipment and basic knowledge and skills of supervision.

1. Title	Inspect, test and commission railway traffic management system	
2. Code	EMRAIT409A	
3. Range	Inspect, test and commission railway traffic management system at railway premises, railway traffic control rooms and signal switch rooms, including computer control equipment and information network equipment.	
4. Level	4	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Structure and working principles of railway traffic management system</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the control programming system of the railway traffic management system, including: <ul style="list-style-type: none"> <li>• Signal and control monitor system</li> <li>• Train route and programming control system</li> <li>• Train location indication and communication system</li> <li>• Train operation control system</li> <li>• Data collection and management reporting system</li> <li>• Interface devices</li> </ul> </li> <li>◆ Understand the structure and working principles of the network system of the railway traffic management system, including: <ul style="list-style-type: none"> <li>• LAN</li> <li>• WAN</li> <li>• Signal transmission equipment</li> <li>• Interface devices</li> </ul> </li> <li>◆ Understand the scope and standards for inspection, testing and commissioning of the railway traffic management system</li> </ul> <p>6.2 Methods and procedures of inspecting, testing and commissioning railway traffic management system and equipment</p> <ul style="list-style-type: none"> <li>◆ Able to read the inspection, testing and commissioning guidelines and circuit diagrams and select useful information</li> <li>◆ Calculate and compile the details for testing and commissioning according to relevant information</li> <li>◆ Inspect, test and commission the control programming system and relevant equipment of the railway traffic management system according to guidelines and standards, and record the data from tests</li> <li>◆ Inspect, test and commission the network system and relevant equipment of the railway traffic management system according to guidelines and standards, and record the data from tests</li> <li>◆ Use general electrical and electronic equipment testing instruments and tools efficiently</li> </ul>	

	<p>6.3 Professionalism in inspecting, testing and commissioning railway traffic management system and equipment</p> <ul style="list-style-type: none"> <li>◆ Inspect, test and commission the railway traffic management system and equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in inspecting, testing and commissioning the railway traffic management system and equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to inspect, test and commission safely and efficiently the railway traffic management system according to instructions, relevant programme and standards; and</p> <p>(ii) Capable to record the data from tests correctly and effectively.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of electronics, computer and communication.</p>

1. Title	Inspect, test and commission railway signal interlock system	
2. Code	EMRAIT410A	
3. Range	Inspect, test and commission railway signal interlock system at railway premises, railway traffic control rooms and signal switch rooms to ensure that the train receives signals correctly and the interlock system functions properly to prevent train accidents.	
4. Level	4	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Structure and working principles of the railway signal and control system</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the railway signal and control system</li> <li>◆ Understand the structure and working principles of the central interlock units, including: <ul style="list-style-type: none"> <li>• PLC units</li> <li>• Electronic circuit units</li> </ul> </li> <li>◆ Understand the structure and working principles of the trackside functional units of the railway signal and control system, including: <ul style="list-style-type: none"> <li>• Trackside units</li> <li>• Interface devices</li> <li>• Signal and information transmission equipment</li> </ul> </li> <li>◆ Understand the scope and standards for inspection, testing and commissioning of the railway signal interlock system</li> </ul> <p>6.2 Methods and procedures of inspecting, testing and commissioning railway signal interlock system</p> <ul style="list-style-type: none"> <li>◆ Able to read the inspection, testing and commissioning guidelines and circuit diagrams and select useful information</li> <li>◆ Calculate and compile the details for testing and commissioning according to relevant information</li> <li>◆ Inspect, test and commission the central interlock components of the railway signal interlock system according to guidelines and standards, and record the data from tests</li> <li>◆ Inspect, test and commission the trackside functional components of the railway signal interlock system according to guidelines and standards, and record the data from tests</li> <li>◆ Use general electrical and electronic equipment testing instruments and tools efficiently</li> </ul>	

	<p>6.3 Professionalism in inspecting, testing and commissioning railway signal interlock system equipment</p> <ul style="list-style-type: none"> <li>◆ Inspect, test and commission the railway signal interlock system equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in inspecting, testing and commissioning the railway signal interlock system equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to inspect, test and commission safely and efficiently the operation of interlock of the railway signal and control system, including conducting function test for the central interlock components and trackside interlock components; and</li> <li>(ii) Capable to record the data from tests correctly and effectively.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of electronics, computer and communication.</p>

1. Title	Inspect, test and commission trackside equipment and SCADA System	
2. Code	EMRAIT411A	
3. Range	Undertake visual inspection and insulation, function and interlocking tests and measure, adjust, set and commission the trackside equipment of the railway signal and control system and Supervisory, Control and Data Acquisition System at railway premises, control rooms and signal switch rooms.	
4. Level	4	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Structure and working principles of the railway signal and control system and interlock</p> <ul style="list-style-type: none"> <li>◆ Understand the working principles of the railway signal and control system</li> <li>◆ Understand the structure and working principles of the railway signal interlock system, including: <ul style="list-style-type: none"> <li>• PLC</li> <li>• Solid-state interlock</li> <li>• Relay interlock</li> <li>• Electronic control circuits</li> </ul> </li> <li>◆ Understand the structure and working principles of the trackside equipment of the railway signal and control system, including: <ul style="list-style-type: none"> <li>• PLC and control components</li> <li>• Train location detecting devices</li> <li>• Platform screen door control devices</li> <li>• Railway signal display devices</li> <li>• Electronic interface devices</li> <li>• Points</li> <li>• Supervisory, Control and Data Acquisition System (SCADA)</li> </ul> </li> <li>◆ Understand the scope and standards for inspection, testing and commissioning of interlock</li> </ul> <p>6.2 Methods and procedures of inspecting, testing and commissioning the trackside equipment of the railway signal and control system and SCADA System</p> <ul style="list-style-type: none"> <li>◆ Able to read the inspection, testing and commissioning guidelines and circuit diagrams and select useful information</li> <li>◆ calculate and compile the details for testing and commissioning according to relevant information</li> <li>◆ Inspect, test and commission trackside equipment according to guidelines and standards and record the data from tests</li> <li>◆ Inspect, test and commission points switches and control and protection circuits according to guidelines and standards and record the data</li> <li>◆ Inspect, test and commission SCADA System according to guidelines and standards</li> <li>◆ Use general electrical and electronic equipment testing instruments and tools efficiently</li> </ul>	

	<p>6.3 Professionalism in inspecting, testing and commissioning the trackside equipment of the railway signal and control system and SCADA System</p> <ul style="list-style-type: none"> <li>◆ Inspect, test and commission the trackside signal system equipment and the SCADA System equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in inspecting, testing and commissioning the trackside signal system equipment and the SCADA System equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to inspect, test and commission safely and efficiently the functions and data of the trackside equipment of the railway signal and control system according to relevant standards; and</li> <li>(ii) Capable to inspect, test and commission safely and efficiently the motor-driven points fitted with interlock according to relevant standards.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of electrical engineering, electronics and telecommunication.</p>

1. Title	Inspect, test and commission automatic train control system equipment on the train
2. Code	EMRAIT412A
3. Range	Inspect and use instruments to test automatic train control (ATC) system equipment on the train according to guidelines and standards to assure that the ATC system function properly.
4. Level	4
5. Credits	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Structure and working principles of the ATC system</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the ATC system</li> <li>◆ Understand the functions and working principles of the ATC system equipment components on the train, including: <ul style="list-style-type: none"> <li>• ATC electronic control unit on the train</li> <li>• Interface unit</li> <li>• Antennas</li> <li>• Accelerometer</li> <li>• Tachometer</li> </ul> </li> <li>◆ Understand the scope and standards of inspection, testing and commissioning of the ATC system equipment on the train</li> </ul> <p>6.2 Methods and procedures of inspecting, testing and commissioning the ATC system equipment on the train</p> <ul style="list-style-type: none"> <li>◆ Able to read the inspection, testing and commissioning guidelines and circuit diagrams and select useful information</li> <li>◆ Calculate and compile the details for testing and commissioning according to relevant information</li> <li>◆ Inspect, test and commission trackside equipment according to guidelines and standards and record the data from tests</li> <li>◆ Use general electronic equipment repairing and testing instruments and specialized ATC system testing instruments efficiently</li> </ul> <p>6.3 Professionalism in inspecting, testing and commissioning the ATC system equipment on the train</p> <ul style="list-style-type: none"> <li>◆ Inspect, test and commission the ATC system equipment on the train according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in inspecting, testing and commissioning the ATC system equipment on the train</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to inspect, test and commission safely and efficiently a range of ATC system equipment on the train according to guidelines and standards to assure the safety of train operation, and record the data from tests.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of electronics and telecommunication.

1. Title	Supervise the inspection, commissioning and testing of railway signal and control system	
2. Code	EMRAIT413A	
3. Range	Supervise the inspection, commissioning and testing of the railway signal and control system at railway premises, control rooms and signal switch rooms so as to ensure quality, standard and efficiency of work.	
4. Level	4	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Procedures, operation modes of units and supervisory skills of inspecting, commissioning and testing railway signal and control system</p> <ul style="list-style-type: none"> <li>◆ Master the inspection, commissioning and testing methods and processes of railway signal and control system, relevant quality requirements, and control point selection techniques</li> <li>◆ Understand the operation modes and culture of units involved in the inspection, commissioning and testing of railway signal and control system</li> <li>◆ Possess the knowledge and skills of supervising and supporting railway signal and control system works</li> </ul> <p>6.2 Methods and procedures of supervising the inspection, commissioning and testing of railway signal and control system</p> <ul style="list-style-type: none"> <li>◆ Supervise and support the inspection, commissioning and testing of railway signal and control system to ensure quality, standard and efficiency of work. Supervisory procedures include: <ul style="list-style-type: none"> <li>• Selecting and monitoring quality control points</li> <li>• Analyzing the causes of non-compliance with standard and formulating improvement measures</li> <li>• Maintaining adequate coordination and communication in the inspection, commissioning and testing processes</li> </ul> </li> <li>◆ Formulate plans for maintaining persistently the quality of inspection, commissioning and testing work and for improving its efficiency, including: <ul style="list-style-type: none"> <li>• Providing adequate training for staff</li> <li>• Establishing effective communication channels</li> <li>• Planning for updating and upgrading of equipment</li> </ul> </li> </ul> <p>6.3 Professionalism in supervising the inspection, commissioning and testing of railway signal and control system equipment</p> <ul style="list-style-type: none"> <li>◆ Supervise the inspection, commissioning and testing of railway signal and control system equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in supervising the inspection, commissioning and testing of railway signal and control system equipment</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is:  (i) Capable to supervise and support efficiently the inspection, commissioning and testing of the railway signal and control system to ensure compliance with safety codes and standards, and quality and efficiency requirements; to formulate plans for maintaining persistently the quality of inspection, commissioning and testing work and for improving its efficiency.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of the signal and control system and equipment and basic knowledge and skills of supervision.

1. Title	Troubleshoot intermittent and hidden faults in train	
2. Code	EMRAOR401A	
3. Range	Apply fault finding and analysis techniques professionally with a good knowledge of the equipment system at a train maintenance centre or a train in operation to find the root causes of intermittent and hidden faults in such system and equipment.	
4. Level	4	
5. Credits	5	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Techniques of analyzing and finding intermittent and hidden faults in train system and equipment</p> <ul style="list-style-type: none"> <li>◆ Understand the causes and types of intermittent intractable and hidden faults</li> <li>◆ Master the techniques of analyzing intermittent and hidden faults</li> <li>◆ Understand the operation characteristics of train system and equipment, and the devices and circuits which are prone to hidden faults</li> </ul> <p>6.2 Methods and procedures of finding intermittent and hidden faults in train system and equipment</p> <ul style="list-style-type: none"> <li>◆ Apply the following techniques to find hidden faults in train system and equipment effectively so as to improve the efficiency of finding faults <ul style="list-style-type: none"> <li>• Analyze past fault symptoms and identify suspected faulty equipment</li> <li>• Simulate different operation conditions to trigger hidden faults</li> <li>• Analyze the performance data of relevant system equipment</li> </ul> </li> <li>◆ Apply the following techniques to find intermittent faults in train system and equipment effectively so as to improve the efficiency of finding faults <ul style="list-style-type: none"> <li>• Install and connect data logging instruments for monitoring of faults</li> <li>• Install and connect the fault latching circuit for monitoring of faults</li> <li>• Interchange with identical equipment for testing (by trial and error)</li> <li>• Simulate different operation conditions to trigger intermittent faults</li> <li>• Analyze the performance data of relevant system equipment</li> </ul> </li> <li>◆ Use general E&amp;M and pneumatic equipment measuring and testing instruments and data logging instruments efficiently</li> </ul>	

	<p>6.3 Professionalism in identifying intermittent and hidden faults in train system and equipment</p> <ul style="list-style-type: none"> <li>◆ Identify intermittent and hidden faults in train system and equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice to handle supervision work of identifying intermittent and hidden faults in train system and equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to identify a preset hidden faults in a train control circuit within a reasonable period of time; and</li> <li>(ii) Capable to illustrate the techniques of identifying intermittent faults in the train system and equipment.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person is familiar with the operation and working principles of train equipment.</p>

1. Title	Supervise the fault repair of train equipment	
2. Code	EMRAOR402A	
3. Range	Supervise the fault finding and repair of train equipment at train maintenance centres and railway premises so as to ensure the quality and efficiency of the work.	
4. Level	4	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Procedures, operation modes of units and supervisory skills of repairing train equipment faults</p> <ul style="list-style-type: none"> <li>◆ Master the fault finding and repair methods and processes of the train equipment, relevant quality requirements, and check point selection techniques</li> <li>◆ Understand the operation modes and culture of units involved in the fault repair of train equipment</li> <li>◆ Possess the knowledge and skills of supervising and supporting electrical and mechanical works</li> </ul> <p>6.2 Methods and procedures of supervising the fault finding and repair of train equipment</p> <ul style="list-style-type: none"> <li>◆ Supervise and support the fault finding and repair of train equipment to ensure the quality and efficiency of work</li> <li>◆ Provide useful opinions to improve the efficiency of finding faults</li> <li>◆ Provide sufficient support for the repair work after identifying the roots of fault</li> <li>◆ Have adequate communication with the designing team and the manufacturer in order to collect information for use in supporting fault finding for trains</li> <li>◆ Analyze train equipment fault symptoms and fault repair records in order to provide information for supporting fault finding for trains</li> <li>◆ Formulate plans for maintaining persistently the quality of fault finding and repair work and for improving its efficiency, including: <ul style="list-style-type: none"> <li>• Providing adequate training for staff</li> <li>• Establishing effective communication channels</li> <li>• Planning for updating and upgrading of fault finding instruments and equipment</li> </ul> </li> </ul> <p>6.3 Professionalism in supervising fault finding and repair of train equipment</p> <ul style="list-style-type: none"> <li>◆ Supervise the fault finding and repair of train equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in finding and repairing train equipment faults</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is:  (i) Capable to supervise and support efficiently the fault finding and repair of the train system equipment to ensure that it complies with the code of safety and standards, and that the quality and efficiency of work are up to standard and requirements; to formulate plans for maintaining persistently the quality of fault finding and repair work and for improving its efficiency.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person is familiar with the operation and working principles of train equipment and basic knowledge and skills of supervision.

1. Title	Troubleshoot intermittent and hidden faults in the railway overhead feeder system	
2. Code	EMRAOR403A	
3. Range	Apply fault finding and analysis techniques professionally with a good knowledge of the equipment system at power control rooms, switch rooms and areas with the railway overhead feeder system to identify the root causes of faults in such system.	
4. Level	4	
5. Credits	5	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Techniques of analyzing and finding intermittent and hidden faults in railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ Understand the causes and types of intermittent and hidden faults</li> <li>◆ Master the techniques of analyzing intermittent and hidden faults</li> <li>◆ Understand the operation characteristics of railway overhead feeder system equipment, and the devices and circuits which are prone to hidden faults</li> </ul> <p>6.2 Methods and procedures of finding intermittent and hidden faults in railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ Apply the following techniques to find hidden faults in railway overhead feeder system equipment effectively so as to improve the efficiency of finding faults <ul style="list-style-type: none"> <li>• Analyze past fault symptoms and identify suspected faulty equipment</li> <li>• Simulate different operation conditions to trigger hidden faults</li> </ul> </li> <li>◆ Analyze the performance data of relevant system equipment</li> <li>◆ Apply the following techniques to find intermittent faults in railway overhead feeder system equipment effectively so as to improve the efficiency of finding faults <ul style="list-style-type: none"> <li>• Use the data logging instruments of the railway overhead feeder system and select relevant information for fault analysis</li> <li>• Install and connect data logging instruments for monitoring of faults</li> <li>• Install and connect the fault latching circuit for monitoring of faults</li> <li>• Interchange with identical equipment for testing (by trial and error)</li> <li>• Simulate different operation conditions to trigger intermittent faults</li> <li>• Analyze the performance data of relevant system equipment</li> </ul> </li> <li>◆ Use general E&amp;M and overhead line measuring and testing instruments and data logging instruments efficiently</li> </ul>	

	<p>6.3 Identifying Professionalism in intermittent and hidden faults in railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ Identify intermittent and hidden faults in railway overhead feeder system equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice to handle supervision work of identifying intermittent and hidden faults in railway overhead feeder system equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to identify a preset hidden faults in a railway overhead feeder system within a reasonable period of time; and</li> <li>(ii) Capable to illustrate the techniques of identifying intermittent faults in the railway overhead feeder system.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person is familiar with the operation and working principles of the railway overhead feeder system and equipment.</p>

1. Title	Fix the faults in railway signal interlock system	
2. Code	EMRAOR404A	
3. Range	Identify and repair the faults in railway signal interlock system at railway premises, railway traffic control rooms and signal switch rooms.	
4. Level	4	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Structure and working principles of the railway signal and control system</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the railway signal and control system</li> <li>◆ Understand the structure and working principles of the central interlock components, including: <ul style="list-style-type: none"> <li>• Processor components</li> <li>• PLC components</li> <li>• Solid-state interlock (SSI)</li> <li>• Electronic circuit components</li> </ul> </li> <li>◆ Understand the structure and working principles of the trackside functional components of the railway signal and control system, including: <ul style="list-style-type: none"> <li>• PLC components</li> <li>• Solid-state interlock (SSI)</li> <li>• Relay interlock</li> <li>• Interface devices</li> <li>• Signal and information transmission equipment</li> </ul> </li> </ul> <p>6.2 Methods and procedures of identifying and repairing the faults in railway signal interlock system</p> <ul style="list-style-type: none"> <li>◆ Able to read the engineering drawings of the railway signal and control system and check the signal system equipment and devices systematically and efficiently</li> <li>◆ Analyze the information and fault symptoms and check the railway signal central interlock devices and circuits to find the root cause of fault</li> <li>◆ Analyze the information and fault symptoms and check the trackside equipment of the interlock system to find the root cause of fault</li> <li>◆ Analyze the information and fault symptoms and check the following signal and information transmission devices to find the root cause of fault <ul style="list-style-type: none"> <li>• Information transmission interface components</li> <li>• Signal transmission network including optical fibre network</li> </ul> </li> <li>◆ Repair the fault after finding out the fault equipment or component</li> <li>◆ Use general electrical and electronic equipment repairing and testing instruments and data logging instruments efficiently</li> </ul>	

	<p>6.3 Professionalism in identifying and repairing the faults in railway signal interlock system devices</p> <ul style="list-style-type: none"> <li>◆ Identify and repair the faults in the railway signal interlock system devices according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in identifying and repairing the faults in the railway signal interlock system devices</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to identify the faults in the central interlock device components of the railway signal interlock system within a reasonable period of time according to the fault symptoms;</li> <li>(ii) Capable to identify the faults in the trackside equipment of the railway signal interlock system within a reasonable period of time.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of electronics and the railway signal system.</p>

1. Title	Fix the faults in railway signal and control system and trackside equipment and SCADA	
2. Code	EMRAOR405A	
3. Range	Identify and repair the faults in railway signal and control system and trackside equipment and SCADA at railway premises, railway traffic control rooms and signal switch rooms.	
4. Level	4	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Structure and working principles of the railway signal and control system and interlock</p> <ul style="list-style-type: none"> <li>◆ Understand the working principles of the railway signal and control system</li> <li>◆ Understand the structure and working principles of the railway signal interlock system, including: <ul style="list-style-type: none"> <li>• PLC</li> <li>• Solid-state interlock</li> <li>• Relay interlock</li> <li>• Electronic control circuits</li> </ul> </li> <li>◆ Understand the structure and working principles of the trackside equipment of the railway signal and control system, including: <ul style="list-style-type: none"> <li>• PLC and control components</li> <li>• Train location detecting devices</li> <li>• Platform screen door control devices</li> <li>• Railway signal display devices</li> <li>• Electronic interface devices</li> <li>• Points</li> <li>• Supervisory, Control and Data Acquisition System (SCADA)</li> </ul> </li> <li>◆ Master the basic fault finding techniques</li> </ul> <p>6.2 Methods and procedures of identifying and repairing the faults in the trackside equipment of the railway signal and control system</p> <ul style="list-style-type: none"> <li>◆ Able to read the engineering drawings of the railway signal and control system and check the signal system equipment and devices systematically and efficiently</li> <li>◆ Analyze the information and signs of faults and check the trackside equipment and circuits of the railway signal and control system to find the root cause of fault</li> <li>◆ Analyze the information and fault symptoms and check the motors, mechanical devices and status indicators of points and the control and protection circuits to find the root cause of fault</li> <li>◆ Analyze the information and fault symptoms and check the SCADA functions and transmission devices to find the root cause of fault</li> <li>◆ Repair the fault after finding out the faulty equipment or component</li> <li>◆ Use general electrical and electronic equipment repairing and testing instruments and data logging instruments efficiently</li> </ul>	

	<p>6.3 Professionalism in identifying and repairing the faults in the trackside equipment of the railway signal and control system and the SCADA System equipment</p> <ul style="list-style-type: none"> <li>◆ Identify and repair the faults in the trackside equipment of the railway signal and control system and the SCADA System equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in identifying and repairing the faults in the trackside equipment of the railway signal and control system and the SCADA System equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to identify the faults in the trackside equipment of the railway signal and control system within a reasonable period of time according to the fault symptoms;</li> <li>(ii) Capable to identify and eliminate the faults in the points within a reasonable period of time according to the fault symptoms; and</li> <li>(iii) Capable to identify the faults in the SCADA and transmission devices within a reasonable period of time according to the fault symptoms.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of electronics and the railway signal system.</p>

1. Title	Fix the faults in automatic train control system equipment on the train	
2. Code	EMRAOR406A	
3. Range	Identify and repair the faults in automatic train control (ATC) system equipment on the train at a train maintenance centre or in operation.	
4. Level	4	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Structure and working principles of the ATC system</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the ATC system</li> <li>◆ Understand the functions and working principles of the ATC system equipment components on the train, including: <ul style="list-style-type: none"> <li>• ATC electronic control unit on the train</li> <li>• Interface unit</li> <li>• Antennas</li> <li>• Accelerometer</li> <li>• Tachometer</li> </ul> </li> <li>◆ Master the basic fault finding techniques</li> </ul> <p>6.2 Methods and procedures of identifying and repairing the faults in the ATC system equipment on the train</p> <ul style="list-style-type: none"> <li>◆ Able to read the microprocessor, electronic and communication engineering drawings and check the ATC system equipment on the train systematically and efficiently</li> <li>◆ Analyze the information and fault symptoms and check the ATC system equipment on the train to find the root cause of fault</li> <li>◆ Analyze the information and fault symptoms and check the ATC system equipment under the train to find the root causes of faults</li> <li>◆ Repair the fault after identifying the faulty equipment or component</li> <li>◆ Use general electronic equipment repairing and testing instruments and specialized ATC system testing instruments efficiently</li> </ul> <p>6.3 Professionalism in identifying and repairing the faults in the ATC system equipment on the train</p> <ul style="list-style-type: none"> <li>◆ Identify and repair the faults in the ATC system equipment on the train according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in identifying and repairing the faults in the ATC system equipment on the train</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is:  (i) Capable to identifying the faults in the ATC system equipment on the train (and under the train) within a reasonable period of time according to the fault symptoms, and to fix the faults.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of electronics and the railway signal system.

1. Title	Fix the faults in the railway traffic management system	
2. Code	EMRAOR407A	
3. Range	Identify and repair the faults in the railway traffic management system at railway premises, railway traffic control rooms and signal switch rooms.	
4. Level	4	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Structure and working principles of the railway traffic management system</p> <ul style="list-style-type: none"> <li>◆ Understand the structure and working principles of the control programming system of the railway traffic management system, including: <ul style="list-style-type: none"> <li>• Signal and control monitor system</li> <li>• Train route and programming control system</li> <li>• Train location indication and communication system</li> <li>• Train operation control system</li> <li>• Data collection and management reporting system</li> <li>• Interface devices</li> </ul> </li> <li>◆ Understand the structure and working principles of the network system of the railway traffic management system, including: <ul style="list-style-type: none"> <li>• LAN</li> <li>• WAN</li> <li>• Signal transmission equipment</li> <li>• Interface devices</li> </ul> </li> </ul> <p>6.2 Methods and procedures of identifying and repairing the faults in the railway traffic management system equipment</p> <ul style="list-style-type: none"> <li>◆ Able to read the engineering drawings of the railway signal system and network and check the railway traffic management system equipment systematically and efficiently</li> <li>◆ Analyze the information and fault symptoms and check the control programming system of the railway traffic management system to find the root causes of faults</li> <li>◆ Analyze the information and fault symptoms and check the network system of the railway traffic management system to identify the root causes of faults</li> <li>◆ Consult information recording equipment to help identify the roots of faults in the network system</li> <li>◆ Repair the faults after identifying the fault equipment or component</li> <li>◆ Use general electronic and network system equipment repairing and testing instruments efficiently</li> </ul>	

	<p>6.3 Professionalism in identifying and repairing the faults in the railway traffic management system</p> <ul style="list-style-type: none"> <li>◆ Identify and repair the faults in the railway traffic management system according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in identifying and repairing the faults in the railway traffic management system</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to identify the faults in the control programming system of the railway traffic management system within a reasonable period of time according to the fault symptoms; and</li> <li>(ii) Capable to identify the faults in the network system of the railway traffic management system within a reasonable period of time according to the fault symptoms.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of electronics and the network system.</p>

1. Title	Analyze operation information and records of railway signal and control system equipment to clear the root causes of faults
2. Code	EMRAOR408A
3. Range	Collect and select data, information and records related to railway signal and control system faults to help find the root causes of faults of the system equipment.
4. Level	4
5. Credits	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Application of operation information and records of railway signal and control system equipment</p> <ul style="list-style-type: none"> <li>◆ Understand the method and classification of operation information and records of railway signal and control system equipment</li> <li>◆ Master the data selection and application techniques</li> </ul> <p>6.2 Select and analyze data and fault records in the data recording device of railway signal and control system equipment to help find and clear the root causes of faults</p> <ul style="list-style-type: none"> <li>◆ Select relevant fault information from individual systems of the railway signal and control system</li> <li>◆ Select relevant fault information from the data recording device of the central traffic management system</li> <li>◆ Analyze the data change before a fault occurs, the signs of the fault and the data after the fault occurs to help find and clear the root causes of faults</li> <li>◆ Analyze abnormal data to help find the root causes of intermittent faults and hidden faults</li> <li>◆ Select fault information related to railway signal and control system equipment from the equipment fault records or files according to the fault symptoms, and analyze according to the working principles so as to find and clear the root causes of faults</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to select useful information from the records of a range of data recording devices of the railway signal and control system equipment, and deduce the root causes of faults; and</p> <p>(ii) Capable to deduce effectively the causes of an intermittent fault from the range of data.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of operation principles of railway signal and control system.

1. Title	Supervise equipment maintenance work to ensure its quality, standard and efficiency	
2. Code	EMCUMA401A	
3. Range	Supervise, coordinate and support the maintenance working team to perform the repair work for electrical and mechanical engineering equipment.	
4. Level	4	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Procedures, standard and requirements for repairing engineering equipment</p> <ul style="list-style-type: none"> <li>◆ Understand the general procedures, standard and requirements for repairing engineering equipment, and analyze and set the procedures, standard and requirements for repairing them according to the repairing instructions and knowledge of relevant repairing techniques</li> </ul> <p>6.2 Supervise equipment maintenance work to ensure its quality</p> <ul style="list-style-type: none"> <li>◆ Support and coordinate the repair work <ul style="list-style-type: none"> <li>• Support the repair work technically and in the aspect of resource allocation</li> <li>• Coordinate all items of repair and pay attention to the progress of crucial procedures</li> </ul> </li> <li>◆ Monitor the repair work <ul style="list-style-type: none"> <li>• Check randomly the repair quality according to the importance of procedure</li> <li>• Take appropriate steps to rectify the repair work not up to the standard, and ensure that rectification continues to be effective and the job can be finished in time</li> </ul> </li> <li>◆ Purchase suitable tools and equipment to enhance the repairing efficiency <ul style="list-style-type: none"> <li>• Apply repairing procedures and techniques, and purchase adequate suitable repairing tools and equipment to enhance the repairing efficiency</li> <li>• Formulate and implement repairing tools and equipment maintenance plan</li> </ul> </li> <li>◆ Maintain good human resources management, time management and interpersonal relationship <ul style="list-style-type: none"> <li>• Analyze and formulate manpower training plans</li> <li>• Implement good time management</li> <li>• Maintain good interpersonal relationship</li> </ul> </li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is:  (i) Capable to support, coordinate and monitor effectively the implementation of repair work; work out methods to ensure the quality, standard and efficiency of the repair work; formulate long-term plans for equipment maintenance with human resources concerned; and maintain good staff interpersonal relationship.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic management knowledge

1. Title	Inspect, and perform system function tests and running tests for overhauled trains	
2. Code	EMRAMA401A	
3. Range	Perform system function tests and running tests for overhauled trains at train maintenance centres or railway main line according to different equipment functions, and record the data as performance reference.	
4. Level	4	
5. Credits	7	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Items, scope and standards for the inspection, function test and running test for overhauled trains</p> <ul style="list-style-type: none"> <li>◆ Understand the items, scope and standards for the inspection of overhauled trains</li> <li>◆ Understand the items, scope and standards for the function tests for all major systems</li> <li>◆ Understand the items, scope and standards for the running test of trains</li> </ul> <p>6.2 Methods and procedures of the inspection, function test and running test for overhauled trains</p> <ul style="list-style-type: none"> <li>◆ Perform visual inspection, insulation tests and function tests for the electrical system equipment of trains</li> <li>◆ Perform visual inspection, insulation tests and function tests for the traction system control equipment</li> <li>◆ Perform function tests for the brake control system of trains in standstill state</li> <li>◆ Perform function tests for the pneumatic system of trains and record the pressure of the main pipe line</li> <li>◆ Perform visual inspection, insulation tests and function tests for the inverter</li> <li>◆ Perform function tests for the air-conditioning system</li> <li>◆ Perform main line running tests for trains according to the operation pattern of the railway main line, and measure and record data for the train speed of different sections, traveling time required, electric current during running and brake performance</li> <li>◆ Use instruments and tools for measuring and checking general E&amp;M, pneumatic and air-conditioning equipment efficiently</li> <li>◆ Enforce safety and protective measures comprehensively for performing function tests and running tests</li> </ul> <p>6.3 Professionalism in inspection, function test and operation test for overhauled trains</p> <ul style="list-style-type: none"> <li>◆ Perform inspection, function test and running test for overhauled trains according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in handling the inspection, function test and running test for overhauled trains</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is:  (i) Capable to perform function tests for all systems of trains safely and efficiently according to the standards for testing equipment functions, and to measure the data from such tests and maintain an accurate record; and  (ii) Capable to perform main line running tests for trains, and measure and record data generally required for train operation.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of major train equipment.

1. Title	Teach electrical and mechanical engineering courses
2. Code	EMRAOM401A
3. Range	Master the objectives of courses and understand the level of learners; apply technical course teaching skills; write course plans; and teach technical courses to achieve the course objectives.
4. Level	4
5. Credits	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Make preparations for teaching courses</p> <ul style="list-style-type: none"> <li>◆ Write and arrange course plans by mastering the objectives of courses and understanding the level of learners, including <ul style="list-style-type: none"> <li>• Teaching the working principles and structure of equipment</li> <li>• Technical demonstration</li> <li>• Practical assignment</li> <li>• Assessment design</li> <li>• Technical requirements and code of practice for electrical and mechanical works</li> <li>• Venue design</li> <li>• Requirements on teaching equipment</li> </ul> </li> </ul> <p>6.2 Teach electrical and mechanical engineering courses</p> <ul style="list-style-type: none"> <li>◆ Make use of the following teaching skills to deliver the course smoothly so that the learners can achieve the learning outcomes <ul style="list-style-type: none"> <li>• Relevant and practical course content</li> <li>• Clear explanation</li> <li>• Emphasis on the technical requirements and code of practice for electrical and mechanical works</li> <li>• Stimulating the learning atmosphere</li> <li>• Encouraging the learners to ask</li> <li>• Responding eagerly</li> <li>• Appropriate use of teaching equipment</li> <li>• Guiding hands-on practice</li> <li>• Safety precautions for hands-on practice</li> <li>• Effective time management</li> </ul> </li> </ul> <p>6.3 Course review and improvement</p> <ul style="list-style-type: none"> <li>◆ Collect learners' feedback to review and improve the course</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to follow course performance standard to write a course plan for a specified electrical and mechanical course; and</p> <p>(ii) Capable to follow the above-mentioned course plan to teach the course in order to meet the course performance standard.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses the technical knowledge and skills of the teaching items.

1. Title	Formulate code of safety for machinery operation
2. Code	EMRASH401A
3. Range	Identify regulated machinery according to legal requirements and codes of safety, etc., and formulate codes of safety for operating such machinery.
4. Level	4
5. Credits	5
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 State the scope for the code of safety for machinery operation</p> <ul style="list-style-type: none"> <li>◆ State the scope for the code of safety for machinery operation according to the regulations and the analysis of machinery operation risk assessment</li> <li>◆ State the types of regulated machinery, including: <ul style="list-style-type: none"> <li>• Lifting and hoisting machinery</li> <li>• Handling machinery</li> <li>• Rotating machinery</li> </ul> </li> </ul> <p>6.2 Formulate the methods and procedures of code of safety for machinery operation</p> <ul style="list-style-type: none"> <li>◆ Formulate code of safety operation for each type of machinery, including: <ul style="list-style-type: none"> <li>• Necessity for safety training</li> <li>• Examination requirements</li> <li>• Protection devices for machinery</li> <li>• Safety certificate / maintenance of machinery</li> <li>• Contingency measures</li> <li>• Special cautious items</li> </ul> </li> </ul> <p>6.3 Formulate management, monitoring and audit mechanisms</p> <ul style="list-style-type: none"> <li>◆ Formulate management, monitoring and audit mechanisms for the safety of machinery operation</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to classify a specified batch of machinery and draft codes of safety operation for such machinery; and</p> <p>(ii) Capable to draw up management, monitoring and audit mechanisms for safety operation of machinery.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of safety and related regulations and risk assessment.

1. Title	Perform tasks of power disconnection, isolation and earthing and of issuing works permits (i.e. the duty of an authorized person)	
2. Code	EMRASH402A	
3. Range	Perform tasks of power disconnection, isolation and earthing involved in electrical and mechanical works according to the safety requirements for working with high voltage and low voltage installations stated in the Code of Practice for the Electricity (Wiring) Regulations; issue works permits, as required by the regulations, to persons-in-charge to ensure safety.	
4. Level	4	
5. Credits	4	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge and skills of power disconnection, isolation and earthing and of issuing works permits</p> <ul style="list-style-type: none"> <li>◆ Understand the electrical installations and related circuits to be isolated</li> <li>◆ Master the techniques of reading electrical wiring diagrams and relevant documents</li> <li>◆ Master the knowledge and skills of operating switching, isolation and earthing devices</li> <li>◆ Be familiar with the site with electrical installations and its surroundings</li> <li>◆ Test and assess the reliability of switching, isolation and earthing devices</li> <li>◆ Understand the roles, qualifications, authority and responsibilities of a nominated person, an authorized person and a person-in-charge and the required identification documents to be provided by them.</li> <li>◆ Be familiar with the procedures of power disconnection, isolation and earthing, securing with safety locks, placing warning notices and danger notices and issuing works permits, and the techniques of handling records and papers</li> </ul> <p>6.2 Methods and procedures of power disconnection, isolation and earthing and of issuing works permits</p> <ul style="list-style-type: none"> <li>◆ Adopt safety precautions according to the Code of Practice for the Electricity (Wiring) Regulations and correctly undertake power disconnection, isolation and earthing in accordance with the safety requirements for working with high voltage and low voltage installations</li> <li>◆ Secure with safety locks and place warning notices and danger notices effectively</li> <li>◆ Indicate to the person-in-charge the electrical installation to be isolated and describe the works limit and safety measures</li> <li>◆ Adopt special safety measures and issue special instructions if necessary</li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Issue the works permit when all safety measures are in place and the details of such permit are confirmed by the person-in-charge, according to the Code of Practice for the Electricity (Wiring) Regulations</li> <li>◆ Maintain a record of work permits effectively</li> <li>◆ Handle the tasks of power disconnection, isolation and earthing and of issuing works permits according to the safety guidelines as required by the electricity law and codes of practice</li> </ul> <p>6.3 Professionalism in handling power disconnection, isolation and earthing and in issuing works permits</p>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to undertake power disconnection, isolation and earthing for an electrical installation correctly and efficiently according to the requirements of the Code of Practice for the Electricity (Wiring) Regulations; and</li> <li>(ii) Capable to issue works permits efficiently according to the Electricity (Wiring) Regulations.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses the appropriate grade of registration certificate for an electrical worker issued by the Electrical and Mechanical Services Department.</p>

1. Title	Implement quality management in electrical and mechanical engineering services	
2. Code	EMCUQM402A	
3. Range	Plan, organize and control effectively the working procedures prior to and during the project so as to achieve the result of minimal cost and high quality for electrical and mechanical project.	
4. Level	4	
5. Credit	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Division of procedure for electrical and mechanical installation project</p> <ul style="list-style-type: none"> <li>◆ Understand and analyze the division of process for electrical and mechanical installation project; set the following for quality control before the project starts: <ul style="list-style-type: none"> <li>• Check points for different stages of the project</li> <li>• Quality management goals such as completion dates for different stages of the project, alert level for the number of items not conforming to the plan, accident rate, productivity, etc.</li> </ul> </li> </ul> <p>6.2 Implement the quality management plan and organized working procedure of the quality control system effectively</p> <ul style="list-style-type: none"> <li>◆ Confirm and analyze items not conforming to the rules at different stages of the project, and formulate improvement plans with working teams concerned</li> <li>◆ Performance indicators for different stages of the project should be set with reference to level of performance specified by the contract, code of practice, and international standards, etc.</li> <li>◆ Formulate quality management plan, including the following, to control procedure costs and quality in an organized and effective way: <ul style="list-style-type: none"> <li>• Division of procedure for the project</li> <li>• Check points of 'planning-implementation-commissioning-rectification' for quality management at different stages of the project</li> <li>• Performance indicators at different stages of the project</li> <li>• Ways to handle items not conforming to the rules</li> <li>• Quality management goals</li> <li>• Mechanism to communicate with relevant teams and formulation of timetables for improvement plans, etc.</li> </ul> </li> </ul>	
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to formulate quality management plans effectively, monitor project quality, control costs and improve process not conforming to the rules.</p>	
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic concept of quality management.	

1. Title	Promote quality management culture at working level
2. Code	EMCUQM403A
3. Range	Master the knowledge of quality management, lead the quality management working group to promote and foster basic level quality management culture for the electrical and mechanical services.
4. Level	4
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of quality management management</p> <ul style="list-style-type: none"> <li>◆ Understand the concept of quality management</li> <li>◆ Understand the goals of organizational quality management culture</li> </ul> <p>6.2 Promote and foster basic level quality management culture</p> <ul style="list-style-type: none"> <li>◆ Promote basic level quality management culture, including: <ul style="list-style-type: none"> <li>• Implement on-the-job training on quality knowhow for frontline staff</li> <li>• Set up frontline staff quality monitoring group to foster quality management culture at working level</li> <li>• Organize quality management culture promotional activities, such as quiz competitions, quality circle, visits, seminars, etc.</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to master the knowledge of quality management, and lead the quality management working group to promote and foster quality management culture at working level.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic concept of quality management.

# **Competency Level 5**

1. Title	Analyze and assess performance of electrical system and equipment
2. Code	EMCUDE501A
3. Range	Master the theories of electromagnetic field, electromagnetic wave propagation, signal conversion and control circuit, electric motor, etc. with respect to electrical and mechanical engineering design; and apply the knowledge to analyze the performance of the electric motor operation, power transfer and control circuit system.
4. Level	5
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Performance and operating principles of electric motor</p> <ul style="list-style-type: none"> <li>◆ Understand the performance and operating principles of single-phase and three-phase induction motor, including the unbalanced operation, dynamic operation, temperature-rise simulation tests and conditioning monitoring</li> </ul> <p>6.2 Analyze and assess performance of electrical system and equipment</p> <ul style="list-style-type: none"> <li>◆ Analyze the harmonic effect of using stepped wave or PWM Inverter for power transfer of the induction motor</li> <li>◆ Analyze the open-loop control and close-loop control of the motor</li> <li>◆ Use suitable non-carbon brush DC motor</li> <li>◆ Apply communication switching technology and mathematical models to analyze and improve the control system <ul style="list-style-type: none"> <li>• Apply analogue/digital converter and digital/analogue converter to optimize the control system</li> <li>• Apply mathematical model to analyze and improve the control system</li> </ul> </li> <li>◆ Analyze the electromagnetic wave propagation and its effect on surrounding signals <ul style="list-style-type: none"> <li>• Apply the Maxwell equation and wave equation to calculate and analyze data propagated by waves and the effect on surrounding signals</li> <li>• Project the wave interference and use shields to protect from it</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to analyze and assess accurately and effectively the performance of an electro-electronic controlled three-phase variable voltage variable frequency heavy induction motor; and</p> <p>(ii) Capable to analyze accurately and effectively the interference of the current of the above-mentioned motor and its effect on surrounding signals, and advice on the improvement measures.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic electrical knowledge.

1. Title	Use programmable logic controller (PLC) to upgrade control equipment	
2. Code	EMCUDE502A	
3. Range	For electrical and mechanical engineering design, use PLC human-machine interface software, groupware and PLC network system to write monitoring and management system programmes for electrical and mechanical equipment and production; and integrate PLC systems of different levels into a large PLC integrated production control, operation control, monitoring and management system.	
4. Level	5	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Operating principles of PLC software system</p> <ul style="list-style-type: none"> <li>◆ Understand the operating principles of PLC software system</li> </ul> <p>6.2 Use PLC to upgrade control equipment</p> <ul style="list-style-type: none"> <li>◆ Use PLC human-machine interface software to set up the production control system <ul style="list-style-type: none"> <li>• Use PLC human-machine interface software, processor emulation software, programmable/testing software and communication software to write programmes and set up human-machine interface PLC electrical and mechanical equipment and production control system</li> <li>• Test and debug the PLC human-machine interface control system</li> <li>• Modify and rationalize the PLC human-machine interface control system</li> </ul> </li> <li>◆ Use PLC human-machine interface groupware to set up the monitoring, alarm and management system <ul style="list-style-type: none"> <li>• Use PLC human-machine interface groupware to set up label database and information list, and use the database to set up the alarm and management system</li> <li>• Use groupware to save group data record, and use the analytical function to analyze group data trend to achieve the alarm and management functions</li> <li>• Manage the safety of groupware data system</li> </ul> </li> <li>◆ Integrate PLC systems of different levels into a large PLC integrated monitoring and management system <ul style="list-style-type: none"> <li>• Use large PLC software and network software to integrate PLC systems of different levels into a large integrated production control, operation control, monitoring and management system</li> </ul> </li> </ul>	

	<ul style="list-style-type: none"> <li>• Use PLC software to help analyze data</li> <li>• Use information technology and network to transfer PLC data and information</li> <li>• Test and debug the large integrated PLC system</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to use PLC human-machine interface software to set up a safe, reliable, accurate, convenient and direct operation monitoring, alarm and management system for electrical and mechanical equipment; and</p> <p>(ii) Capable to integrate different levels individual PLC systems of the same production line of a plant into a large integrated monitoring, alarm and management system.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic computer knowledge.

1. Title	Design safe and efficient control, interlocking and protection systems for power supply system
2. Code	EMCUDE503A
3. Range	With regard to electrical and mechanical engineering design, understand the working principles of the power supply system (including transmission and distribution systems), and its protection devices, of an electricity company in order to design efficient, effective and reliable control, interlocking and protection systems.
4. Level	5
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of power supply systems(from transmission to distribution) in Hong Kong</p> <ul style="list-style-type: none"> <li>◆ Understand the working principles of power supply systems (including supply, transmission, distribution), and their protection devices, in Hong Kong</li> <li>◆ Understand the operating principles of protection device of different voltages and zones in a power supply system, such as protection relay, etc.</li> </ul> <p>6.2 Design safe and efficient control, interlocking and interlocking systems</p> <ul style="list-style-type: none"> <li>◆ Calculate data of different protection device in order to set the safe current value and cut-off time</li> <li>◆ Design control, interlocking and protection systems for power supply system</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to calculate correctly safe data for protection device of different circuits of the power supply system in order to design efficient, effective and reliable control, interlocking and protection systems.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of power supply system.

1. Title	Analyze quality of electricity data and design suitable device to improve electricity quality
2. Code	EMCUDE504A
3. Range	For electrical and mechanical engineering design, understand crucial electricity quality data, such as power factor, weights of different harmonic waves and total harmonic distortion in order to design electricity quality improvement devices and circuits.
4. Level	5
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Electricity quality principles and operating principles of electricity quality improvement equipment</p> <ul style="list-style-type: none"> <li>◆ Understand factors affecting electricity quality and reasons why electricity quality is becoming more and more important</li> <li>◆ Understand the operating principles of various electricity quality improvement equipment, such as star-delta transformer, isolating transformer, filter and active filter</li> </ul> <p>6.2 Design electricity quality improvement device</p> <ul style="list-style-type: none"> <li>◆ Design suitable electricity quality improvement devices according to different electricity quality requirements</li> <li>◆ Analyze data related to electricity quality, such as power factor and total harmonic distortion, etc.</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to analyze correctly various electricity quality data, design suitable improvement devices according to different electricity quality requirements and power supply arrangements, and analyze the pros and cons of different improvement devices.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of power supply system.

1. Title	Apply SCADA system to remote control design
2. Code	EMCUDE505A
3. Range	Apply the working principles of SCADA system to remote control design in order to transmit signals and data of the power system to the control room at electrical and mechanical engineering workplaces with power system, railway system, etc.
4. Level	5
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Principle of SCADA system</p> <ul style="list-style-type: none"> <li>◆ Understand the operating principle of SCADA system and list out popular examples of applying SCADA to power system and railway system</li> </ul> <p>6.2 Application of SCADA system</p> <ul style="list-style-type: none"> <li>◆ Master SCADA remote control to transmit data needed by the power system and railway system to the remote control room</li> <li>◆ Design complex remote control programme to transmit data of different levels to the control rooms concerned</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply the SCADA system, and master and design remote control programme applicable to power system and railway system to transmit relevant data to different control rooms concerned.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of electricity.

1. Title	Write all kinds of electrical and mechanical engineering reports in Chinese	
2. Code	EMCUDE506A	
3. Range	For electrical and mechanical engineering design and operation, use correct report format to write all kinds of electrical and mechanical engineering reports in Chinese, including project management progress report, operation management report, engineering progress report, equipment fault report, accident investigation report, etc.	
4. Level	5	
5. Credit	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Key points of all kinds of electrical and mechanical engineering reports and their presentation</p> <ul style="list-style-type: none"> <li>◆ Understand the key points and purposes of all kinds of electrical and mechanical engineering reports, including: <ul style="list-style-type: none"> <li>• Equipment fault report</li> <li>• Equipment inspection report</li> <li>• Accident investigation report</li> <li>• Operation management report <ul style="list-style-type: none"> <li>▸ Financial status of the company</li> <li>▸ Balance of account</li> <li>▸ Engineering budget</li> </ul> </li> <li>• Engineering project management progress report <ul style="list-style-type: none"> <li>▸ Progress of crucial procedures</li> <li>▸ Status of implementation of work plan, delay and causes, monitoring indicators and solutions</li> </ul> </li> </ul> </li> <li>◆ Understand formats the above-mentioned electrical and mechanical engineering reports and common technical terms of electrical and mechanical services</li> </ul> <p>6.2 Write all kinds of electrical and mechanical engineering reports in Chinese</p> <ul style="list-style-type: none"> <li>◆ Use correct report format to write all kinds of the above-mentioned electrical and mechanical engineering reports in Chinese</li> <li>◆ Use drawings to strengthen and enrich the contents of the reports, including bar chart, square chart, pie chart, circular chart and flow chart, etc</li> <li>◆ Write in fluent Chinese</li> </ul>	
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to write all kinds of electrical and mechanical engineering reports in fluent Chinese with graphs which conform to official document standards.</p>	
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic Chinese level.	

1. Title	Write all kinds of electrical and mechanical engineering reports in English	
2. Code	EMCUDE507A	
3. Range	For electrical and mechanical engineering design and operation, use correct report format to write all kinds of electrical and mechanical engineering reports in English, including project management progress report, operation management report, engineering progress report, equipment fault report, accident investigation report, etc.	
4. Level	5	
5. Credit	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Key points of all kinds of electrical and mechanical engineering reports and their presentation</p> <ul style="list-style-type: none"> <li>◆ Understand the key points and purposes of all kinds of electrical and mechanical engineering reports, including: <ul style="list-style-type: none"> <li>• Equipment fault report</li> <li>• Equipment inspection report</li> <li>• Accident investigation report</li> <li>• Operation management report <ul style="list-style-type: none"> <li>▸ Financial status of the company</li> <li>▸ Balance of account</li> <li>▸ Engineering budget</li> </ul> </li> <li>• Engineering project management progress report <ul style="list-style-type: none"> <li>▸ Progress of crucial procedures</li> <li>▸ Status of implementation of work plan, delay and causes, monitoring indicators and solutions</li> </ul> </li> </ul> </li> <li>◆ Understand formats the above-mentioned electrical and mechanical engineering reports and common technical terms of electrical and mechanical services</li> </ul> <p>6.2 Write all kinds of electrical and mechanical engineering reports in English</p> <ul style="list-style-type: none"> <li>◆ Use correct report format to write all kinds of the above-mentioned electrical and mechanical engineering reports in English</li> <li>◆ Use drawings to strengthen and enrich the contents of the reports, including bar chart, square chart, pie chart, circular chart and flow chart, etc</li> <li>◆ Write in fluent English</li> </ul>	
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to write all kinds of electrical and mechanical engineering reports in fluent English with graphs which conform to official document standards.</p>	
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic English level.	

1. Title	Design mechanical equipment of trains
2. Code	EMRADE501A
3. Range	Fully master the theories of mechanical dynamics, and calculate and analyze the dynamic reaction of the mechanical structure in order to design the mechanical equipment of trains.
4. Level	5
5. Credits	5
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Calculate and analyze the dynamic reaction of the mechanical structure</p> <ul style="list-style-type: none"> <li>◆ Apply the equation of motion in the linear system of single-degree of freedom and multi-degree of freedom to estimate the reaction of system to resonance</li> <li>◆ Master the theory of calculating the dynamic reaction of the structure to vibration</li> <li>◆ Capable to calculate the lateral vibration of the beam</li> <li>◆ Capable to calculate the circular vibration of the axle</li> </ul> <p>6.2 Apply the calculation and analysis of mechanical dynamics to design mechanical equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Capable to design system parameters for isolating and absorbing vibration so as to control unnecessary vibration</li> <li>◆ Capable to apply the techniques of calculating and analyzing mechanical dynamics in the design of mechanical equipment of trains</li> </ul> <p>6.3 Professionalism in designing mechanical equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Design mechanical equipment of trains according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in designing mechanical equipment of trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to design system parameters for major train equipment so as to control unnecessary vibration; and</p> <p>(ii) Capable to calculate and analyze the dynamic vibration of machinery and use the data to design major mechanical equipment of trains.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses the professional knowledge of the theories of mechanical dynamics.

1. Title	Design and analyze electronic control circuits
2. Code	EMRADE502A
3. Range	Fully master the electronic control theory to design and analyze the functions and performance of electronic switch control circuits, logic circuits and operational amplifier control circuits and apply to the design of electronic control equipment of trains.
4. Level	5
5. Credits	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design and analyze electronic control circuits</p> <ul style="list-style-type: none"> <li>◆ Master the theory and techniques of calculating data of typical electronic control circuits, including <ul style="list-style-type: none"> <li>• Switch circuits</li> <li>• Logic control circuit</li> <li>• Amplifier circuits and their reaction to frequency</li> </ul> </li> <li>◆ Analyze and assess the functions and performance of electronic control circuits</li> </ul> <p>6.2 Methods and procedures of designing electronic control circuits</p> <ul style="list-style-type: none"> <li>◆ Use diodes, transistors and controllable silicon rectifiers to design switch circuits</li> <li>◆ Use logic circuits to design control circuits</li> <li>◆ Design digital differential and integral circuits</li> <li>◆ Design electric current/voltage and electric voltage / current converters</li> <li>◆ Design instrument amplifiers</li> <li>◆ Design electronic control equipment circuits of trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to design electronic control equipment circuits of trains efficiently, including logic switch and control circuits, digital and electric current/voltage converters and amplifier circuits, according to the functional requirements of the equipment.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of electronic control circuits.

1. Title	Verify the design of electricity power systems of electric trains and perform design reviews
2. Code	EMRADE503A
3. Range	Apply the professional knowledge and techniques of electrical circuit engineering to verify the design of power supply systems of electric trains and perform design reviews according to the design requirements and in coordination with the overall train design.
4. Level	5
5. Credits	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design requirements for electricity power systems of electric trains to match with the overall train design</p> <ul style="list-style-type: none"> <li>◆ Understand the design requirements for power supply systems of electric trains and master the key points. The system equipment includes pantographs, circuit breakers, transformer devices, electricity return devices and control and protection devices</li> <li>◆ Master the key points of the overall train design and the techniques of matching the design of electricity power systems of electric trains</li> </ul> <p>6.2 Methods and procedures of verifying the design of electricity power systems of electric trains and performing design reviews</p> <ul style="list-style-type: none"> <li>◆ Verify the mechanical design of pantographs according to the design requirements for train speed, acceleration rate and deceleration rate, the design of the overhead line and physical environment of the railway</li> <li>◆ Calculate and verify the electrical design of pantographs according to the total electrical load of the train equipment and the overhead line voltage</li> <li>◆ Verify the design of pantographs control and protection according to the design requirements for the pantographs to contact and drop away from the overhead lines</li> <li>◆ Calculate and verify the electrical design of main circuit breaker according to the total electrical load of the train equipment, circuit breaking capacity, fault current capacity and the overhead line voltage</li> <li>◆ Verify the mechanical design of main circuit breaker according to its location and wire connection</li> <li>◆ Verify the design of main circuit breaker control and protection according to the design requirements for train circuits</li> <li>◆ Verify the electrical design of main transformer according to the power demand of train traction control and auxiliary equipment and the overhead line voltage</li> <li>◆ Verify the mechanical design of main transformer according to its location and the design of the suspension system of train</li> </ul>

	<ul style="list-style-type: none"> <li>◆ Verify the design of main transformer control and protection according to the design requirements for train circuits</li> <li>◆ Verify the design of main power line and electricity return devices of trains according to total electrical load of the train and the system voltage</li> <li>◆ Verify the design of the control and protection circuits and devices of electricity power systems of electric trains according to the performance requirements for the electricity power system</li> <li>◆ Review comprehensively the design of electricity power systems of electric trains according to the requirements for the overall train design</li> <li>◆ Consider the safety, reliability, comfort, environmental protection and efficiency of trains during design reviews</li> </ul>
6.3	<p>Professionalism in verifying and reviewing the design of electricity power systems of electric trains</p> <ul style="list-style-type: none"> <li>◆ Verify the design of electricity power systems of electric trains and perform design reviews according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in verifying and reviewing the design of electricity power systems of electric trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to verify the design of major electricity power system equipment of electric trains efficiently according to relevant design standards; and</p> <p>(ii) Capable to review the design of electricity power systems of electric trains efficiently according to the standards complying with the overall train design.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of electrical circuit engineering.</p>

1. Title	Verify the design of diesel locomotive engines and generators and perform design reviews
2. Code	EMRADE504A
3. Range	Apply the professional knowledge and techniques of diesel engine and generator engineering to verify the design of diesel locomotive engines and generators and perform design reviews according to the design requirements and in coordination with the overall diesel locomotive traction control design.
4. Level	5
5. Credits	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design requirements for diesel locomotive engines and generators to match with the overall train design</p> <ul style="list-style-type: none"> <li>◆ Understand the design requirements for diesel locomotive engines and generators and master the key points.</li> <li>◆ Master the key points of the overall diesel locomotive design and the techniques of matching the design of diesel locomotive engines and generators with the overall locomotive design</li> </ul> <p>6.2 Methods and procedures of verifying the design of diesel locomotive engines and generators and performing design reviews</p> <ul style="list-style-type: none"> <li>◆ Verify the design of the diesel locomotive engine according to the design requirements for horsepower output and size limit of the engine</li> <li>◆ Verify the design of the diesel locomotive engine matching with the generator</li> <li>◆ Verify the design of the diesel locomotive engine according to the overall design requirements for loading capacity, speed and acceleration rate of the diesel locomotive</li> <li>◆ Verify the design of the generator according to its power output specifications</li> <li>◆ Verify the design of the generator matching with the diesel locomotive engines and generators</li> <li>◆ Verify the design of the generator according to the overall design requirements for loading capacity, speed, acceleration rate and traction control of the diesel locomotive</li> <li>◆ Review comprehensively the design of diesel locomotive engines and generators according to the requirements for the overall train design</li> <li>◆ Consider the safety, reliability, comfort, environmental protection and efficiency of the diesel locomotive during design review</li> </ul>

	<p>6.3 Professionalism in verifying and reviewing the design of diesel locomotive engines and generators</p> <ul style="list-style-type: none"> <li>◆ Verify the design of diesel locomotive engines and generators and perform design reviews according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in verifying and reviewing the design of diesel locomotive engines and generators</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to verify the design of diesel locomotive engines efficiently according to relevant design standards;</li> <li>(ii) Capable to verify the design of diesel locomotive generators efficiently according to relevant design standards; and</li> <li>(iii) Capable to review the design of diesel locomotive engines and generators efficiently according to the standards complying with the overall diesel locomotive design.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of diesel engines and generators.</p>

1. Title	Verify the design of electric traction control systems of trains and perform design reviews
2. Code	EMRADE505A
3. Range	Apply the professional knowledge and techniques of electric traction control engineering to verify the design of electric traction control systems of trains and perform design reviews according to the design requirements and matching with the overall train design.
4. Level	5
5. Credits	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design requirements for electric traction control systems of trains to match with the overall train design</p> <ul style="list-style-type: none"> <li>◆ Understand the design requirements for electric traction control systems of trains and master the key points. The system equipment includes: <ul style="list-style-type: none"> <li>• Electric motors and main circuits</li> <li>• Traction control and protection circuits</li> <li>• Electronic control equipment</li> <li>• Regenerative brake circuits</li> </ul> </li> <li>◆ Master the key points of the overall train design and the techniques of matching the design of electric traction control systems of trains with the overall train design</li> </ul> <p>6.2 Methods and procedures of verifying the design of electric traction control systems of trains and performing design reviews</p> <ul style="list-style-type: none"> <li>◆ Verify the design of the traction motor according to the requirements for the carrying capacity, acceleration rate, speed and torque of the train and voltage of the electricity power system</li> <li>◆ Verify the design of main circuit contactor according to the total electric current of the traction motor, breaking capacity and working voltage of the main circuit</li> <li>◆ Verify the design of the control circuit and equipment of the electric traction control system according to the requirements for the carrying capacity, acceleration rate, speed, torque and comfort of the train</li> <li>◆ Verify the design of the protection circuit and equipment of the electric traction control system according to the requirements for the safety, reliability and efficiency of the traction control system of the train</li> <li>◆ Verify the design of the electronic protection equipment and circuit according to the requirements for the control of the traction control system of the train</li> <li>◆ Verify the design of the regenerative brake circuit, equipment and control according to the requirements for the regenerative brake function of the traction control system of the train</li> </ul>

	<ul style="list-style-type: none"> <li>◆ Review comprehensively the design of the electric traction control system of the train according to the requirements for the overall train design and the functional requirements of the system</li> <li>◆ Consider the safety, reliability, comfort, environmental protection and efficiency of trains during design reviews</li> </ul> <p>6.3 Professionalism in verifying and reviewing the design of electric traction control systems of trains</p> <ul style="list-style-type: none"> <li>◆ Verify the design of electric traction control systems of trains and perform design reviews according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in verifying and reviewing the design of electric traction control systems of trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to verify the design of the electric traction control system equipment of trains efficiently according to relevant design standards; and</p> <p>(ii) Capable to review the design of electric traction control systems of trains efficiently according to the standards complying with the overall train design.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of electrical engineering.</p>

1. Title	Verify the design of friction brake systems of trains and perform design reviews
2. Code	EMRADE506A
3. Range	Apply the professional knowledge and techniques of friction brake engineering to verify the design of friction brake systems of trains and perform design reviews according to the design requirements and matching with the overall train design.
4. Level	5
5. Credits	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design requirements for friction brake systems of trains to match with the overall train design</p> <ul style="list-style-type: none"> <li>◆ Understand the design requirements for friction brake systems of trains and master the key points. The system equipment includes: <ul style="list-style-type: none"> <li>• Brake mechanical and pneumatic devices</li> <li>• Control equipment</li> <li>• Wheel slide protection devices of trains</li> <li>• Parking brake devices</li> </ul> </li> <li>◆ Master the key points of the overall train design and the techniques of matching the design of friction brake systems of trains with the overall train design</li> </ul> <p>6.2 Methods and procedures of verifying the design of friction brake systems of trains and performing design reviews</p> <ul style="list-style-type: none"> <li>◆ Verify the design of the friction brake mechanical devices of the train according to the designed deceleration rate and speed of the train</li> <li>◆ Verify the design of the friction brake pneumatic devices of the train according to the matching of designed deceleration rate and brake mechanical devices of the train</li> <li>◆ Verify the design of the friction brake system and equipment of the train according to the designed deceleration rate and speed of the train and the performance requirements for deceleration</li> <li>◆ Verify the design of the friction brake pneumatic system and equipment of the train matching with the regenerative brake of the train</li> <li>◆ Verify the design of the wheel slide protection devices of the train, including that of the electrical, pneumatic and electronic equipment, according to the functional requirements for wheel slide protection</li> <li>◆ Verify the design of the parking brake devices according to the functional requirements for parking safety of the train</li> <li>◆ Review comprehensively the design of the friction brake system of the train according to the requirements for the overall train design and the functional requirements of the system</li> <li>◆ Consider the safety, reliability, comfort, environmental protection and efficiency of trains during design reviews</li> </ul>

	<p>6.3 Professionalism in verifying and reviewing the design of friction brake systems of trains</p> <ul style="list-style-type: none"> <li>◆ Verify the design of friction brake systems of trains and perform design reviews according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in verifying and reviewing the design of friction brake systems of trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to verify the design of the friction brake system equipment of trains efficiently according to relevant design standards; and</li> <li>(ii) Capable to review the design of friction brake systems of trains efficiently according to the standards complying with the overall train design.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of electrical and mechanical engineering.</p>

1. Title	Verify the design of pneumatic systems of trains and perform design reviews
2. Code	EMRADE507A
3. Range	Apply the professional knowledge and techniques of pneumatic system engineering to verify the design of pneumatic systems of trains and perform design reviews according to the design requirements and compressed air consumption.
4. Level	5
5. Credits	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design requirements for pneumatic systems of trains to match with the overall train design</p> <ul style="list-style-type: none"> <li>◆ Understand the design requirements for pneumatic systems of trains and master the key points. The system equipment includes: <ul style="list-style-type: none"> <li>• Air compressor devices</li> <li>• Pipe line and pipe network</li> <li>• Equipment to maintain the compressed air quality</li> </ul> </li> <li>◆ Master the key points of the overall train design and the techniques of matching the design of pneumatic systems of trains with the overall train design</li> </ul> <p>6.2 Methods and procedures of verifying the design of pneumatic systems of trains and performing design reviews</p> <ul style="list-style-type: none"> <li>◆ Verify the design of the pneumatic system pressure according to the consumption and using pattern of compressed air by and the pneumatic equipment type of the train</li> <li>◆ Verify the design of the air compressor according to the demand and using frequency of compressed air by the train</li> <li>◆ Verify the design of pipe line distribution and pipe network of the pneumatic system according to the distribution of pneumatic equipment, air consumption and using frequency</li> <li>◆ Verify the design of air cylinder according to the distribution of pneumatic equipment, air consumption and using frequency and system pressure</li> <li>◆ Verify the design of the pipe line valve according to the design requirements for pipe line network and control</li> <li>◆ Verify the design of the pneumatic system equipment to maintain the compressed air quality according to the requirements maintaining compressed air quality</li> <li>◆ Review comprehensively the design of the pneumatic system according to the consumption and using pattern of compressed air by and the pneumatic equipment type of the train</li> <li>◆ Consider the safety, reliability, and efficiency of trains during design reviews</li> </ul>

	<p>6.3 Professionalism in verifying and reviewing the design of pneumatic systems of trains</p> <ul style="list-style-type: none"> <li>◆ Verify the design of pneumatic systems of trains and perform design reviews according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in verifying and reviewing the design of pneumatic systems of trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to verify the design of the pneumatic system equipment of trains efficiently according to the consumption and using pattern of compressed air and the pneumatic equipment type and distribution on trains and the design requirements and standards for pneumatic equipment; and</li> <li>(ii) Capable to review the design of pneumatic systems of trains efficiently according to the standards complying with the overall train design.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of electrical and mechanical engineering.</p>

1. Title	Verify the design of inverters of trains and perform design reviews
2. Code	EMRADE508A
3. Range	Apply the professional knowledge and techniques of inverter circuit engineering to verify the design of inverter systems of trains and perform design reviews according to the design requirements and matching with the overall train design.
4. Level	5
5. Credits	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design requirements for inverter systems of trains to match with the overall train design</p> <ul style="list-style-type: none"> <li>◆ Understand the design requirements for inverter systems of trains and master the key points. The system equipment includes: <ul style="list-style-type: none"> <li>• Main circuit and electronic power circuits of inverter</li> <li>• Electronic control equipment of inverter</li> <li>• Inverter protection devices and circuits</li> </ul> </li> <li>◆ Master the key points of the overall train design and the techniques of matching the design inverter systems of trains with the overall train design</li> </ul> <p>6.2 Methods and procedures of verifying the design of inverter systems of trains and performing design reviews</p> <ul style="list-style-type: none"> <li>◆ Verify the design of the main circuit and electronic power circuits of the inverter according to the total secondary electricity demand of the auxiliary systems of the train including air-conditioning and refrigeration system</li> <li>◆ Verify the design of the main circuit and electronic power circuits of the inverter according to the electricity specifications of the auxiliary systems of the train</li> <li>◆ Verify the arrangement of the connection of the main circuit and output circuits of the inverter according to the functional requirements for load distribution of the auxiliary systems of the train in case of inverter failure</li> <li>◆ Verify the electronic control design according to the switch requirements for the electronic power circuits of the inverter</li> <li>◆ Verify the electronic control design according to the requirements for storing records on the inverter operation and failures</li> <li>◆ Verify the design of the inverter protection equipment and circuit according to the requirements for inverter system protection functions</li> <li>◆ Verify the design of the inverter protection equipment and circuit according to the requirements for inverter system protection functions</li> </ul>

	<ul style="list-style-type: none"> <li>◆ Review comprehensively the design of the inverter according to the electricity demand of the auxiliary systems of the train</li> <li>◆ Consider the safety, reliability, comfort, environmental protection and efficiency of trains during design reviews</li> </ul>
6.3	<p>Professionalism in verifying and reviewing the design of inverter systems of trains</p> <ul style="list-style-type: none"> <li>◆ Verify the design of inverter systems of trains and perform design reviews according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in verifying and reviewing the design of inverter systems of trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to verify the design of the inverter system equipment of trains efficiently according to the design requirements and standards for the auxiliary systems and transformers of the train ; and</p> <p>(ii) Capable to review the design of inverter systems of trains efficiently according to the standards complying with the overall train design.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of electronics.</p>

1. Title	Verify the design of air-conditioning systems of trains and perform design reviews
2. Code	EMRADE509A
3. Range	Apply the professional knowledge and techniques of air-conditioning engineering to verify the design of air-conditioning systems of trains and perform design reviews according to the design requirements and in coordination with the overall train design.
4. Level	5
5. Credits	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design requirements for air-conditioning systems of trains to match with the overall train design</p> <ul style="list-style-type: none"> <li>◆ Understand the design requirements for air-conditioning systems of trains and master the key points. The system equipment includes: <ul style="list-style-type: none"> <li>• Air-conditioners of trains</li> <li>• Ventilation equipment</li> <li>• Control equipment and circuits</li> </ul> </li> <li>◆ Master the key points of the overall train design and the techniques of matching the design of air-conditioning systems of trains with the overall train design</li> </ul> <p>6.2 Methods and procedures of verifying the design of air-conditioning systems of trains and performing design reviews</p> <ul style="list-style-type: none"> <li>◆ Verify the design of the air-conditioner according to the carrying capacity of the train, range of temperature and humidity in Hong Kong, the expected span and mode of operation</li> <li>◆ Verify the design of the ventilation of air-conditioner and air ducts of the train according to the requirements on fresh air volume and total air volume of the train</li> <li>◆ Verify the design of the control equipment and circuits of the air-conditioner of the train according to the requirements on the temperature in train compartment and total air volume of the train</li> <li>◆ Verify the design of the control equipment and circuits of the air-conditioner of the train according to the requirements on the overall control of the air-conditioning system of the train</li> <li>◆ Review comprehensively the design of the air-conditioning system according to the requirements on the comfort of the train compartment</li> <li>◆ Consider the comfort of the train compartment, system reliability, efficiency and environmental protection level during design reviews</li> </ul>

	<p>6.3 Professionalism in verifying and reviewing the design of air-conditioning systems of trains</p> <ul style="list-style-type: none"> <li>◆ Verify the design of air-conditioning systems of trains and perform design reviews according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in verifying and reviewing the design of air-conditioning systems of trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to verify the design of the air-conditioning system equipment of trains efficiently according to the requirements and standards on carrying capacity, temperature and air volume in compartments and air-conditioning systems of trains; and</li> <li>(ii) Capable to review the design of air-conditioning systems of trains efficiently according to the standards complying with the overall train design.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of air-conditioning system equipment.</p>

1. Title	Verify the design of electric multi-car train door system and perform design reviews
2. Code	EMRADE510A
3. Range	Apply the professional knowledge and techniques of train door system engineering to verify the design of electric multi-car train door system and perform design reviews according to the design requirements and in coordination with the overall train design.
4. Level	5
5. Credits	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design requirements for electric multi-car train door system to match with the overall train design</p> <ul style="list-style-type: none"> <li>◆ Understand the design requirements for electric multi-car train door system and master the key points. The system equipment includes: <ul style="list-style-type: none"> <li>• Train door mechanical equipment</li> <li>• Control circuits and equipment</li> <li>• Protection circuits and equipment</li> </ul> </li> <li>◆ Master the key points of the overall train design and the techniques of matching the design of multi-train door system with the overall train design</li> </ul> <p>6.2 Methods and procedures of verifying the design of electric multi-car train door system and performing design reviews</p> <ul style="list-style-type: none"> <li>◆ Verify the design of the electric multi-car train door system control circuits and equipment according to the carrying capacity of the train, number of doors for each car of the train and the door structure</li> <li>◆ Verify the design of the control circuits and equipment according to the requirements on train door opening and closing during normal service</li> <li>◆ Verify the design of the train door mechanical equipment according to the design requirements train door</li> <li>◆ Verify the design of the train door protection circuits and equipment, including the train door closing status confirmation devices and indicators according to the design requirements for train door safety protection</li> <li>◆ Verify the design of train door isolation and circuits</li> <li>◆ Review comprehensively the design of the electric multi-car train door system according to the requirements on train door closing and opening</li> <li>◆ Consider the safety, reliability and efficiency of trains during design reviews</li> </ul>

	<p>6.3 Professionalism in verifying and reviewing the design of electric multi-car train door system</p> <ul style="list-style-type: none"> <li>◆ Verify the design of electric multi-car train door system and perform design reviews according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in verifying and reviewing the design of electric multi-car train door system</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to verify the design of the multi-train door system equipment of trains efficiently according to relevant design standards; and</li> <li>(ii) Capable to review the design of electric multi-car train door system efficiently according to the standards complying with the overall train design.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of electrical and mechanical, including pneumatic, engineering and is familiar with the working principles of electric multi-car train door system.</p>

1. Title	Verify the design of train bogies, gangways and couplers and perform design reviews
2. Code	EMRADE511A
3. Range	Apply the professional knowledge and techniques of mechanics to verify the design of train bogies, gangways and couplers and perform design reviews according to the design requirements and in matching with the overall train design.
4. Level	5
5. Credits	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design requirements for train bogies, gangways and couplers to match with the overall train design</p> <ul style="list-style-type: none"> <li>◆ Understand the design requirements for train bogies, gangways and couplers and master the key points. The equipment includes: <ul style="list-style-type: none"> <li>• Power car bogies</li> <li>• Trailer car bogies</li> <li>• Gangways</li> <li>• Automatic couplers</li> <li>• Bar couplers</li> </ul> </li> <li>◆ Master the key points of the overall train design and the techniques of coordinating the design of train bogies, gangways and couplers</li> <li>◆ Know about data calculations related to mechanics of materials</li> </ul> <p>6.2 Methods and procedures of verifying the design of train bogies, gangways and couplers and performing design reviews</p> <ul style="list-style-type: none"> <li>◆ Verify the design of power car bogies and trailer car bogies according to the design requirements for train bogies and the overall design requirements for the train transmission and suspension system</li> <li>◆ Verify the design of power car bogies and trailer car bogies according to their design requirements and the requirements for the overall design of train motion</li> <li>◆ Verify the design of gangways according to mechanics and the design requirements for mechanical locking</li> <li>◆ Verify the design of gangways according to the design requirements for the interior of train compartment</li> <li>◆ Verify the design of gangways according to the requirements for the overall design of train motion</li> <li>◆ Verify the design of automatic couplers according to mechanics and the design requirements for mechanical locking</li> <li>◆ Verify the design of lever couplers according to mechanics and the design requirements for mechanical locking</li> <li>◆ Verify the design of train couplers according to the requirements for the overall design of train motion</li> </ul>

	<ul style="list-style-type: none"> <li>◆ Review comprehensively the design of train bogies, gangways and couplers according to the requirements for the overall train design</li> <li>◆ Consider the safety, reliability, comfort, environmental protection and efficiency of trains during design reviews</li> </ul>
6.3	<p>Professionalism in verifying and reviewing the design of train bogies, gangways and couplers</p> <ul style="list-style-type: none"> <li>◆ Verify the design of train bogies, gangways and couplers and perform design reviews according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in verifying and reviewing the design of train bogies, gangways and couplers</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to verify the design of power car bogies efficiently according to relevant design standards;</li> <li>(ii) Capable to verify the design of gangways efficiently according to relevant design standards;</li> <li>(iii) Capable to verify the design of automatic couplers efficiently according to relevant design standards; and</li> <li>(iv) Capable to review the overall design of power car bogies, gangways and automatic couplers efficiently according to the standards complying with the overall train design.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of mechanical engineering and is familiar with the working principles of train bogies, gangways and couplers.</p>

1. Title	Verify the design of train compartment frame, body, head and interior and perform design reviews
2. Code	EMRADE512A
3. Range	Apply the professional knowledge and techniques of mechanics and design to verify the design of train compartment frame, body, head and interior and perform design reviews according to the design requirements and matching with the overall train design.
4. Level	5
5. Credits	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design requirements for train compartment frame, body, head and interior to match with the overall train design</p> <ul style="list-style-type: none"> <li>◆ Understand the design requirements for train compartment frame, body, head and interior and master the key points</li> <li>◆ Master the key points of the overall train design and the techniques of matching the design of train compartment frame, body, head and interior with the overall train design</li> <li>◆ Know about data calculations related to mechanics of materials</li> </ul> <p>6.2 Methods and procedures of verifying the design of train compartment frame, body, head and interior and performing design reviews</p> <ul style="list-style-type: none"> <li>◆ Verify the design of different parts of the compartment frame according to the design requirements for mechanics of compartment frame of trains</li> <li>◆ Verify the design of different parts of the compartment body and head according to the design requirements for mechanics of train compartment body and head</li> <li>◆ Verify the design of different parts of the car body and head according to the design requirements for the exterior of car body and head of trains</li> <li>◆ Verify the design of train compartment frame, body and head according to the requirements for the overall design of train motion</li> <li>◆ Verify the design of compartment lighting, air-conditioning outlets and compartment layout according to the design requirements for the interior of train compartments</li> <li>◆ Verify the design of train compartment interior according to the carrying capacity of trains and the compartment space</li> <li>◆ Review comprehensively the design of train compartment frame, body and head according to the requirements for the overall train design</li> <li>◆ Review comprehensively the design of train compartment interior according to the requirements for the overall train design</li> </ul>

	<p>6.3 Professionalism in verifying and reviewing the design of train compartment frame, body, head and interior</p> <ul style="list-style-type: none"> <li>◆ Consider the safety, reliability, comfort, environmental protection and efficiency of trains and the railway during verification and reviews. Verify the design of train compartment frame, body, head and interior and perform design reviews according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand codes of practice and the standards and requirements for quality management to handle tasks of verifying and reviewing the design of train compartment frame, body, head and interior</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to verify the design of different parts of the train compartment frame efficiently according to relevant design standards;</li> <li>(ii) Capable to verify the design of different parts of the compartment body and head efficiently according to relevant design standards;</li> <li>(iii) Capable to verify the design of train compartment interior efficiently according to relevant design standards; and</li> <li>(iv) Capable to review the overall design of train compartment frame, body, head and interior efficiently according to the standards complying with the overall train design.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of mechanical engineering.</p>

1. Title	Verify the design of train interlock protection loops and perform design reviews
2. Code	EMRADE513A
3. Range	Apply the professional knowledge and techniques of train door system and brake system engineering to verify the design of train interlock protection loops and perform design reviews according to the design requirements and matching with the overall train design.
4. Level	5
5. Credits	5
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Verify the design requirements for train interlock protection loops to match with the overall train design</p> <ul style="list-style-type: none"> <li>◆ Understand the design requirements for train interlock protection loops and master the key points. The system equipment includes: <ul style="list-style-type: none"> <li>• Train door protection loops</li> <li>• Brake protection loops</li> <li>• Protection pipe line running through the whole train</li> </ul> </li> <li>◆ Master the key points of the overall train design and the techniques of matching the design of interlock protection loops with the overall train design</li> </ul> <p>6.2 Methods and procedures of verifying the design of train interlock protection loops and performing design reviews</p> <ul style="list-style-type: none"> <li>◆ Verify the design of the train door protection loops according to relevant design requirements</li> <li>◆ Verify the design of the brake protection loops according to relevant design requirements</li> <li>◆ Verify the design of the protection pipe line running through the whole train according to relevant design requirements</li> <li>◆ Review comprehensively the design of the train door protection loops and brake protection loops of the whole train according to the overall design requirements for train protection loops</li> <li>◆ Review comprehensively the design of the brake protection pipe line running through the whole train according to the design requirements for the protection pipe line running through the whole train</li> </ul> <p>6.3 Professionalism in verifying and reviewing the design of train interlock protection loops</p> <ul style="list-style-type: none"> <li>◆ Verify the design of train interlock protection loops and perform design reviews according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in verifying and reviewing the design of train interlock protection loops</li> </ul>

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: <ul style="list-style-type: none"><li>(i) Capable to verify the design of train door protection loops efficiently according to relevant design standards;</li><li>(ii) Capable to verify the design of train brake protection loops or pipe line efficiently according to relevant design standards; and</li><li>(iii) Capable to review the design of train door protection loops and brake protection loops or pipe line efficiently according to the standards complying with the overall train design.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of control circuit and control pipe line.

1. Title	Formulate tenders for railway electrical and mechanical works	
2. Code	EMRADE515A	
3. Range	Draft and formulate tenders for railway electrical and mechanical works, including works contents, works standards, contract details and drawings, according to design requirements.	
4. Level	5	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Specifications and requirements for tenders for railway electrical and mechanical works</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the general specifications and requirements for tenders for railway electrical and mechanical works</li> <li>◆ Translate the design requirements of railway electrical and mechanical works into clear and accurate specifications and standards</li> </ul> <p>6.2 Methods and procedures of formulating tenders for railway electrical and mechanical works</p> <ul style="list-style-type: none"> <li>◆ Draft the technical details of the works tenders according to the specifications and standards of the design, including: <ul style="list-style-type: none"> <li>• Project deliverables</li> <li>• Product features and standards</li> <li>• Inspection and testing requirements in the course of testing and production</li> <li>• Quality assurance and standards</li> <li>• Requirements for product information, drawings and documents</li> </ul> </li> <li>◆ Draft relevant contract details of works tenders, including: <ul style="list-style-type: none"> <li>• Delivery time</li> <li>• Regulations and requirements for occupational safety, health and environmental protection</li> <li>• Requirements of relevant legislations</li> <li>• Warranty details</li> <li>• After-sale service</li> <li>• Training in operation and maintenance</li> </ul> </li> <li>◆ Verify the draft works tender with reference to the overall railway works design so as to ensure clarity, accuracy and adequacy of technical details and compatibility of engineering products with existing facilities</li> <li>◆ Identify the clauses with implications of liability and consult legal professionals on these clauses</li> <li>◆ Coordinate with the purchase department and include relevant clauses when formulating tenders for railway electrical and mechanical works</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: <ul style="list-style-type: none"><li>(i) Capable to draft a clear, accurate and compliant tender for railway electrical and mechanical works according to specified design requirements and information; and</li><li>(ii) Capable to verify efficiently the draft works tender according to the overall railway works design.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of tenders for railway electrical and mechanical works.

1. Title	Design the railway AC overhead feeder system	
2. Code	EMRADE516A	
3. Range	Design the railway AC overhead power system linking feeder stations with the overhead lines and return lines along the railway.	
4. Level	5	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of the power supply system and preparations for its design</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the working principles of the railway AC overhead power supply system, including the power supply system of the electricity company</li> <li>◆ Master the techniques of calculating the power line requirements</li> <li>◆ Master the techniques of calculating the protection device requirements, including: <ul style="list-style-type: none"> <li>• Overcurrent protection</li> <li>• Short-circuit protection</li> <li>• Earth fault protection</li> <li>• Lightning protection</li> <li>• Interlock protection</li> </ul> </li> <li>◆ Be familiar with the working principles of the circuit devices of the AC overhead feeder system, including: <ul style="list-style-type: none"> <li>• Isolation and switching devices</li> <li>• Interlocking devices</li> <li>• Insulation devices</li> <li>• Overcurrent and sectional protection devices</li> <li>• Lightning protection devices</li> <li>• Earth electrode devices</li> <li>• Electricity quality improvement devices</li> <li>• Control circuits and devices, including PLC control components</li> </ul> </li> </ul> <p>6.2 Methods and procedures of designing circuit devices for the railway AC overhead feeder system</p> <ul style="list-style-type: none"> <li>◆ Design the length of various sections of the overhead line according to data calculations</li> <li>◆ Design protection devices according to data calculations</li> <li>◆ Design isolation, switching and insulation devices according to data calculations</li> <li>◆ Design electricity quality improvement devices</li> <li>◆ Design the control system of the overhead feeder system</li> </ul>	

	<p>6.3 Professionalism in designing the railway AC overhead feeder system</p> <ul style="list-style-type: none"> <li>◆ Design the railway AC overhead feeder system and devices according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in handling the tasks of designing the railway AC overhead feeder system and devices</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to design effectively the railway AC overhead feeder system, and the main circuit and switches of the circuit devices according to the design requirements and standards of the overall railway system and the circuit devices of the railway AC overhead feeder system, and the safety guidelines and codes of practice; and</p> <p>(ii) Capable to design effectively protection devices for the railway AC overhead feeder system according to design standards.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses comprehensive knowledge of the overhead power supply system and electricity.</p>

1. Title	Design the mechanical structure and line location of the railway overhead feeder system	
2. Code	EMRADE517A	
3. Range	Design the mechanical structure and line location of the railway overhead feeder system basing on the data calculations of mechanical dynamics for the overhead line support and considering the train speed and the type of the pantographs.	
4. Level	5	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Information and factors for the design of the mechanical structure of the railway overhead feeder system</p> <ul style="list-style-type: none"> <li>◆ Master the techniques of calculating the stress on the overhead line and supporting line</li> <li>◆ Master the techniques of calculating the stress on the overhead line support</li> <li>◆ Master the techniques of calculating the stress on the insulation devices</li> <li>◆ Capable to consider the geographical factor</li> <li>◆ Be familiar with the types and applications of railway overhead line support and supporting line</li> </ul> <p>6.2 Methods and procedures of designing the mechanical structure and line location of the railway overhead feeder system</p> <ul style="list-style-type: none"> <li>◆ Design the location of the power line support correctly according to data calculations and operation of the railway so as to evenly distribute the contact points of pantographs and the power line</li> <li>◆ Design and select suitable support for use according to data calculations</li> <li>◆ Design the tension of the contact power line according to the train speed requirements so as to maximize the efficiency of the pantographs of trains</li> </ul> <p>6.3 Professionalism in designing the mechanical structure and line location of the railway overhead feeder system</p> <ul style="list-style-type: none"> <li>◆ Design the mechanical structure and line location of the railway overhead feeder system according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in handling the tasks of designing the mechanical structure and line location of the railway overhead feeder system</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is:  (i) Capable to calculate the dynamic data of the power line and support correctly and design an efficient and reliable railway overhead feeder system, and its mechanical structure and line location according to the design requirements and standards of the overall railway system and the railway overhead feeder system, and the safety guidelines and codes of practice.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses comprehensive knowledge of mechanical dynamics.

1. Title	Design rectifiers for the railway DC overhead feeder system
2. Code	EMRADE520A
3. Range	Design the railway DC overhead feeder system to ensure the stability of the DC voltage.
4. Level	5
5. Credits	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of the power rectifier</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the working principles of advanced power rectifiers, including application of typical power electronic parts and understand their characteristics</li> <li>◆ Capable to calculate the rectification data</li> <li>◆ Master the techniques of controlling the rectifiers</li> </ul> <p>6.2 Methods and procedures of designing rectifiers for the railway DC overhead feeder system</p> <ul style="list-style-type: none"> <li>◆ Apply the theory of power rectifier to the railway DC power supply system, consider the factor of full railway length, and design the location of rectifier stations, ensuring that the value of DC output voltage is within an acceptable range</li> <li>◆ Design an efficient and reliable railway DC overhead feeder system</li> <li>◆ Design an efficient and reliable electricity return circuit including the cathodic protection</li> <li>◆ Design an efficient control circuit for the rectifier</li> <li>◆ Design an efficient protection circuit for the rectifier</li> </ul> <p>6.3 Professionalism in designing rectifiers for the railway DC overhead feeder system</p> <ul style="list-style-type: none"> <li>◆ Design the rectifiers for the railway DC overhead feeder system according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in handling the tasks of designing the rectifiers for the railway DC overhead feeder system</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to use power electronic parts to design efficient and reliable rectifiers for the railway DC overhead feeder system and ensure the stability of the output voltage according to the design requirements and standards of the overall railway system and the railway DC overhead feeder system devices, and the safety guidelines and codes of practice; and</p> <p>(ii) Capable to design efficiently protection devices for the railway DC overhead feeder system according to design standards.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses advanced knowledge of power rectification.

1. Title	Verify the design of railway traffic management systems and perform design reviews
2. Code	EMRADE521A
3. Range	Verify the design of railway traffic management systems and perform design reviews according to the overall design requirements for railway signal and control systems and matching with the operation of all kinds of trains.
4. Level	5
5. Credits	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design requirements for railway traffic management systems and requirements of the operation of all kinds of trains</p> <ul style="list-style-type: none"> <li>◆ Understand the design requirements for railway traffic management systems and master the key points. The equipment includes: <ul style="list-style-type: none"> <li>• Signal and control monitoring systems</li> <li>• Routing and programming control systems</li> <li>• Train location indication and communication systems</li> <li>• Data collection and management reporting systems</li> <li>• Network systems</li> <li>• Signal transmission equipment</li> <li>• Interface devices</li> </ul> </li> <li>◆ Understand the requirements of the operation of all kinds of trains on the design of railway operation control and monitoring</li> </ul> <p>6.2 Methods and procedures of verifying the design of railway traffic management systems and performing design reviews</p> <ul style="list-style-type: none"> <li>◆ Verify the design of signal and control monitoring systems according to the requirements for railway operation control and monitoring</li> <li>◆ Verify the design of routing and programming control systems according to train schedules, routes, car speed and rail track speed limit</li> <li>◆ Verify the design of train location indication and communication systems according to the requirements for railway operation monitoring and communication</li> <li>◆ Verify the design of data collection and management reporting systems according to the requirements for railway operation</li> <li>◆ Verify the design of network systems and signal transmission equipment according to the operational requirements for the railway traffic management systems</li> <li>◆ Verify the design of interface devices in coordination with the requirements for the railway traffic management systems</li> <li>◆ Review comprehensively the design of railway traffic management systems according to the requirements for the overall design of railway signal and control systems</li> </ul>

	<p>6.3 Professionalism in verifying and reviewing the design of railway traffic management systems</p> <ul style="list-style-type: none"> <li>◆ Verify the design of railway traffic management systems and perform design reviews according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in verifying and reviewing the design of railway traffic management systems</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to verify the design of railway traffic management systems efficiently according to the overall requirements for railway signal and control systems and design standards for railway traffic management systems; and</li> <li>(ii) Capable to review the design of railway traffic management systems efficiently to match with the requirements on railway operation.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of railway signal and control systems.</p>

1. Title	Verify the design of railway signal interlock systems and perform design reviews
2. Code	EMRADE522A
3. Range	Verify the design of railway signal interlock systems, including the central interlock components and trackside components, and perform design reviews according to the requirements for the overall design of railway signal and control systems.
4. Level	5
5. Credits	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design requirements for railway signal interlock systems to match with the overall design of railway signal and control systems</p> <ul style="list-style-type: none"> <li>◆ Understand the design requirements for railway signal interlock systems and master the key points. The equipment includes: <ul style="list-style-type: none"> <li>• Central interlock components</li> <li>• Trackside components</li> <li>• Interface devices</li> <li>• Signal and information transmission equipment</li> </ul> </li> <li>◆ Master the techniques of matching the design of railway signal interlock systems with the overall design of railway signal and control systems</li> </ul> <p>6.2 Methods and procedures of verifying the design of railway signal interlock systems and performing design reviews</p> <ul style="list-style-type: none"> <li>◆ Verify the design of central interlock components, including PLC components and electronic circuits components, according to the requirements for railway signal interlock</li> <li>◆ Verify the design of trackside components, including PLC components, electronic circuits components, interface devices and information transmission equipment, according to the requirements for railway signal interlock</li> <li>◆ Review comprehensively the design of railway signal interlock systems according to the requirements for the overall design of railway signal and control systems</li> </ul> <p>6.3 Professionalism in verifying and reviewing the design of railway signal interlock systems</p> <ul style="list-style-type: none"> <li>◆ Verify the design of railway signal interlock systems and perform design reviews according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in verifying and reviewing the design of railway signal interlock systems</li> </ul>

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is:  (i) Capable to verify the design of railway signal interlock systems efficiently according to the overall requirements for railway signal and control systems and design standards for railway signal interlock systems; and  (ii) Capable to review the design of railway signal interlock systems efficiently to match with the overall requirements for railway signal and control systems.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of railway signal and control systems.

1. Title	Verify the design of trackside equipment of railway signal and control systems and perform design reviews
2. Code	EMRADE523A
3. Range	Verify the design of trackside equipment of railway signal and control systems and perform design reviews according to the requirements for the overall design of railway signal and control systems.
4. Level	5
5. Credits	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Verify the design requirements for trackside equipment of railway signal and control systems to match with the overall design of railway signal and control systems</p> <ul style="list-style-type: none"> <li>◆ Understand the design requirements for trackside equipment of railway signal and control systems and master the key points. The equipment includes: <ul style="list-style-type: none"> <li>• PLC and control components</li> <li>• Train location detecting devices</li> <li>• Platform screen door control devices</li> <li>• Railway signal display devices</li> <li>• Electronic interface devices</li> <li>• Points</li> </ul> </li> <li>◆ Master the techniques of matching the design of trackside equipment of railway signal and control systems with the overall design of railway signal and control systems</li> </ul> <p>6.2 Methods and procedures of verifying the design of trackside equipment of railway signal and control systems and performing design reviews</p> <ul style="list-style-type: none"> <li>◆ Verify the design of the devices of trackside equipment according to the requirements on railway signal control and monitoring</li> <li>◆ Verify the design of trackside components according to the requirements on railway operation</li> <li>◆ Verify the design of points and circuits according to the requirements on railway signal and track control</li> <li>◆ Review comprehensively the design of trackside equipment of railway signal and control systems according to the requirements for the overall design of railway signal and control systems</li> </ul> <p>6.3 Professionalism in verifying and reviewing the design of trackside equipment of railway signal and control systems</p> <ul style="list-style-type: none"> <li>◆ Verify the design of trackside equipment of railway signal and control systems and perform design reviews according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in verifying and reviewing the design of trackside equipment of railway signal and control systems</li> </ul>

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: <ul style="list-style-type: none"><li>(i) Capable to verify the design of trackside PLC and control components efficiently according to the overall requirements for railway signal and control systems and design standards for trackside equipment ;</li><li>(ii) Capable to verify the design of points and circuits efficiently according to the requirements on railway signal and track control and design standards for points; and</li><li>(iii) Capable to review the design of trackside equipment efficiently to match with the overall requirements for railway signal and control systems.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of railway signal and control systems.

1. Title	Verify the design of automatic train control (ATC) system equipment on the train and perform design reviews
2. Code	EMRADE524A
3. Range	Verify the design of ATC system equipment and perform design reviews according to the requirements for the overall design of railway signal and control systems and match with train operation equipment.
4. Level	5
5. Credits	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design requirements for ATC system equipment on the train to match with the overall design of railway signal control systems and train operation equipment</p> <ul style="list-style-type: none"> <li>◆ Understand the design requirements for ATC system equipment on the train and master the key points. The equipment includes: <ul style="list-style-type: none"> <li>• ATC electronic control equipment on the train</li> <li>• Interface devices</li> <li>• Receive and transmit antennas</li> </ul> </li> <li>◆ Master the techniques of coordinating the design of ATC system equipment on the train with the overall design of railway signal and control systems and train operation equipment</li> </ul> <p>6.2 Methods and procedures of verifying the design of ATC system equipment on the train and performing design reviews</p> <ul style="list-style-type: none"> <li>◆ Verify the design of the ATC system equipment on the train according to the design requirements for ATC system</li> <li>◆ Verify the design of the ATC system equipment on the train matching with the traction control system and brake system of the train</li> <li>◆ Review comprehensively the design of ATC system equipment on the train according to the requirements for the overall design of the railway signal and control system</li> </ul> <p>6.3 Professionalism in verifying and reviewing the design of ATC system equipment on the train</p> <ul style="list-style-type: none"> <li>◆ Verify the design of ATC system equipment on the train and perform design reviews according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in verifying and reviewing the design of ATC system equipment on the train</li> </ul>

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: <ul style="list-style-type: none"><li>(i) Capable to verify the design of ATC system equipment on the train efficiently according to relevant design requirements and standards; and</li><li>(ii) Capable to review the design of ATC system equipment on the train efficiently to match with the railway signal and control systems and train operation equipment.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of electronics and communication.

1. Title	Formulate installation instructions for overhead line system	
2. Code	EMCUIN501A	
3. Range	Formulate instructions on overhead line system installation for the electrical and mechanical services, including the formulation of all information relevant to installation, electrical and mechanical data of cable, requirements and relevant concerns for the installation of isolator and insulator, etc.	
4. Level	5	
5. Credit	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Principles of the whole overhead line system      ♦ Understand the structure and working principles of the whole overhead line system, including requirements on voltage variation for all transformers</p> <p>6.2 Formulate installation instructions for the system      ♦ Formulate installation instructions for the overhead line system, including relevant information, electrical and mechanical data of cable, and data requirements for the isolators and insulators</p> <p style="padding-left: 150px;">♦ Formulate installation instructions, illustrate the installation method, tools and instruments required, and noting points, etc.</p>	
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to understand the requirements for the whole overhead line system and different voltage variations so as to formulate installation instructions, including the cable type, electrical and mechanical data, requirements for protective devices, and relevant concerns for installation, etc., for installation staff to follow.</p>	
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of electricity.	

1. Title	Formulate installation instructions for mechanical equipment of trains	
2. Code	EMRAIN501A	
3. Range	Formulate installation instructions for mechanical equipment of trains by referring to their design and the installation guidelines provided by the manufacturer, and considering the overall installation of trains.	
4. Level	5	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design and installation principles of mechanical equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the structure and design of mechanical equipment of trains</li> <li>◆ Apply the installation guidelines provided by the manufacturer</li> <li>◆ Master the standard for installing mechanical equipment of trains</li> <li>◆ Be familiar with the applications of instruments and tools commonly used for installing mechanical equipment of trains</li> <li>◆ Design and arrange special tools for installation</li> </ul> <p>6.2 Method and procedures of formulating installation instructions for mechanical equipment of trains</p> <ul style="list-style-type: none"> <li>◆ By referring to the design of train bogies, gangways and couplers and the installation guidelines provided by the manufacturer, and considering the overall installation of trains, capable to draft installation instructions for the train bogies, gangways and couplers, including: <ul style="list-style-type: none"> <li>• Installation procedures</li> <li>• Installation standards</li> <li>• Adjustments and preliminary function tests</li> <li>• Points to note during installation</li> </ul> </li> <li>◆ Capable to test the draft installation instructions</li> <li>◆ Capable to amend and formulate installation instructions for train bogies, gangways and couplers</li> <li>◆ Capable to draft, test and formulate installation instructions for the friction brake system of trains</li> <li>◆ Capable to draft, test and formulate installation instructions for the wheel slide protection devices of trains</li> <li>◆ Capable to draft, test and formulate installation instructions for the train door mechanical devices of trains</li> <li>◆ Capable to draft, test and formulate installation instructions for train door control and protection devices of trains</li> <li>◆ Capable to draft, test and formulate installation instructions for air-conditioners of trains and their control equipment</li> </ul>	

	<p>6.3 Professionalism in formulating installation instructions for mechanical equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate installation instructions and standards for mechanical equipment of trains according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating installation instructions for mechanical equipment of trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to draft installation instructions for specified mechanical equipment of trains in compliance with the installation requirements for train equipment; and</li> <li>(ii) Capable to test the effectiveness of the draft installation instructions and make amendments effectively.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of mechanical engineering and the mechanical equipment of trains.</p>

1. Title	Formulate installation instructions for pneumatic equipment of trains	
2. Code	EMRAIN502A	
3. Range	Formulate installation instructions for pneumatic equipment of trains by referring to their design and the installation guidelines provided by the manufacturer, and considering the overall installation of trains.	
4. Level	5	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design and installation principles of pneumatic system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the structure and design of pneumatic system equipment of trains</li> <li>◆ Apply the installation guidelines provided by the manufacturer</li> <li>◆ Master the standard for installing pneumatic equipment of trains</li> <li>◆ Be familiar with the applications of instruments and tools commonly used for installing pneumatic equipment of trains</li> <li>◆ Design and arrange special tools for installation</li> </ul> <p>6.2 Method and procedures of formulating installation instructions for pneumatic equipment of trains</p> <ul style="list-style-type: none"> <li>◆ By referring to the design of air compressors of trains and the installation guidelines provided by the manufacturer, and considering the overall installation of trains, capable to draft installation instructions for the air compressors of trains and their control and protection equipment, including: <ul style="list-style-type: none"> <li>• Installation procedures</li> <li>• Installation standards</li> <li>• Adjustments and preliminary function tests</li> <li>• Points to note during installation</li> </ul> </li> <li>◆ Capable to test the draft installation instructions</li> <li>◆ Capable to amend and formulate installation instructions for air compressors of trains and their control and protection equipment</li> <li>◆ Capable to draft, test and formulate installation instructions for the pipe line installations and protection equipment of trains</li> <li>◆ Capable to draft, test and formulate installation instructions for the various pipe line and pneumatic equipment of the pneumatic systems of trains</li> <li>◆ Capable to draft, test and formulate installation instructions for pressure and leak tests of the entire pneumatic system of trains</li> </ul>	

	<p>6.3 Professionalism in formulating installation instructions for pneumatic system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate installation instructions and standards for pneumatic equipment of trains according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating installation instructions for pneumatic equipment of trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to draft installation instructions for specified pneumatic equipment of trains in compliance with the installation requirements for train equipment; and</li> <li>(ii) Capable to test the effectiveness of the draft installation instructions and make amendments effectively.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of pneumatic system engineering and the pneumatic equipment of trains.</p>

1. Title	Formulate installation instructions for electrical equipment of trains
2. Code	EMRAIN503A
3. Range	Formulate installation instructions for electrical equipment of trains by referring to their design and the installation guidelines provided by the manufacturer, and considering the overall installation of trains.
4. Level	5
5. Credits	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design and installation principles of electrical system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the structure and design of electrical system equipment of trains</li> <li>◆ Apply the installation guidelines provided by the manufacturer</li> <li>◆ Master the standard for installing electrical equipment of trains</li> <li>◆ Be familiar with the applications of instruments and tools commonly used for installing electrical equipment of trains</li> <li>◆ Design and arrange special tools for installation</li> </ul> <p>6.2 Method and procedures of formulating installation instructions for electrical system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ By referring to the design of electrical system equipment of trains and the installation guidelines provided by the manufacturer, and considering the overall installation of trains, capable to draft installation instructions for the electrical system equipment of trains and their control and protection equipment, including: <ul style="list-style-type: none"> <li>• Installation procedures</li> <li>• Installation standards</li> <li>• Adjustments and preliminary function tests</li> <li>• Points to note during installation</li> </ul> </li> <li>◆ Capable to test the draft installation instructions</li> <li>◆ Capable to amend and formulate installation instructions for electrical system equipment of trains</li> <li>◆ Capable to draft, test and formulate installation instructions for the electrical system control and protection equipment of trains</li> <li>◆ Capable to draft, test and formulate installation instructions for the electric traction system control and protection equipment of trains</li> <li>◆ Capable to draft, test and formulate installation instructions for inverters of trains and their control and protection equipment</li> <li>◆ Capable to draft, test and formulate installation instructions for electric motor control and protection equipment of trains</li> <li>◆ Capable to draft, test and formulate installation instructions for the wiring, the train loop protection circuits and brake loop protection circuits of trains</li> </ul>

	<p>6.3 Professionalism in formulating installation instructions for electrical system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate installation instructions and standards for electrical system equipment of trains according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating installation instructions for electrical system equipment of trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to draft installation instructions for specified major electrical equipment of trains and their control and protection circuits in compliance with the installation requirements for train equipment; and</li> <li>(ii) Capable to test the effectiveness of the draft installation instructions and make amendments effectively.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of electrical engineering and the electrical equipment of trains.</p>

1. Title	Formulate installation instructions for railway overhead feeder system equipment and electricity quality improvement devices	
2. Code	EMRAIN504A	
3. Range	Formulate installation instructions for the switching devices, control circuits, protection devices and electricity quality improvement devices of the railway overhead feeder system by referring to their installation guidelines, and considering the overall design of the railway overhead power supply system.	
4. Level	5	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design and installation principles of railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the structure and design of railway overhead feeder system equipment</li> <li>◆ Apply the installation guidelines provided by the manufacturer</li> <li>◆ Master the standard for installing railway overhead feeder system equipment</li> <li>◆ Be familiar with the applications of instruments and tools commonly used for installing railway overhead feeder system equipment</li> <li>◆ Design and arrange special tools for installation</li> </ul> <p>6.2 Method and procedures of formulating installation instructions for railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ By referring to the design of railway overhead feeder system equipment and devices and the installation guidelines provided by the manufacturer, and considering the overall railway design, capable to draft installation instructions for the railway overhead feeder system equipment and devices, including: <ul style="list-style-type: none"> <li>• Installation procedures</li> <li>• Installation standards</li> <li>• Adjustments and preliminary function tests</li> <li>• Points to note during installation</li> </ul> </li> <li>◆ Capable to test the draft installation instructions</li> <li>◆ Capable to amend and formulate installation instructions for railway overhead feeder system equipment</li> <li>◆ Capable to draft, test and formulate installation instructions for the power switching devices, circuit breakers, interlock devices and protection devices of the overhead feeder system</li> <li>◆ Capable to draft, test and formulate installation instructions for the electricity quality improvement devices</li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Capable to draft, test and formulate installation instructions for the control circuits and devices including PLC control units, and control and display circuits</li> <li>◆ Capable to draft, test and formulate installation instructions for the protection circuits and devices including distance and district overcurrent and earthing fault protection devices</li> <li>◆ Capable to formulate installation instructions and standards for railway overhead feeder system equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating installation instructions for railway overhead feeder system equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to draft installation instructions for railway overhead feeder system equipment in a particular region, including switching devices, control circuits, protection devices and electricity quality improvement devices, in compliance with the installation requirements for railway overhead feeder system; and</p> <p>(ii) Capable to test the effectiveness of the draft installation instructions and make amendments effectively.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of overhead feeder systems.</p>

1. Title	Formulate installation instructions for railway signal and control system equipment	
2. Code	EMRAIN505A	
3. Range	Formulate installation instructions for the various equipment and secondary systems of the railway signal and control system by referring to their design, and considering the overall installation of the railway signal and control system.	
4. Level	5	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design and installation principles of railway signal and control system equipment</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the structure and design of railway signal and control system equipment</li> <li>◆ Apply the installation guidelines provided by the manufacturer</li> <li>◆ Master the standard for installing railway signal and control system equipment</li> <li>◆ Be familiar with the applications of instruments and tools commonly used for installing railway signal and control system equipment</li> </ul> <p>6.2 Method and procedures of formulating installation instructions for railway signal and control system equipment</p> <ul style="list-style-type: none"> <li>◆ By referring to the design of railway signal and control system equipment and devices and the installation guidelines provided by the manufacturer, and considering the work safety of the installation workers, capable to draft installation instructions for the system equipment, including: <ul style="list-style-type: none"> <li>• Installation procedures</li> <li>• Installation standards</li> <li>• Adjustments and preliminary function tests of the equipment</li> <li>• Safety precautions during installation</li> </ul> </li> <li>◆ Capable to test, amend and formulate installation instructions for the traffic management system</li> <li>◆ Capable to draft, test and formulate installation instructions for the railway signal interlock system</li> <li>◆ Capable to draft, test and formulate installation instructions for the trackside equipment of railway signal and control systems including points and the SCADA system</li> <li>◆ Capable to draft, test and formulate installation instructions for the automatic train control (ATC) system equipment on the train</li> </ul>	

	<p>6.3 Professionalism in formulating installation instructions for railway signal and control system equipment</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate installation instructions and standards for railway signal and control system equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating installation instructions for railway signal and control system equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to draft installation instructions for railway signal and control system equipment including the trackside equipment and the ATC system of trains in compliance with the installation requirements for railway signal and control system; and</li> <li>(ii) Capable to test the effectiveness of the draft installation instructions and make amendments effectively.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of electronic control circuit and railway signal system engineering.</p>

1. Title	Formulate instructions on overhead line system inspection, testing and commissioning
2. Code	EMCUIT501A
3. Range	Formulate instructions on overhead line system inspection, testing and commissioning so that engineering personnel who involve in such work could commission the equipment according to the instructions.
4. Level	5
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Requirements on various overhead line system equipment</p> <ul style="list-style-type: none"> <li>◆ Understand the requirements on various overhead line system equipment in order to formulate commissioning instructions and standards</li> <li>◆ Understand relevant safety instructions and pay attention to possible hazards for inspection staff</li> </ul> <p>6.2 Formulate instructions and standards, and provide information necessary for commissioning</p> <ul style="list-style-type: none"> <li>◆ Formulate the instructions and standards according to the requirements on various equipment and the overall overhead line system for the inspection staff to carry out inspection, testing and commissioning on various equipment and the overall overhead line system</li> <li>◆ Formulate relevant safety instructions for inspection staff to protect their work safety</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to formulate instructions and standards on various equipment of the overhead line system for the inspection staff to carry out inspection, testing and commissioning; and to ensure their safety by listing out the safety instructions and potential hazards.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of electricity.

1. Title	Formulate instructions on inspection, testing and commissioning of switchboard, control circuit, protector and electricity quality improvement device
2. Code	EMCUIT502A
3. Range	Formulate instructions on inspection, testing and commissioning of switchboard, control circuit, protector and electricity quality upgrading device so that engineering personnel who involve in such work could commission the installations and improve the devices according to the instructions.
4. Level	5
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Installation requirements and standards for electrical works</p> <ul style="list-style-type: none"> <li>◆ Understand clearly requirements and standards for all installations of electrical works, including switchboard, control circuit and protector</li> </ul> <p>6.2 Formulate requirements and standards for inspection staff to follow</p> <ul style="list-style-type: none"> <li>◆ Formulate requirements and standards according to installation requirements and the overall electrical works system for inspection staff to carry out inspection, testing and commissioning of all installations, including live test</li> <li>◆ Formulate testing and commissioning instructions and standards for electricity quality improvement devices including filter power factor improvement device</li> <li>◆ Know clearly the potential hazards for commissioning staff and formulate relevant safety instructions to protect their work safety</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to formulate instructions and standards on various equipment of the electrical works system for the inspection staff to carry out inspection, testing and commissioning; and to ensure their safety by listing out the safety instructions and potential hazards.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of electricity.

1. Title	Formulate the inspection, commissioning and testing guidelines and standards for the mechanical equipment of trains
2. Code	EMRAIT501A
3. Range	Refer to the design of the mechanical equipment of trains and the inspection and testing guidelines of manufacturers and undertake site inspection, measurement and tests of the equipment so as to formulate the inspection, commissioning and testing guidelines and standards for the mechanical equipment of trains.
4. Level	5
5. Credits	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design, working principles and standards of the mechanical system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Understand the design, structure and working principles of the mechanical equipment of trains</li> <li>◆ Know about the application of the inspection and testing guidelines of manufacturers</li> <li>◆ Master the techniques of working out the inspection, commissioning and testing standards for the mechanical system equipment of trains</li> <li>◆ Understand the application of typical mechanical equipment measuring and testing instruments and tools</li> </ul> <p>6.2 Methods and procedures of formulating the inspection, commissioning and testing guidelines for the mechanical system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Refer to the design of the train bogies, gangways and couplers and the inspection and testing guidelines of manufacturers and undertake site inspection, measurement and testing of the equipment and draft the inspection, commissioning and testing guidelines and standards for the train bogies, gangways and couplers. Aspects to be covered are: <ul style="list-style-type: none"> <li>• Inspection procedures (including visual inspection and data taking) and standards</li> <li>• Testing procedures and standards (including function tests)</li> <li>• Procedures and standards of equipment setting</li> <li>• Important points for inspection, testing and setting</li> </ul> </li> <li>◆ Test the drafted inspection, commissioning and testing guidelines and standards</li> <li>◆ Analyze data and modify and formulate the inspection, commissioning and testing guidelines and standards for the train bogies, gangways and couplers of trains</li> <li>◆ Draft, test and formulate the inspection, commissioning and testing guidelines and standards for the friction brake system and control and protection devices of trains</li> </ul>

	<ul style="list-style-type: none"> <li>◆ Draft, test and formulate the inspection, commissioning and testing guidelines and standards for the wheel slide protection devices of trains</li> <li>◆ Draft, test and formulate the inspection, commissioning and testing guidelines and standards for the train door mechanical devices of trains</li> <li>◆ Draft, test and formulate the inspection, commissioning and testing guidelines and standards for the train door control and protection devices of trains</li> </ul> <p>6.3 Professionalism in formulating the inspection, commissioning and testing guidelines for the mechanical system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Formulate the inspection, commissioning and testing guidelines for the mechanical system equipment of trains according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating the inspection, commissioning and testing guidelines for the mechanical system equipment of trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to draft a set of inspection, commissioning and testing guidelines and standards for the mechanical system / major equipment of trains according to commissioning requirements; and</p> <p>(ii) Capable to test the effectiveness of the drafted inspection, commissioning and testing guidelines and standards efficiently; analyze data and conduct reviews and modifications.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of mechanical engineering and the mechanical system of trains.</p>

1. Title	Formulate the inspection, commissioning and testing guidelines and standards for the pneumatic equipment of trains
2. Code	EMRAIT502A
3. Range	Refer to the design of the pneumatic equipment of trains and the inspection and testing guidelines of manufacturers and undertake site inspection, measurement and tests of the equipment so as to formulate the inspection, commissioning and testing guidelines and standards for the pneumatic equipment of trains.
4. Level	5
5. Credits	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design, working principles and standards of the pneumatic system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Understand the design, structure and working principles of the pneumatic equipment of trains</li> <li>◆ Know about the application of the inspection and testing guidelines of manufacturers</li> <li>◆ Master the techniques of working out the inspection, commissioning and testing standards for the pneumatic system equipment of trains</li> <li>◆ Understand the application of typical pneumatic equipment measuring and testing instruments and tools</li> </ul> <p>6.2 Methods and procedures of formulating the inspection, commissioning and testing guidelines for the pneumatic system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Refer to the design of the air compressors of trains and the inspection and testing guidelines of manufacturers and undertake site observation, measurement and testing of the equipment and draft the inspection, commissioning and testing guidelines and standards for the air compressors and control and protection equipment of trains. Aspects to be covered are: <ul style="list-style-type: none"> <li>• Inspection procedures (including visual inspection and data taking) and standards</li> <li>• Testing procedures and standards (including insulation, continuity and function tests)</li> <li>• Procedures and standards of equipment setting</li> <li>• Important points for inspection, testing and setting</li> </ul> </li> <li>◆ Test the drafted inspection, commissioning and testing guidelines and standards</li> <li>◆ Analyze data and modify and formulate the inspection, commissioning and testing guidelines and standards for the air compressors and control and protection equipment of trains</li> </ul>

	<ul style="list-style-type: none"> <li>◆ Draft, test and formulate the inspection, commissioning and testing guidelines and standards for the pipe line installations and protection equipment of trains</li> <li>◆ Draft, test, analyze data and formulate the inspection, commissioning and testing guidelines and standards for various pipe line and pneumatic equipment of the pneumatic systems of trains</li> <li>◆ Draft, test, analyze data and formulate the procedures and standards for pressure and leak tests of the entire pneumatic system of trains</li> </ul> <p>6.3 Professionalism in formulating the inspection, commissioning and testing guidelines for the pneumatic system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Formulate the inspection, commissioning and testing guidelines for the pneumatic system equipment of trains according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating the inspection, commissioning and testing guidelines for the pneumatic system equipment of trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to draft a set of inspection, commissioning and testing guidelines and standards for the pneumatic devices of trains according to commissioning requirements; and</p> <p>(ii) Capable to test the effectiveness of the drafted inspection, commissioning and testing guidelines and standards efficiently; analyze data and conduct reviews and modifications.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of pneumatic engineering and is familiar with the pneumatic devices of trains.</p>

1. Title	Formulate the inspection, commissioning and testing guidelines and standards for the electrical equipment of trains	
2. Code	EMRAIT503A	
3. Range	Refer to the design of the electrical equipment of trains and the inspection and testing guidelines of manufacturers and undertake site inspection, measurement and tests of the equipment so as to formulate the inspection, commissioning and testing guidelines and standards for the electrical equipment of trains.	
4. Level	4	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design, working principles and standards of the electrical system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Understand the design, structure and working principles of the electrical equipment of trains</li> <li>◆ Know about the application of the inspection and testing guidelines of manufacturers</li> <li>◆ Master the techniques of working out the inspection, commissioning and testing standards for the electrical system equipment of trains</li> <li>◆ Understand the application of typical electrical equipment measuring and testing instruments and tools</li> </ul> <p>6.2 Methods and procedures of formulating the inspection, commissioning and testing guidelines for the electrical system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Refer to the design of the power supply system equipment of trains and the inspection and testing guidelines of manufacturers and undertake site inspection, measurement and testing of the equipment and draft the inspection, commissioning and testing guidelines and standards for the electricity power system equipment of trains, including pantograph, lighting arresters, spark gaps, main power circuits, breakers, and electricity return brush. Aspects to be covered are: <ul style="list-style-type: none"> <li>• Inspection procedures (including visual inspection and data taking) and standards</li> <li>• Testing procedures and standards (including insulation, continuity and function tests)</li> <li>• Procedures and standards of equipment setting</li> <li>• Important points for inspection, testing and setting</li> </ul> </li> <li>◆ Test the drafted inspection, commissioning and testing guidelines and standards</li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Analyze data and modify and formulate the inspection, commissioning and testing guidelines and standards for the power supply system and control and protection equipment of trains</li> <li>◆ Draft, test and formulate the inspection, commissioning and testing guidelines and standards for the traction motors and control and protection equipment of trains</li> <li>◆ Draft, test and formulate the inspection, commissioning and testing guidelines and standards for the inverters and control and protection equipment of trains</li> <li>◆ Compile, test and analyze data and formulate the inspection, commissioning and testing guidelines and standards for the motor-alternators and control and protection equipment of trains</li> <li>◆ Draft, test and formulate the inspection, commissioning and testing guidelines and standards for the train lines and the train door loop protection circuit and brake loop protection circuit</li> </ul> <p>6.3 Professionalism in formulating the inspection, commissioning and testing guidelines for the electrical system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Formulate the inspection, commissioning and testing guidelines for the electrical system equipment of trains according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating the inspection, commissioning and testing guidelines for the electrical system of trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to draft a set of inspection, commissioning and testing guidelines and standards for the major electrical equipment and control and protection circuits of trains according to commissioning requirements; and</p> <p>(ii) Capable to test the effectiveness of the drafted inspection, commissioning and testing guidelines and standards efficiently; analyze data and conduct reviews and modifications.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of electrical engineering and the electrical system of trains.</p>

1. Title	Formulate the inspection, commissioning and testing guidelines and standards for the train air-conditioning systems	
2. Code	EMRAIT504A	
3. Range	Refer to the design of the train air-conditioning systems and the inspection and testing guidelines of manufacturers and undertake site inspection, measurement and tests of the equipment so as to formulate the inspection, commissioning and testing guidelines and standards for the train air-conditioning system and equipment.	
4. Level	4	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design, working principles and standards of the air-conditioning system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Understand the design, structure and working principles of the air-conditioning equipment of trains</li> <li>◆ Know about the application of the inspection and testing guidelines of manufacturers</li> <li>◆ Master the techniques of working out the inspection, commissioning and testing standards for the air-conditioning system equipment of trains</li> <li>◆ Understand the application of typical air-conditioning equipment measuring and testing instruments and tools</li> <li>◆ Be familiar with the treatment and legal requirements on refrigerant of air-conditioning system</li> </ul> <p>6.2 Methods and procedures of formulating the inspection, commissioning and testing guidelines for the air-conditioning system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Refer to the design of the air-conditioners and air ducts of trains and the inspection and testing guidelines of manufacturers and undertake site inspection, measurement and testing of the equipment and draft the inspection, commissioning and testing guidelines and standards for the air-conditioners and air ducts of trains. Aspects to be covered are: <ul style="list-style-type: none"> <li>• Inspection procedures and standards</li> <li>• Measurement of operating data of air-conditioners (including insulation and function tests)</li> <li>• Inspection procedures and standards (including insulation, continuity and function tests)</li> <li>• Procedures and standards of equipment setting</li> <li>• Important points for inspection, testing and setting the equipment</li> </ul> </li> <li>◆ Test the drafted inspection, commissioning and testing guidelines and standards</li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Analyze data and modify and formulate the inspection, commissioning and testing guidelines and standards for the air-conditioners and air ducts of trains</li> <li>◆ Draft, test and formulate the inspection, commissioning and testing guidelines and standards for the air-conditioning circuit control system and equipment of trains</li> <li>◆ Draft, test and formulate the inspection, commissioning and testing guidelines and standards for the air-conditioning circuit protection system and equipment of trains</li> <li>◆ Compile, test, analyze data and formulate guidelines and standards for measuring the overall operating parameters of the train air-conditioning systems, including the temperature, humidity, air velocity, pressure and noise level</li> </ul> <p>6.3 Professionalism in formulating the inspection, commissioning and testing guidelines for the air-conditioning system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Formulate the inspection, commissioning and testing guidelines for the air-conditioning system equipment of trains according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating the inspection, commissioning and testing guidelines for the train air-conditioning systems</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to draft a set of inspection, commissioning and testing guidelines and standards for the train air-conditioning systems according to commissioning requirements; and</p> <p>(ii) Capable to formulate guidelines and standards for measuring the overall operating parameters of the train air-conditioning systems; analyze data and conduct reviews and modifications efficiently.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of air-conditioning system and equipment.</p>

1. Title	Conduct comprehensive train tests and analyze train performance	
2. Code	EMRAIT505A	
3. Range	Conduct comprehensive tests for trains in depot and railway main lines, measure and analyze operational data systematically and assess the dynamic performance of the trains.	
4. Level	5	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Methods and techniques for comprehensive train tests and data analysis</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the methods of testing performance of different aspects of trains, including: <ul style="list-style-type: none"> <li>• Speed / time curve test</li> <li>• Brake test</li> <li>• Acceleration test</li> </ul> </li> <li>◆ Master the techniques of measuring operational data</li> <li>◆ Be familiar with methods and techniques of analyzing operational data</li> </ul> <p>6.2 Procedures for comprehensive train tests and performance data analysis</p> <ul style="list-style-type: none"> <li>◆ Work out a driving pattern and conduct full distance tests for trains safely and effectively according to the driving pattern, and measure relevant data</li> <li>◆ Choose railway sections to conduct brake tests and acceleration tests safely and effectively, and measure relevant data</li> <li>◆ Use statistical techniques for selection and analytical principles to appraise the dynamic performance of trains</li> </ul> <p>6.3 Professionalism in conducting for comprehensive train tests and performance data analysis</p> <ul style="list-style-type: none"> <li>◆ Be familiar with safety guidelines and codes of practice for railway and apply them in comprehensive tests for trains</li> </ul>	
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to draft a set of instructions for conducting an comprehensive test safely and effectively on train operation, including testing procedures, measurements and important points to note; and</p> <p>(ii) Capable to conduct brake tests for trains systematically and effectively, and use techniques for data selection and analysis to analyze the brake performance according to the data from tests.</p>	
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses the knowledge of train operation and performance.	

1. Title	Supervise and manage train inspection, commissioning and testing work	
2. Code	EMRAIT506A	
3. Range	Apply the knowledge and skills of supervision, coordination and support and the familiarity with train inspection, commissioning and testing work to monitor the inspection, commissioning and testing of train equipment and to manage team operation so as to ensure quality and efficiency.	
4. Level	5	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Procedures, operation modes of units and supervisory and management skills of inspecting, commissioning and testing train equipment</p> <ul style="list-style-type: none"> <li>◆ Master the methods and processes of inspecting, commissioning and testing of major train equipment, relevant quality requirements, and check points</li> <li>◆ Understand the modes and culture of operation involved in train inspection, commissioning and testing work</li> <li>◆ Possess the knowledge and skills of supervising, coordinating, supporting and managing the electrical and mechanical works of trains</li> <li>◆ Master the techniques of analyzing and assessing testing and commissioning data, and of evaluating train equipment performance</li> </ul> <p>6.2 Procedures of monitoring and managing train inspection, commissioning and testing work</p> <ul style="list-style-type: none"> <li>◆ Apply the knowledge and skills of supervision, coordination and support and the familiarity with the processes and standards of inspecting, commissioning and testing train equipment to monitor quality control points so as to ensure quality, efficiency and standard</li> <li>◆ Maintain adequate coordination and communication with the commissioning team, the design team and manufacturers so as to ensure smooth handling of inspection, commissioning and testing work</li> <li>◆ Analyze and assess efficiently the testing and commissioning data, and evaluate train equipment performance for confirmation of acceptance</li> <li>◆ Review the inspection, commissioning and testing processes for improving the operation of working teams</li> <li>◆ Review and improve the organization of the inspection, commissioning and testing teams with reference to quality management models</li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Formulate plans for enhancing persistently the quality and efficiency of inspection, commissioning and testing work, including: <ul style="list-style-type: none"> <li>• Negotiating with staff on formulation of training programmes and providing adequate training for them</li> <li>• Establishing effective communication channels</li> <li>• Planning for updating and upgrading of equipment</li> </ul> </li> </ul>
6.3	<p>Professionalism in supervising and managing the inspection, commissioning and testing of train system equipment</p> <ul style="list-style-type: none"> <li>◆ Supervise and manage the inspection, commissioning and testing of train system equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in supervising and managing the inspection, commissioning and testing of train system equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to supervise and manage efficiently train inspection, commissioning and testing work to ensure quality and efficiency; and</li> <li>(ii) Capable to formulate plans for enhancing persistently the quality and efficiency of supervising and managing train inspection, commissioning and testing work.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses expertise and supervisory skills of electrical and mechanical engineering.</p>

1. Title	Inspect, commission and test power recovery systems	
2. Code	EMRAIT507A	
3. Range	Analyze the design of railway overhead feeder system and the circuit configuration logic; inspect, commission and test the power recovery system control interlocking and protection functions according to the conclusions of analysis.	
4. Level	5	
5. Credits	5	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of railway overhead feeder system and power recovery system</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the working principles of railway overhead feeder system</li> <li>◆ Be familiar with the operation and working principles of power recovery system</li> <li>◆ Understand the requirements and procedures of resuming the power of railway overhead feeder system</li> </ul> <p>6.2 Methods and procedures of inspecting, commissioning and testing power recovery system</p> <ul style="list-style-type: none"> <li>◆ Capable to analyze the railway overhead feeder system design and the circuit configuration logic; inspect, commission and test the controlling functions of the power recovery system, including the circuit switching logic, the PLC controlling function and the control circuit, according to the conclusions of analysis</li> <li>◆ Capable to inspect, commission and test the interlocking functions of the power recovery system, including the circuit logic, the PLC function and the circuit, according to the circuit configuration logic</li> <li>◆ Capable to inspect, commission and test the protective functions of the power recovery system, including the circuit logic, the PLC function and the circuit, according to the circuit configuration logic and protection logic</li> <li>◆ Capable to analyze all test results and confirm the commissioning of the power recovery system of railway overhead feeder system</li> </ul> <p>6.3 Professionalism in inspecting, commissioning and testing power recovery system equipment of railway overhead system</p> <ul style="list-style-type: none"> <li>◆ Inspect, test and commission the power recovery system equipment of railway overhead system according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in inspecting, testing and commissioning the power recovery system equipment</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: <ul style="list-style-type: none"><li>(i) Capable to draft a set of instructions and standards for inspecting, testing and commissioning the controlling, interlocking and protection functions of the power recovery system effectively; and</li><li>(ii) Capable to analyze all test results effectively and commission the power recovery system of railway overhead feeder system.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses the professional knowledge of power supply system and equipment.

1. Title	Perform insulation tests, pressure tests and overall system commissioning tests for the railway overhead feeder system	
2. Code	EMRAIT508A	
3. Range	Perform overall system commissioning tests for the railway overhead feeder system, including insulation tests, pressure tests, earth impedance tests and drop-short tests, and undertake function tests and interlocking tests for the control and protection system.	
4. Level	5	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Principles and standards for commissioning tests for the railway overhead feeder system</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the uses, methods and standards of commissioning tests for the railway overhead feeder system</li> <li>◆ Master the techniques of applying various types of testing instruments</li> </ul> <p>6.2 Methods and procedures of performing insulation tests, pressure tests and overall system commissioning tests for the railway overhead feeder system</p> <ul style="list-style-type: none"> <li>◆ Undertake insulation tests and pressure tests for the main circuit of the overhead wire according to testing standards</li> <li>◆ Measure and record the data from tests</li> <li>◆ Undertake insulation tests, pressure tests, earth impedance tests and drop-short tests for the main circuit of the overall railway overhead feeder system according to testing standards</li> <li>◆ Undertake load tests and full-load tests according to testing standards</li> <li>◆ Measure and record the data from tests, including the data of electricity quality</li> <li>◆ Undertake function tests, interlocking tests and control logic tests for the control and protection devices of the power supply system of trains, including control and protection relays and circuits, PLC devices and SCADA devices, according to circuit configuration, and control and protection logic</li> <li>◆ Analyze the data from railway overhead feeder system tests and assess whether the system complies with commissioning standards</li> </ul> <p>6.3 Professionalism in performing commissioning tests for the railway overhead feeder system</p> <ul style="list-style-type: none"> <li>◆ Understand the safety measures for performing commissioning tests for the railway overhead feeder system</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in handling the commissioning tests for the railway overhead feeder system</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: <ul style="list-style-type: none"><li>(i) Capable to draft the procedures and standards of the overall system tests for the main circuit of the railway overhead feeder system; and</li><li>(ii) Capable to calculate and analyze the measurements from tests efficiently and assess whether the feeder system complies with commissioning standards.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses expertise in power supply system and equipment.

1. Title	Formulate the inspection, commissioning and testing guidelines and standards for the railway traffic management system	
2. Code	EMRAIT509A	
3. Range	Refer to the design of the railway traffic management system and the overall design of the railway signal and control system and apply knowledge and techniques of electronic control programme and network system to formulate the inspection, commissioning and testing guidelines and standards for the railway traffic management system.	
4. Level	5	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design, working principles and standards of the railway traffic management system</p> <ul style="list-style-type: none"> <li>◆ Understand the design, structure and working principles of the railway traffic management system</li> <li>◆ Know about the application of the inspection and testing guidelines of manufacturers</li> <li>◆ Master the techniques of working out the inspection, commissioning and testing standards for the railway traffic management system</li> <li>◆ Understand the application of typical measuring and testing instruments and tools for the railway traffic management system</li> </ul> <p>6.2 Methods and procedures of formulating the inspection, commissioning and testing guidelines for the railway traffic management system</p> <ul style="list-style-type: none"> <li>◆ Refer to the design of the railway traffic management system and the overall signal control design and draft, test and formulate the inspection, commissioning and testing guidelines and standards for the control programming system. Aspects to be covered are: <ul style="list-style-type: none"> <li>• Inspection procedures (including visual inspection and data taking) and standards</li> <li>• Function tests and standards</li> <li>• Interlock tests and standards</li> <li>• Standards for equipment setting</li> <li>• Important points for inspection, testing and setting</li> </ul> </li> <li>◆ Draft, test and formulate the inspection, commissioning and testing guidelines and standards for the following systems and equipment <ul style="list-style-type: none"> <li>• Signal and control monitoring system</li> <li>• Routing and programming control system</li> <li>• Train location indication and communication system</li> <li>• Train operation control system</li> <li>• Data collection and management reporting system</li> <li>• Interface devices (including human-machine interface)</li> </ul> </li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Draft, test and formulate the inspection, commissioning and testing guidelines and standards for the following network equipment of the railway traffic management system <ul style="list-style-type: none"> <li>• LAN</li> <li>• WAN</li> <li>• Signal transmission equipment</li> <li>• Interface devices</li> </ul> </li> </ul>
6.3	<p>Professionalism in formulating the inspection, commissioning and testing guidelines for the railway traffic management system</p> <ul style="list-style-type: none"> <li>◆ Formulate the inspection, commissioning and testing guidelines for the railway traffic management system according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating the inspection, commissioning and testing guidelines for the railway traffic management system</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to draft a set of inspection, commissioning and testing guidelines and standards for a specified railway traffic management system according to commissioning requirements; and</li> <li>(ii) Capable to test the effectiveness of the drafted inspection, commissioning and testing guidelines and standards efficiently; analyze data and conduct reviews and modifications.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of electronic control circuit and railway signal system.</p>

1. Title	Formulate the inspection, commissioning and testing guidelines and standards for the railway signal interlock system	
2. Code	EMRAIT510A	
3. Range	Refer to the design of the railway signal interlock system and the overall design of the railway signal and control system and apply knowledge and techniques of electronic control circuit, control programme and programmable logic controller (PLC) and network system to formulate the inspection, commissioning and testing guidelines and standards for the railway signal interlock system.	
4. Level	5	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design, working principles and standards of the railway signal interlock system</p> <ul style="list-style-type: none"> <li>◆ Understand the design, structure and working principles of the railway signal interlock system</li> <li>◆ Know about the application of the inspection and testing guidelines of manufacturers</li> <li>◆ Master the techniques of working out the inspection, commissioning and testing standards for the railway signal interlock system</li> <li>◆ Understand the application of typical measuring and testing instruments and tools for the railway signal system</li> </ul> <p>6.2 Methods and procedures of formulating the inspection, commissioning and testing guidelines for the railway signal interlock system</p> <ul style="list-style-type: none"> <li>◆ Refer to the design of the railway signal interlock system and the overall signal control design and draft, test and formulate the inspection, commissioning and testing guidelines and standards for the central interlock components of the railway signal interlock system, including the control programme components, PLC components and electronic circuit components. Aspects to be covered are: <ul style="list-style-type: none"> <li>• Inspection procedures and standards</li> <li>• Function tests and standards</li> <li>• Interlock tests and standards</li> <li>• Standards for equipment setting</li> <li>• Important points for inspection, testing and setting</li> </ul> </li> <li>◆ Draft, test and formulate the inspection, commissioning and testing guidelines and standards for the trackside functional components of the railway signal and control system, including: <ul style="list-style-type: none"> <li>• Trackside components</li> <li>• Interface devices</li> <li>• Signal and information transmission equipment</li> </ul> </li> </ul>	

	<p>6.3 Professionalism in formulating the inspection, commissioning and testing guidelines for the railway signal interlock system</p> <ul style="list-style-type: none"> <li>◆ Formulate the inspection, commissioning and testing guidelines for the railway signal interlock system according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating the inspection, commissioning and testing guidelines for the railway signal interlock system</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to draft a set of inspection, commissioning and testing guidelines and standards for a specified railway signal interlock system according to commissioning requirements; and</li> <li>(ii) Capable to test the effectiveness of the drafted inspection, commissioning and testing guidelines and standards efficiently; analyze data and conduct reviews and modifications.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of electronic control circuit and railway signal system.</p>

1. Title	Formulate the inspection, commissioning and testing guidelines and standards for the trackside equipment of the railway signal system and the SCADA System	
2. Code	EMRAIT511A	
3. Range	Refer to the design of the trackside equipment of the railway signal system and points and the functions and standards of the Supervisory, Control and Data Acquisition (SCADA) System and the overall design of the railway signal and control system, and apply knowledge and techniques of electronic control circuit, electrical circuit and equipment so as to formulate the inspection, commissioning and testing guidelines and standards for the trackside equipment of the railway signal system, points and the SCADA System.	
4. Level	5	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design, working principles and standards of the trackside equipment of the railway signal system and the SCADA System</p> <ul style="list-style-type: none"> <li>◆ Understand the working principles of the railway signal system</li> <li>◆ Understand the design, structure and working principles of the trackside equipment of the railway signal system including points</li> <li>◆ Understand the functions and application principles of the SCADA System</li> <li>◆ Know about the application of the inspection and testing guidelines of manufacturers</li> <li>◆ Master the techniques of working out the inspection, commissioning and testing standards for the railway signal system equipment</li> <li>◆ Understand the application of typical measuring and testing instruments and tools for the railway signal system equipment</li> </ul> <p>6.2 Methods and procedures of formulating the inspection, commissioning and testing guidelines for the trackside equipment of the railway signal system and the SCADA System</p> <ul style="list-style-type: none"> <li>◆ Refer to the design of the railway trackside equipment and the overall signal control design and draft, test and formulate the inspection, commissioning and testing guidelines and standards for the trackside equipment including train location detecting devices, platform screen door control devices, railway signal display devices, control components and interface devices.</li> </ul> <p>Aspects to be covered are:</p> <ul style="list-style-type: none"> <li>• Inspection procedures and standards</li> <li>• Function tests and standards</li> <li>• Interlock tests and standards</li> <li>• Standards for equipment setting</li> <li>• Important points for inspection, testing and setting</li> </ul>	

	<ul style="list-style-type: none"> <li>• Draft, test and formulate the inspection, commissioning and testing guidelines and standards for points equipment including electric motors, mechanical devices, locking devices and indicators, and control and protection circuits</li> <li>• Draft, test and formulate the inspection, commissioning and testing guidelines and standards for the functions of remote control and signal data acquisition of the SCADA System</li> </ul> <p>6.3 Professionalism in formulating the inspection, commissioning and testing guidelines for the trackside equipment of the railway signal system and the SCADA System</p> <ul style="list-style-type: none"> <li>◆ Formulate the inspection, commissioning and testing guidelines for the trackside equipment of the railway signal system and the SCADA System according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating the inspection, commissioning and testing guidelines for the trackside equipment of the railway signal system and the SCADA System</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to draft a set of inspection, commissioning and testing guidelines and standards for a trackside system equipment with specified functions according to commissioning requirements; and</p> <p>(ii) Capable to draft a set of inspection, commissioning and testing guidelines and standards for points according to commissioning requirements.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of electronic control circuit and railway signal system.</p>

1. Title	Formulate the inspection, commissioning and testing guidelines and standards for the automatic train control (ATC) system equipment on train	
2. Code	EMRAIT512A	
3. Range	Refer to the design and functions of the ATC system equipment on the train, train control design and the overall design of the railway signal and control system and apply knowledge and techniques of electronic circuit control to formulate the inspection, commissioning and testing guidelines and standards for the ATC system equipment on train.	
4. Level	5	
5. Credits	4	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design, working principles and standards of the ATC system equipment on train</p> <ul style="list-style-type: none"> <li>◆ Understand the train control design and the overall design of the railway signal and control system</li> <li>◆ Understand the working principles of the ATC system</li> <li>◆ Understand the design, structure and working principles of the ATC system equipment on train</li> <li>◆ Know about the application of the inspection and testing guidelines of manufacturers</li> <li>◆ Master the techniques of working out the inspection, commissioning and testing standards for the railway signal and control system equipment</li> <li>◆ Understand the application of typical measuring and testing instruments and tools for the railway signal system</li> </ul> <p>6.2 Methods and procedures of formulating the inspection, commissioning and testing guidelines for the ATC system equipment on train</p> <ul style="list-style-type: none"> <li>◆ Refer to the design and functions of the ATC system equipment on train, train control design and the overall railway signal and control design and draft, test and formulate the inspection, commissioning and testing guidelines and standards for the ATC system equipment on train including the electronic control unit and interface unit. Aspects to be covered are: <ul style="list-style-type: none"> <li>• Inspection procedures and standards</li> <li>• Function tests and standards</li> <li>• Interlock tests and standards</li> <li>• Standards for equipment setting</li> <li>• Important points for inspection, testing and setting</li> </ul> </li> <li>◆ Draft, test and formulate the inspection, commissioning and testing guidelines and standards for the ATC system equipment under train, including: <ul style="list-style-type: none"> <li>• Receiving antenna</li> </ul> </li> </ul>	

	<ul style="list-style-type: none"> <li>• Transmitting antenna</li> <li>• Accelerometer</li> <li>• Tachometer</li> <li>• Docking antenna</li> </ul>
6.3	<p>Professionalism in formulating the inspection, commissioning and testing guidelines for the ATC system equipment on train</p> <ul style="list-style-type: none"> <li>◆ Formulate the inspection, commissioning and testing guidelines for the ATC system equipment on train according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating the inspection, commissioning and testing guidelines for the ATC system equipment on train</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to draft a set of inspection, commissioning and testing guidelines and standards for ATC system equipment on train according to commissioning requirements; and</p> <p>(ii) Capable to test the effectiveness of the drafted inspection, commissioning and testing guidelines and standards efficiently; analyze data and conduct reviews and modifications.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of electronic control circuit and railway signal system.</p>

1. Title	Analyze fault records to find frequent faults and their root causes
2. Code	EMRAOR501A
3. Range	Make use of the highly-efficient data storage and access system to access and analyze equipment system fault records, including analyzing by equipment system and by train unit, in order to find and study the frequent faults and to locate their root causes.
4. Level	5
5. Credits	5
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Causes of faults and their analyzing methods</p> <ul style="list-style-type: none"> <li>◆ Master the techniques of analyzing causes of faults</li> <li>◆ Master the typical methods of analyzing faults such as ( FMEA ) and Fault Tree Analysis ( FTA ) to find the root causes of faults</li> <li>◆ Master the techniques of screening information</li> </ul> <p>6.2 Methods and procedures of analyzing fault records to find frequent faults and their root causes</p> <ul style="list-style-type: none"> <li>◆ Capable to analyze frequent faults in equipment system from the equipment fault and repair records categorized by equipment system</li> <li>◆ Capable to identify the root causes of fault according to data analysis. Causes include <ul style="list-style-type: none"> <li>• Design deviation</li> <li>• Overloading</li> <li>• Equipment fatigue (equipment fault curve)</li> <li>• Human mistake</li> <li>• Environment factor</li> </ul> </li> <li>◆ Capable to base on the fault record or repair record of an independent equipment system unit (e.g. an independent train unit) to analyze whether a frequent fault of that particular unit occurs repeatedly</li> <li>◆ Capable to base on data analyzed to judge whether the frequent fault has been repaired</li> <li>◆ Capable to formulate record analysis system to enhance the reliability of equipment through the following ways <ul style="list-style-type: none"> <li>• Analyze and review equipment fault and repair records regularly</li> <li>• Communicate effectively with other departments and the manufacturer to implement the recommendations on equipment improvements</li> </ul> </li> </ul>

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: <ul style="list-style-type: none"><li>(i) Capable to analyze systematically and efficiently frequent faults in equipment system from the equipment fault and repair records, and judge whether the frequent faults have been repaired; and</li><li>(ii) Capable to find the frequent faults in an independent unit of equipment from the equipment fault and repair records, and judge whether the fault has been repaired.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person is familiar with the structure and working principles of equipment and system.

1. Title	Use new technologies and methods to support fault finding in trains
2. Code	EMRAOR502A
3. Range	Make use of the instruments and equipment developed by new technologies to judge the condition of train equipment and record the operational data of train equipment in order to support the finding of train faults; make use of the information network to obtain information on railways of other countries for finding and analyzing train faults.
4. Level	5
5. Credits	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Information on technological development and operation of railways of other countries</p> <ul style="list-style-type: none"> <li>◆ Search technological developments related to railway operation and engineering, and understand their application</li> <li>◆ Liaise with railways and relevant organizations of other countries to acquire information on railway operation especially that related to railway engineering</li> </ul> <p>6.2 Methods and procedures of using instruments and equipment developed by new technologies and information technology in finding faults</p> <ul style="list-style-type: none"> <li>◆ Capable to use instruments and equipment developed by new technologies to support monitoring the condition on the train roof and under the train so as to improve the fault finding rate for train equipment, such as using <ul style="list-style-type: none"> <li>• Video equipment to monitor the condition of brake shoe and bow collector</li> <li>• Thermal or infrared instrument to monitor the temperature of the train equipment (e.g. temperature of axle bearing)</li> </ul> </li> <li>◆ Capable to use recording instruments developed by new technologies to record operational data of train equipment to support finding of recurring and hidden faults</li> <li>◆ Capable to use information network to collect data of operation and faults for identical train equipment used by railways of other countries</li> <li>◆ Capable to use computer technology to analyze information on faults in train equipment and systems so as to provide data for finding faults in train equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to use new technologies and methods to monitor the dynamic performance of and find hidden faults in major train equipment effectively; and</p> <p>(ii) Capable to collect information on operational performance and faults of similar train equipment used by railways of other countries.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person is familiar with the operation and development of different disciplines in railway engineering.

1. Title	Formulate maintenance instructions for mechanical equipment and train air-conditioning systems	
2. Code	EMRAMA501A	
3. Range	Formulate maintenance instructions for mechanical equipment and train air-conditioning systems by referring to their design and the repairing guidelines provided by the manufacturer, and considering the overall operational performance of trains and their repair arrangements and history.	
4. Level	5	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design, structure and working principles of mechanical equipment and train air-conditioning systems</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the design, structure and working principles of mechanical equipment and train air-conditioning systems</li> <li>◆ Apply the repairing guidelines provided by the manufacturer</li> <li>◆ Master the techniques in calculating the standard for maintaining mechanical equipment and train air-conditioning systems</li> <li>◆ Master the applications of instrument and tools commonly used for repairing and checking mechanical equipment and train air-conditioning systems</li> </ul> <p>6.2 Method and procedures of formulating maintenance instructions for mechanical equipment and train air-conditioning systems</p> <ul style="list-style-type: none"> <li>◆ By referring to the design of train bogies, gangways and couplers and the repairing guidelines provided by the manufacturer, and considering the overall operational performance of trains and their repair arrangements and history, capable to draft maintenance instructions for the train bogies, gangways and couplers, including: <ul style="list-style-type: none"> <li>• Maintenance procedures</li> <li>• Maintenance standards</li> <li>• Adjustments, setting and preliminary function tests</li> <li>• Points to note during maintenance</li> </ul> </li> <li>◆ Capable to test the draft maintenance instructions</li> <li>◆ Capable to analyze data, amend and formulate maintenance instructions for train bogies, gangways and couplers</li> <li>◆ Capable to draft, test, analyze data and formulate maintenance instructions for the friction brake system and control and protection devices of trains</li> <li>◆ Capable to draft, test, analyze data and formulate maintenance instructions for the wheel slide protection devices of trains</li> <li>◆ Capable to draft, test, analyze data and formulate maintenance instructions for the train door mechanical devices of trains</li> <li>◆ Capable to draft, test, analyze data and formulate maintenance instructions for train door control and protection devices of trains</li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Capable to draft, test, analyze data and formulate maintenance instructions for air-conditioners</li> <li>◆ Capable to draft, test, analyze data and formulate maintenance instructions for air-conditioning control equipment</li> </ul> <p>6.3 Professionalism in formulating maintenance instructions for mechanical equipment and train air-conditioning systems</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate maintenance instructions and standards for mechanical equipment and train air-conditioning systems according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating maintenance instructions for mechanical equipment and train air-conditioning systems</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to draft maintenance instructions for specified mechanical equipment and train air-conditioning systems in compliance with the maintenance requirements for train equipment; and</p> <p>(ii) Capable to test the effectiveness of the draft maintenance instructions, analyze data and make amendments effectively.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of mechanical engineering and air-conditioning equipment and is familiar with the mechanical equipment and train air-conditioning systems.</p>

1. Title	Formulate maintenance instructions for pneumatic system equipment of trains
2. Code	EMRAMA502A
3. Range	Formulate maintenance instructions for pneumatic system equipment of trains by referring to their design and the repairing guidelines provided by the manufacturer, and considering the overall operational performance of trains and their repair arrangements and history.
4. Level	5
5. Credits	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design, structure and working principles of pneumatic system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the design, structure and working principles of pneumatic system equipment of trains</li> <li>◆ Apply the repairing guidelines provided by the manufacturer</li> <li>◆ Master the techniques in calculating the standard for maintaining pneumatic system equipment of trains</li> <li>◆ Master the applications of instrument and tools commonly used for measuring and checking pneumatic equipment of trains</li> </ul> <p>6.2 Method and procedures of formulating maintenance instructions for pneumatic system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ By referring to the design of air compressor of trains and the repairing guidelines provided by the manufacturer, and considering the overall operational performance of trains and their repair arrangements and history, capable to draft maintenance instructions for the air compressor of trains, including: <ul style="list-style-type: none"> <li>• Maintenance procedures</li> <li>• Maintenance standards</li> <li>• Adjustments, setting and preliminary function tests</li> <li>• Points to note during maintenance</li> </ul> </li> <li>◆ Capable to test the draft maintenance instructions</li> <li>◆ Capable to analyze data, amend and formulate maintenance instructions for air compressor of trains</li> <li>◆ Capable to draft, test, analyze data and formulate maintenance instructions for the air compressors control and protection equipment</li> <li>◆ Capable to draft, test, analyze data and formulate maintenance instructions for the pipe line installations and protection equipment of trains</li> <li>◆ Capable to draft, test, analyze data and formulate maintenance instructions for the various pipe line and pneumatic equipment of the pneumatic systems of trains</li> <li>◆ Capable to draft, test, analyze data and formulate maintenance instructions for pressure and leak tests of the entire pneumatic system of trains</li> </ul>

	<p>6.3 Professionalism in formulating maintenance instructions for pneumatic system equipment of trains</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate maintenance instructions and standards for pneumatic system equipment of trains according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating maintenance instructions for pneumatic system equipment of trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to draft maintenance instructions for specified major pneumatic equipment of trains in compliance with the maintenance requirements for train equipment; and</li> <li>(ii) Capable to test the effectiveness of the draft maintenance instructions analyze data and make amendments effectively.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of pneumatic equipment engineering and is familiar with the pneumatic equipment of trains.</p>

1. Title	Formulate maintenance instructions for electrical systems of trains
2. Code	EMRAMA503A
3. Range	Formulate maintenance instructions for electrical systems of trains by referring to their design and the repairing guidelines provided by the manufacturer, and considering the overall operational performance of trains and their repair arrangements and history.
4. Level	5
5. Credits	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles and performance requirements for electrical systems of trains</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the working principles and performance requirements for the following electrical systems of trains <ul style="list-style-type: none"> <li>• Power system equipment</li> <li>• Electric traction control system equipment</li> <li>• Inverters of trains</li> <li>• Electric motor</li> <li>• Train loop protection circuit</li> </ul> </li> <li>◆ Master the experience in repairing electrical system equipment of trains</li> </ul> <p>6.2 Procedures of formulating maintenance instructions for electrical systems of trains</p> <ul style="list-style-type: none"> <li>◆ By analyzing data, referring to the design of electrical system equipment of trains and the repairing guidelines provided by the manufacturer, and considering the overall operational performance of trains and their repair arrangements and history, capable to draft maintenance instructions for the electrical system equipment of trains</li> <li>◆ Capable to analyze data from tests and amend the maintenance instructions for the electrical system equipment of trains</li> </ul> <p>6.3 Professionalism in formulating maintenance instructions for electrical systems of trains</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the safety guidelines as required by the law and codes of practice, and apply them in formulating maintenance instructions for electrical systems of trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to draft maintenance instructions for specified major electrical equipment of trains and their control and protection circuits in compliance with the maintenance requirements for train equipment; and</p> <p>(ii) Capable to test the effectiveness of the draft maintenance instructions analyze data and make amendments effectively.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of electrical systems of trains.

1. Title	Test and select materials for train equipment components	
2. Code	EMRAMA504A	
3. Range	Design and select appropriate testing methods according to the purpose and nature, monitor the conduct of tests under controlled environment, record and analyze data and select better materials for application.	
4. Level	5	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Methods of selecting and designing material testing</p> <ul style="list-style-type: none"> <li>◆ Select the methods for material testing according to the purpose and nature of testing, such as: <ul style="list-style-type: none"> <li>• Using laboratory experiments to test the material strength</li> <li>• Using the mode for operating under controlled environment to speed up the testing of material durability</li> <li>• Using the mode for operating on site to test the performance and actual wear rate</li> <li>• Using simulation modes to test the material performance under specified environment</li> </ul> </li> <li>◆ Apply relevant knowledge and skills, after selecting the testing mode, to design appropriate testing methods according to the purpose</li> </ul> <p>6.2 Procedures of testing and selecting component materials</p> <ul style="list-style-type: none"> <li>◆ Monitor and record the testing environment so as to ensure that the operation is under expected environment</li> <li>◆ Apply statistical knowledge and skills to select reliable data</li> <li>◆ Apply statistical and analytical theories, such as linear regression and numeric calculus to analyze testing data</li> <li>◆ Select better materials for application after analysis</li> </ul> <p>6.3 Testing and selecting materials for train equipment components</p> <ul style="list-style-type: none"> <li>◆ Test and select materials for train equipment components according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in testing and selecting materials for train equipment components</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: <ul style="list-style-type: none"><li>(i) Capable to select testing modes and design testing methods effectively according to specified purposes for material testing;</li><li>(ii) Capable to undertake tests and record data efficiently, analyze systematically and effectively the performance and durability of materials from a wide range of data and select better materials for application.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of mechanical material engineering.

1. Title	Formulate maintenance instructions for railway overhead feeder system equipment	
2. Code	EMRAMA505A	
3. Range	Formulate maintenance instructions for railway overhead feeder system equipment by referring to their design and the repairing standards for train overhead lines and power switching and protection devices, and considering their overall operational performance and repair history.	
4. Level	5	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design, structure and working principles of railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the design, structure and working principles of railway overhead feeder system equipment</li> <li>◆ Apply the repairing guidelines provided by the manufacturer</li> <li>◆ Master the techniques in calculating the standard for maintaining railway overhead feeder system equipment</li> <li>◆ Master the applications of instruments and tools commonly used for repairing and checking railway overhead feeder system equipment</li> </ul> <p>6.2 Method and procedures of formulating maintenance instructions for railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ By referring to the design of train power supply system and the repairing standards for train overhead lines and power switching and protection devices, capable to draft maintenance instructions for the contact wire, catenary wire, insulator, isolator and associated devices of overhead line system, including: <ul style="list-style-type: none"> <li>• Maintenance procedures</li> <li>• Maintenance standards</li> <li>• Adjustments, setting and preliminary function tests</li> <li>• Points to note during maintenance</li> </ul> </li> <li>◆ Capable to test the draft maintenance instructions</li> <li>◆ Capable to analyze data, amend and formulate maintenance instructions for overhead line system</li> <li>◆ Capable to draft, test and formulate maintenance instructions for the power switching devices, circuit breakers, interlock devices and protection devices of the power supply system</li> <li>◆ Capable to draft, test and formulate maintenance instructions for the electricity quality improvement devices such as wave filtering devices, power factor improvement devices, etc.</li> <li>◆ Capable to draft, test and formulate maintenance instructions for the control circuits and devices of the power supply system including PLC control units, control and display circuits and equipment, etc.</li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Capable to draft, test and formulate maintenance instructions for the protection circuits and devices of the power supply system including distance and region overcurrent and earthing fault protection devices</li> </ul>
6.3	<p>Professionalism in formulating maintenance instructions for railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate maintenance instructions and standards for railway overhead feeder system equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating maintenance instructions for railway overhead feeder system equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to draft maintenance instructions for railway overhead feeder system equipment in a particular region in compliance with the maintenance requirements for railway overhead feeder system equipment; and</p> <p>(ii) Capable to test the effectiveness of the draft maintenance instructions, analyze data and make amendments.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of overhead feeder system.</p>

1. Title	Formulate maintenance instructions for railway signal and control systems	
2. Code	EMRAMA506A	
3. Range	Formulate maintenance instructions and frequency for railway signal and control systems by referring to their design and considering their overall operational performance and repair history.	
4. Level	5	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Design, structure and working principles of railway signal and control systems</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the design, structure and working principles of railway signal and control systems</li> <li>◆ Apply the repairing instructions provided by the manufacturer</li> <li>◆ Master the techniques in calculating the standard and frequency for maintaining railway signal and control systems</li> <li>◆ Master the applications of instrument and tools commonly used for repairing and checking railway signal and control systems</li> </ul> <p>6.2 Method and procedures of formulating maintenance instructions and frequency for railway signal and control systems</p> <ul style="list-style-type: none"> <li>◆ By referring to the design of transportation management system and the overall design of signal and control systems, capable to draft maintenance instructions for the computer control program system and network system of transportation management system including: <ul style="list-style-type: none"> <li>• Maintenance procedures</li> <li>• Maintenance standards</li> <li>• Tests and standard setting</li> <li>• Back up of operation data record</li> <li>• Points to note during maintenance</li> </ul> </li> <li>◆ Capable to test the draft maintenance instructions</li> <li>◆ Capable to analyze data, amend and formulate maintenance instructions for transportation management system</li> <li>◆ Capable to draft, test and formulate maintenance instructions for railway signal interlock systems including processor unit, PLC unit, solid state interlock and relay interlock circuit and equipment, and signal transmission equipment</li> <li>◆ Capable to draft, test and formulate maintenance instructions for the trackside equipment of railway signal and control systems including PLC and control unit, train detection device, platform screen door control device, railway signal display and electronic interface</li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Capable to draft, test and formulate maintenance instructions for railway point machines including motors, mechanical devices, and control and protection circuits</li> <li>◆ Capable to draft, test and formulate maintenance instructions for SCADA systems</li> <li>◆ Capable to draft, test and formulate maintenance instructions for ATC system equipment on the train including electronic control equipment, interface equipment, antenna and electronic equipment</li> <li>◆ Capable to identify the critical factors for system maintenance cycles and calculate the suitable frequency for performing maintenance for different systems</li> </ul> <p>6.3 Professionalism in formulating maintenance instructions for railway signal and control systems</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate maintenance instructions and standards for railway signal and control systems according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating maintenance instructions for railway signal and control systems</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to draft maintenance instructions for railway signal and control systems in the entire signal area in compliance with the maintenance requirements for railway signal and control systems; and</p> <p>(ii) Capable to test the effectiveness of the draft maintenance instructions, analyze data and make amendments.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of railway signal and control system engineering.</p>

1. Title	Plan, organize and coordinate maintenance work for trains	
2. Code	EMRAMA507A	
3. Range	Plan, organize and coordinate maintenance work for trains by applying knowledge and techniques of planning, organizing and coordination as well as familiarity with different maintenance levels and maintenance cycles for trains and their content in order to guarantee the smooth execution of maintenance work for trains.	
4. Level	5	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of planning, organizing and coordinating maintenance work for train</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the information about maintenance cycles for trains, and master knowledge and techniques of formulating a scheduling mechanism for different maintenance levels for trains</li> <li>◆ Understand the operation mode and culture of different units engaged in the maintenance works and operation of trains</li> <li>◆ Master human relations, and knowledge and techniques in communicating and coordinating with railway engineering and operational departments</li> <li>◆ Be familiar with the content of different levels of train maintenance and the workflow of maintenance for different major equipment, master the technique of calculating time taken in maintaining each train</li> <li>◆ Master knowledge and techniques of formulating a mechanism for keeping repair and maintenance records</li> </ul> <p>6.2 Method and procedures of planning, organizing and coordinating maintenance work for trains</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate a mechanism for scheduling different maintenance levels for trains according to their maintenance cycles</li> <li>◆ Capable to coordinate different engineering departments engaged in train maintenance and determine the actual time, manpower, equipment and materials required for maintaining each train by referring to the content of different levels of train maintenance and the actual operation record and condition of the train</li> <li>◆ Capable to coordinate different departments engaged in train maintenance works and railway operation to arrange the scheduled level of maintenance work for trains according to the schedule of the maintenance plan</li> <li>◆ Capable to formulate a mechanism for keeping repair and maintenance records to facilitate the efficient storage and retrieval of information</li> </ul>	

	<p>6.3 Professionalism in planning, organizing and coordinating maintenance work for trains</p> <ul style="list-style-type: none"> <li>◆ Capable to plan, organize and coordinate maintenance work for trains according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in planning, organizing and coordinating maintenance work for trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to formulate maintenance plans for trains and arrange trains to undergo the planned maintenance work effectively; and</li> <li>(ii) Capable to formulate a mechanism for keeping train repair and maintenance records effectively, a mechanism that can facilitate the efficient storage and retrieval of information.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of railway engineering and management skills.</p>

1. Title	Plan, organize and coordinate maintenance work for railway overhead feeder system equipment	
2. Code	EMRAMA508A	
3. Range	Plan, organize and coordinate maintenance work for railway overhead feeder system equipment by applying knowledge and techniques of planning, organizing and coordination as well as familiarity with different maintenance levels and maintenance cycles for railway overhead feeder system equipment and their content in order to guarantee the smooth execution of maintenance work.	
4. Level	5	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of planning, organizing and coordinating maintenance work for railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the information about maintenance cycles for railway overhead feeder system equipment, and master knowledge and techniques of formulating a scheduling mechanism for different maintenance levels for railway overhead feeder system equipment</li> <li>◆ Understand the operation mode and culture of different units engaged in the maintenance works and operation of railway overhead feeder system</li> <li>◆ Master human relations, and knowledge and techniques in communicating and coordinating with railway engineering and operational departments</li> <li>◆ Be familiar with the content and workflow of maintenance for major equipment of the railway overhead feeder system, and master the technique of calculating time for maintenance</li> <li>◆ Master knowledge and techniques of formulating a mechanism for keeping repair and maintenance records</li> </ul> <p>6.2 Method and procedures of planning, organizing and coordinating maintenance work for railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate a mechanism for scheduling different maintenance levels for major equipment of the railway overhead feeder system according to their maintenance cycles</li> <li>◆ Capable to coordinate different engineering departments engaged in railway overhead feeder system equipment maintenance and determine the actual time, manpower, equipment and materials required for maintenance by referring to the content of different levels of railway overhead feeder system equipment maintenance and the actual operation record and condition of the railway overhead feeder system equipment</li> <li>◆ Capable to coordinate different departments engaged in railway overhead feeder system equipment maintenance works and railway operation to arrange the scheduled level of maintenance work for major equipment of the railway overhead feeder system according to the schedule of the maintenance plan</li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Capable to formulate a mechanism for keeping repair and maintenance records to facilitate the efficient storage and retrieval of information</li> </ul> <p>6.3 Professionalism in planning, organizing and coordinating maintenance work for railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ Capable to plan, organize and coordinate maintenance work for railway overhead feeder system equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in planning, organizing and coordinating maintenance work for railway overhead feeder system equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to formulate maintenance plans for major equipment of the railway overhead feeder system and arrange the equipment to undergo the planned maintenance work effectively; and</li> <li>(ii) Capable to formulate a mechanism for keeping railway overhead feeder system equipment repair and maintenance records effectively, a mechanism that can facilitate the efficient storage and retrieval of information.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of railway overhead feeder system engineering and management skills.</p>

1. Title	Plan, organize and coordinate maintenance work for railway signal and control system equipment	
2. Code	EMRAMA509A	
3. Range	Plan, organize and coordinate maintenance work for major equipment of the railway signal and control system by applying knowledge and techniques of planning, organizing and coordination as well as familiarity with different maintenance levels and maintenance cycles for major equipment of the railway signal and control system and their content in order to guarantee the smooth execution of maintenance work.	
4. Level	5	
5. Credits	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of planning, organizing and coordinating maintenance work for railway signal and control system equipment</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the information about maintenance cycles for major equipment of the railway signal and control system, and master knowledge and techniques of formulating a scheduling mechanism for different maintenance levels for major equipment of the system</li> <li>◆ Understand the operation mode and culture of different units engaged in the maintenance works and operation of railway signal and control system</li> <li>◆ Master human relations, and knowledge and techniques in communicating and coordinating with railway engineering and operational departments</li> <li>◆ Be familiar with the content and workflow of maintenance for major equipment of the railway signal and control system, and master the technique of calculating time for maintenance</li> <li>◆ Master knowledge and techniques of formulating a mechanism for keeping repair and maintenance records</li> </ul> <p>6.2 Method and procedures of planning, organizing and coordinating maintenance work for railway signal and control system equipment</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate a mechanism for scheduling different maintenance levels for major equipment of the railway signal and control system according to their maintenance cycles</li> <li>◆ Capable to coordinate different engineering departments engaged in railway signal and control system equipment maintenance and determine the actual time, manpower, equipment and materials required for maintenance by referring to the content of different levels of railway signal and control system equipment maintenance and the actual operation record and condition of the equipment</li> <li>◆ Capable to coordinate different departments engaged in railway signal and control system equipment maintenance works and railway operation to arrange the scheduled level of maintenance work for major equipment of the system according to the schedule of the maintenance plan</li> </ul>	

	<p>6.3 Professionalism in planning, organizing and coordinating maintenance work for railway signal and control system equipment</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate a mechanism for keeping repair and maintenance records to facilitate the efficient storage and retrieval of information</li> <li>◆ Capable to plan, organize and coordinate maintenance work for railway signal and control system equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in planning, organizing and coordinating maintenance work for railway signal and control system equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to formulate maintenance plans for major equipment of the railway signal and control system and arrange the equipment to undergo the planned maintenance work effectively; and</li> <li>(ii) Capable to formulate a mechanism for keeping railway signal and control system equipment repair and maintenance records effectively, a mechanism that can facilitate the efficient storage and retrieval of information.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of railway signal and control system engineering and management skills.</p>

1. Title	Formulate project procedures and schedule
2. Code	EMCUPM501A
3. Range	Formulate project procedures and schedule for electrical and mechanical services according to the specifications, scope and targets of the project.
4. Level	5
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Principles and techniques of electrical and mechanical project management</p> <ul style="list-style-type: none"> <li>◆ Understand the principles and techniques of electrical and mechanical engineering project management, including the formulation of project procedures, schedule, contingency plan and review mechanism</li> </ul> <p>6.2 Formulate procedures, schedule, contingency plans and review mechanism for electrical and mechanical projects</p> <ul style="list-style-type: none"> <li>◆ Draft project procedures <ul style="list-style-type: none"> <li>• Confirm the project specifications, scope and targets according to the contract and related information</li> <li>• Analyze the work breakdown structure and organisational breakdown structure</li> <li>• Pay attention to safety, health and environmental protection ordinances and codes, the protection of intellectual property and quality management system of the organization when drafting project procedures</li> </ul> </li> <li>◆ Formulate project schedule <ul style="list-style-type: none"> <li>• Apply project management techniques to formulate project schedule according to the contract and related information as well as project procedures drafted and the following arrangements: <ul style="list-style-type: none"> <li>▸ Critical path and flow chart</li> <li>▸ Arrangements of equipment, materials and parts</li> <li>▸ Arrangements of human resources</li> </ul> </li> </ul> </li> <li>◆ Formulate contingency mechanism and review mechanisms <ul style="list-style-type: none"> <li>• Conduct risk assessment for the projects and formulate contingency mechanism</li> </ul> </li> <li>● Formulate review mechanism for the project to ensure that targets of the project be achieved</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to formulate project procedures and schedules for electrical and mechanical projects according to the project specifications and targets; and</p> <p>(ii) Capable to formulate effective review check points and review mechanism for the projects.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of operation management.

1. Title	Implement risk management for railway electrical and mechanical engineering projects
2. Code	EMRAPM501A
3. Range	In managing railway electrical and mechanical engineering projects, apply risk assessment and management knowledge and techniques to assess the risks and formulate control and management plans for engineering projects.
4. Level	5
5. Credits	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Principles and techniques of risk management for railway electrical and mechanical engineering projects</p> <ul style="list-style-type: none"> <li>◆ Be familiar with railway electrical and mechanical engineering projects and operational environment</li> <li>◆ Master the knowledge and techniques of project risk assessment</li> <li>◆ Know how to quantify and prioritize risks and hazards</li> <li>◆ Master knowledge and techniques of monitoring and controlling risks</li> <li>◆ Master knowledge and techniques of drafting contingency plans</li> <li>◆ Know how to implement the contingency plans for projects</li> </ul> <p>6.2 Methods and procedures of risk management for railway electrical and mechanical engineering projects</p> <ul style="list-style-type: none"> <li>◆ Capable to perform risk management for a railway electrical and mechanical engineering project and compile a risk management report including the following: <ul style="list-style-type: none"> <li>• Crisis and crisis identification</li> <li>• Assessment of the impact of hazards</li> <li>• Risk estimation and assessment</li> <li>• Methods of reducing and eliminating risks</li> <li>• Conclusions and recommendations</li> <li>• Identification of signs and triggers of hazards</li> <li>• Use project flow chart to calculate the cause and effect relationship of hazards</li> </ul> </li> <li>◆ Capable to monitor and control the risks of a railway electrical and mechanical engineering project, including: <ul style="list-style-type: none"> <li>• Monitoring the hazard alarm</li> <li>• Making choices of solutions</li> <li>• Quantifying the impact of hazards</li> </ul> </li> <li>◆ Capable to draft contingency plans for engineering projects in Railway E&amp;M branch; Analyse and review the outcomes; assess the need of change of the engineering projects</li> </ul>

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: <ul style="list-style-type: none"><li>(i) Capable to perform risk assessment and compile a report for the railway electrical and mechanical engineering project effectively;</li><li>(ii) Capable to draft a plan for monitoring and controlling project risks; and</li><li>(iii) Capable to draft a contingency plan for the project.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic risk assessment competency and knowledge of railway electrical and mechanical works.

1. Title	Implement purchasing management for railway electrical and mechanical engineering projects	
2. Code	EMRAPM502A	
3. Range	Apply the expertise of purchasing and familiarity with the operation mode of railway electrical and mechanical engineering projects to manage the purchase and supply of products and services required by works related to railway electrical and mechanical project engineering.	
4. Level	5	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Principles and techniques of purchasing management for railway electrical and mechanical engineering projects</p> <ul style="list-style-type: none"> <li>◆ Master the techniques of collecting information about related products and services in the market</li> <li>◆ Master the knowledge and techniques of sourcing suitable potential suppliers in the market</li> <li>◆ Be familiar with the procedures and regulations for procurement of products and services</li> <li>◆ Be familiar with different evaluation systems and handling methods, and master their application techniques</li> <li>◆ Be familiar with the knowledge and techniques of compiling purchase contractual documents for products and services required by railway electrical and mechanical engineering projects</li> <li>◆ Master the knowledge and techniques of following up the implementation and management of purchase contracts</li> </ul> <p>6.2 Methods and procedures of purchasing management for railway electrical and mechanical engineering projects</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate a document to gather proposals from potential suppliers systematically, a document that efficiently collects accurate and complete information from potential suppliers</li> <li>◆ Effectively motivate potential suppliers to submit supply proposals and tenders</li> <li>◆ Communicate with potential suppliers effectively, ensure that all potential suppliers have a clear and correct understanding of the technical requirements for the products and services</li> <li>◆ Capable to amend purchasing documents according to correct procedures and regulations when it is deemed necessary</li> <li>◆ Capable to form an effective and suitable tender board, and set evaluation standards and details</li> <li>◆ Apply suitable evaluation systems and methods effectively, determine the priority of the supply proposals and tenders submitted by different suppliers according to the evaluative standards and details, in order to reach the best choice</li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Capable to formulate supply agreement documents and contracts with the selected supplier, including the classification of responsibilities and authorities, legal binding clauses, technical and transactional management methods, financial arrangement, time limit and price, etc.</li> <li>◆ Follow up the implementation and management of the agreement and contract effectively</li> <li>◆ Capable to formulate correct and efficient procedures for handling purchasing documents, including the control over confidential information</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to gather supply proposals from potential suppliers for products and services required by railway electrical and mechanical engineering projects systematically;</li> <li>(ii) Capable to formulate effective tender evaluation mechanisms, standards and details; and</li> <li>(iii) Capable to handle the arrangement and management for supply agreements and contracts effectively.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses general purchasing knowledge and techniques.</p>

1. Title	Implement coordination and integration management for railway electrical and mechanical engineering projects	
2. Code	EMRAPM503A	
3. Range	In managing railway electrical and mechanical engineering projects, apply coordination and integration engineering knowledge and techniques to manage the execution and development of the projects in order to achieve the objectives of the projects and keep in line with the organizational development.	
4. Level	5	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Principles and techniques of coordination and integration management for railway electrical and mechanical engineering projects</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the knowledge and techniques of estimating, assessing and ascertaining the features of railway electrical and mechanical engineering projects</li> <li>◆ Clearly understand the objectives of the engineering projects, their connection with other works of the organization, and the importance and usage of their interfaces</li> <li>◆ Be familiar with the methods for developing project engineering plans</li> <li>◆ Master general management skills for engineering plans including communication skills, human relations, review skills, coordination skills, information management, problem solving skills and document handling skills, etc.</li> <li>◆ Be familiar with the management skills for contingency procedures</li> </ul> <p>6.2 Methods and procedures of coordination and integration management for railway electrical and mechanical engineering projects</p> <ul style="list-style-type: none"> <li>◆ Capable to ascertain the limits, assumptions and boundaries of railway electrical and mechanical engineering projects,</li> <li>◆ Study the feasibility of the engineering project effectively</li> <li>◆ Capable to ascertain the objectives and relevant information of the engineering project including its objectives, its relationship with the organizational goal and other works, quality standards, liabilities, classification of stages and its life cycle, etc.</li> <li>◆ Formulate development plans for the engineering project effectively</li> <li>◆ Capable to formulate management plans for the engineering project including: <ul style="list-style-type: none"> <li>• Selection of the best development plan</li> <li>• Confirmation of stakeholders</li> <li>• Interfaces with other engineering plans of the organization</li> <li>• Information management</li> <li>• Monitoring management</li> </ul> </li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Capable to ascertain the arrangement of management, monitoring and contingency organization for the engineering project</li> <li>◆ Select check points and ascertain organizational and technical interfaces</li> <li>◆ Coordinate and integrate the execution of the engineering project effectively</li> <li>◆ Monitor and react effectively including the study of the need for making changes to the works according to procedures</li> <li>◆ Implement review and continuous improvement plans for the engineering project effectively</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to formulate development plans for railway electrical and mechanical engineering projects effectively;</li> <li>(ii) Capable to formulate management plans for engineering projects effectively; and</li> <li>(iii) Capable to coordinate, monitor and integrate the execution and development of engineering projects effectively.</li> </ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic engineering management competency.

1. Title	Implement engineering operation and supervisory management
2. Code	EMCUOM502A
3. Range	Coordinate engineering operation, supervisory management and human resources management for electrical and mechanical services.
4. Level	5
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Understand engineering operation and supervisory areas and techniques</p> <ul style="list-style-type: none"> <li>◆ Understand engineering operation management including: <ul style="list-style-type: none"> <li>• Supervisory management techniques for projects</li> <li>• Management techniques for work site environment</li> <li>• Workflow of electrical works project</li> </ul> </li> </ul> <p>6.2 Implement engineering operation and supervisory management</p> <ul style="list-style-type: none"> <li>◆ Implement engineering operation management to ensure that all engineering procedures be carried out properly. The engineering operation management targets include zero breach of contract, zero accident rate, zero delay, timely delivery of material, balance of income and expenditure, etc.</li> <li>◆ Implement engineering supervisory management such as analyzing and arranging works so that the project can complete in time</li> <li>◆ Understand the tendering strategy and assist the company in project quotation and bidding tenders</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to implement engineering operation, supervisory and management in different technical areas of work in order to achieve the targets.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of electrical and mechanical operation.

1. Title	Manage electrical and mechanical engineering courses
2. Code	EMRAOM501A
3. Range	Draw up electrical and mechanical engineering course plans; arrange and support the implementation of courses; and monitor, review and improve the implementation of the electrical and mechanical engineering courses.
4. Level	5
5. Credits	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Skills in managing electrical and mechanical engineering courses</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the performance requirements and assessment methods of electrical and mechanical engineering courses</li> <li>◆ Be familiar with the implementation flow, quality requirements and controlling points of electrical and mechanical engineering courses</li> <li>◆ Know how to calculate the needs and budget of human resources and training facilities for electrical and mechanical engineering courses</li> <li>◆ Master the skills to support, coordinate and supervise the electrical and mechanical engineering courses</li> </ul> <p>6.2 Methods and procedures of managing electrical and mechanical engineering courses</p> <ul style="list-style-type: none"> <li>◆ Know how to draw up electrical and mechanical engineering course plans with the following procedures <ul style="list-style-type: none"> <li>• Identify the training need in electrical and mechanical engineering</li> <li>• Formulate training goals and learning outcome for each course</li> <li>• Consider the human resources and training facilities of the organization so as to draw up electrical and mechanical engineering course plans</li> </ul> </li> <li>◆ Capable to arrange the implementation of electrical and mechanical engineering courses with the following procedures <ul style="list-style-type: none"> <li>• Consider the arrangements of human resources, training facilities and learners so as to work out an overall timetable for electrical and mechanical engineering courses</li> <li>• Implement course arrangements including those of the lecturers and facilities</li> </ul> </li> <li>◆ Capable to monitor the implementation of electrical and mechanical engineering courses with the following procedures <ul style="list-style-type: none"> <li>• Monitor the implementation of the electrical and mechanical engineering courses to ensure the quality and efficiency of the courses</li> <li>• Collect learners' feedback on the course and make a report</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>◆ Capable to review and improve electrical and mechanical engineering courses with the following procedures             <ul style="list-style-type: none"> <li>• Review the opinions of lecturers and learners on courses, class observation report and other information related to the course performance so as to improve the management of the electrical and mechanical engineering courses continuously</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to identify effectively the training needs of staff of electrical and mechanical engineering organizations, and draw up effective electrical and mechanical engineering course plans; and</li> <li>(ii) Capable to manage effectively the organization of electrical and mechanical engineering courses, and review and improve effectively the performance of electrical and mechanical engineering courses.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses the expertise in operation management.</p>

1. Title	Implement risk management for electrical and mechanical services	
2. Code	EMCUSH502A	
3. Range	Apply risk assessment and management techniques to formulate and implement risk management plans.	
4. Level	5	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Know about different kinds of electrical and mechanical engineering risks and their management methods</p> <ul style="list-style-type: none"> <li>◆ Understand different kinds of electrical and mechanical engineering risks such as: <ul style="list-style-type: none"> <li>• Different kinds of potential hazards and risks caused by them</li> <li>• Risk analysis modes such as HAZOP(Hazard and Operability Studies), QRA(Quality Risk Assessment), FMEA(Failure Modes and Effects Analysis) and FTA(Fault Tree Analysis), etc.</li> <li>• Other risk related factors such as occupational safety and health, management systems, Factories and Industrial Undertakings Ordinance, etc.</li> <li>• Risk control and risk management plans</li> </ul> </li> </ul> <p>6.2 Implement risk management for electrical and mechanical services</p> <ul style="list-style-type: none"> <li>◆ Identify potential hazards and their kinds (e.g. chemical hazards, electrical hazards, etc.), the chance of happening and the consequences</li> <li>◆ Conduct risk assessment and analysis <ul style="list-style-type: none"> <li>• Conduct risk assessment for the working procedure, work type, machinery and organization according to the chance of happening and the consequences of the hazard</li> <li>• Analyze the price for the accident and the advantages of safe operation</li> <li>• Consider comprehensively the aspects of occupational safety and health as well as environmental protection when conducting risk assessment</li> </ul> </li> <li>◆ Control and management risks <ul style="list-style-type: none"> <li>• Formulate risk control levels based on risk assessment data</li> <li>• Formulate the risk control and management plan according to risk control levels and by taking into consideration of the OHSAS18000 Occupational Health and Safety Assessment Series and Factories and Industrial Undertakings Ordinance and regulations</li> </ul> </li> <li>◆ Implement risk management for electrical and mechanical services according to the risk control and management plan</li> </ul>	

7. Assessment Criteria	The integrated outcome requirements of this unit of competency are:  (i) Capable to identify hazards and assess risks according to the activities and nature of the electrical and mechanical services; and  (ii) Capable to devise a risk control and management plan according to the hazards identified, risk assessment and other considerations.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of occupational safety management.

1. Title	Formulate occupational safety and health management system
2. Code	EMCUSH504A
3. Range	Master the knowledge of occupational safety and health so as to formulate a basic occupational safety and health management system.
4. Level	5
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Basic knowledge of occupational safety and health</p> <ul style="list-style-type: none"> <li>◆ Understand the operation of the occupational safety and health management system, including: <ul style="list-style-type: none"> <li>• Goals of the management system</li> <li>• Monitoring mechanism</li> <li>• Training methods</li> <li>• Contingency measures</li> <li>• Review measures</li> </ul> </li> </ul> <p>6.2 Formulation of basic occupational safety and health management system</p> <ul style="list-style-type: none"> <li>◆ Formulate occupational safety and health management system according to the requirements of the occupational safety and health ordinances as well as the operation of the company. The tasks include: <ul style="list-style-type: none"> <li>• Setting goals for the management system</li> <li>• Organizing management committee and setting its terms of reference</li> <li>• Establishing management system mechanism</li> <li>• Designing monitoring mechanism</li> <li>• Formulating training plans</li> <li>• Establishing work site contingency measures</li> <li>• Formulating review measures</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to formulate an effective and basic occupational safety and health management system according to the requirements of the occupational safety and health ordinances as well as the operation of the company.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of occupational safety management.

1. Title	Formulate occupational safety and health and environmental protection schemes	
2. Code	EMCUSH505A	
3. Range	Analyze areas that have to be enhanced regarding staff's awareness of occupational safety and health and environmental protection, and to formulate schemes to enhance staff's awareness of occupational safety and health and environmental protection.	
4. Level	5	
5. Credit	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Occupational safety and health and environmental protection scheme</p> <ul style="list-style-type: none"> <li>◆ Understand the importance of occupational safety and health and environmental protection to staff; and draft a scheme relevant to occupational safety and health and environmental protection including the following: <ul style="list-style-type: none"> <li>• Scheme targets</li> <li>• schedule</li> <li>• Effectiveness review</li> <li>• Manpower arrangement</li> <li>• Budget, etc.</li> </ul> </li> </ul> <p>6.2 Formulation of occupational safety and health and environmental protection scheme</p> <ul style="list-style-type: none"> <li>◆ Identify the difference between the company's targets and staff awareness of occupational safety and health and environmental protection <ul style="list-style-type: none"> <li>• Collect opinions of staff on occupational safety and health and environmental protection management</li> <li>• Set the company's targets on occupational safety and health and environmental protection management</li> <li>• Identify the difference between the company's targets and staff awareness of occupational safety and health and environmental protection management</li> </ul> </li> <li>◆ Formulate plans to enhance staff's awareness of occupational safety and health and environmental protection management <ul style="list-style-type: none"> <li>• Analyze company's occupational safety and health and environmental protection management culture, and draft proposals for the enhancement scheme such as training courses, seminars and quiz competitions, etc.</li> <li>• Collect staff's opinions on safety, health and environmental improvement</li> <li>• Collect staff's opinions on the enhancement scheme</li> </ul> </li> </ul>	

	<ul style="list-style-type: none"> <li>• Use other organizations' successful experience in organizing activities to enhance staff's awareness of occupational safety and health and environmental protection</li> <li>• Formulate a scheme to enhance staff's awareness of occupational safety, health environmental protection, including the formulation of scheme targets, implementation methods and schedule, expected performance, budget, measuring methods, etc.</li> <li>• Manpower arrangement for the implementation of the scheme</li> <li>◆ Review the effectiveness of the scheme <ul style="list-style-type: none"> <li>• Ensure good communication during the implementation of the scheme</li> <li>• Measure and review the effectiveness of the scheme after implementation</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to formulate and implement schemes to enhance staff's awareness of occupational safety and health and environmental protection; and to review their effectiveness.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of occupational safety management.</p>

1. Title	Perform risk assessment for electrical and mechanical work
2. Code	EMCUSH506A
3. Range	Apply the knowledge and skills of risk assessment with the understanding of the electrical and mechanical work to perform risk assessment. The competency of this unit is applicable to safety management of the electrical and mechanical services.
4. Level	5
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Engineering work and environment</p> <ul style="list-style-type: none"> <li>◆ Understand the engineering work and environment according to engineering working guidelines and on-site observation</li> <li>◆ Understand the potential risks and hazards according to the accident reports</li> </ul> <p>6.2 Perform risk assessment</p> <ul style="list-style-type: none"> <li>◆ Apply risk assessment skills to perform risk assessment for electrical and mechanical procedures, such as HAZOP (Hazard and Operability), FTA (Fault Tree Analysis), fault-finding analysis, status analysis, and the use of tools under different circumstances and handling of dangerous goods and scope of application</li> <li>◆ Compile risk assessment reports for engineering procedures, including <ul style="list-style-type: none"> <li>• Hazards and their identification</li> <li>• Risk assessment methods</li> <li>• Calculation and assessment of risks</li> <li>• Methods to reduce or eliminate risks</li> <li>• Conclusions and recommendations</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to perform effectively risk assessment and to write proposals for electrical and mechanical work and environment, and come up with conclusions and recommendations.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses the competency of using basic risk assessment methods.

1. Title	Formulate environmental protection management system
2. Code	EMCUSH507A
3. Range	Master the legal requirements on environmental protection so as to formulate a basic environmental protection management system.
4. Level	5
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Basic knowledge of environmental protection</p> <ul style="list-style-type: none"> <li>◆ Understand the legal requirements on environmental protection, including the areas of emissions, waste water, noise, solid waste, chemical waste, etc.</li> <li>◆ Understand the operation of a basic environmental protection management system, including: <ul style="list-style-type: none"> <li>• Goals of the management system</li> <li>• Monitoring mechanism</li> <li>• Contingency measures</li> <li>• Review measures</li> <li>• ISO 14001, etc.</li> </ul> </li> </ul> <p>6.2 Formulation of basic environmental protection management system</p> <ul style="list-style-type: none"> <li>◆ Formulate a basic environmental protection management system according to the legal requirements on environmental protection, including the following: <ul style="list-style-type: none"> <li>• Goals of the management system</li> <li>• Management system mechanism</li> <li>• Monitoring mechanism</li> <li>• Contingency measures</li> <li>• Review measures</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to formulate an effective basic environmental protection management system for the electrical and mechanical services according to the legal requirements on environmental protection, and review its effectiveness.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of environmental protection.

1. Title	Implement occupational safety and health and environmental protection courses and training programmes
2. Code	EMCUSH508A
3. Range	Implement occupational safety and health and environmental protection courses and training programmes, and enhance safety awareness of staff.
4. Level	5
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Contents of general occupational safety and health and environmental protection courses and training</p> <ul style="list-style-type: none"> <li>◆ Understand the objectives and contents of general occupational safety and health and environmental protection courses and training</li> <li>◆ Understand the characteristics and needs of training targets</li> </ul> <p>6.2 Implementation of general occupational safety and health and environmental protection courses and training</p> <ul style="list-style-type: none"> <li>◆ Investigate the needs of training targets within the organization <ul style="list-style-type: none"> <li>• Use different methods to help investigate the needs of training targets within the organization for occupational safety and health and environmental protection training, such as questionnaire, staff appraisal report, company policy, etc</li> </ul> </li> <li>◆ Implement occupational safety and health and environmental protection courses and training projects <ul style="list-style-type: none"> <li>• Make relevant arrangements for enrolment and admission procedures, venue and duration for the course, teaching materials and aids, etc</li> </ul> </li> <li>◆ Enhance staff's safety awareness <ul style="list-style-type: none"> <li>• Encourage the staff to participate actively in occupational safety and health and environmental protection courses and training programmes through continuous staff training, merit assessment, performance incentives, extracurricular activities</li> </ul> </li> </ul>

7. Assessment Criteria	The integrated outcome requirements of this unit of competency are:  (i) Capable to use different methods to investigate and analyze effectively the needs of training targets on occupational safety and health and environmental protection within the organization;  (ii) Capable to organize training courses and programmes, and implement relevant activities effectively according to the internal needs of the organization; and  (iii) Capable to formulate and implement encouragement measures to enhance staff's safety awareness.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses the knowledge of occupational safety management.

1. Title	Conduct safety, health and environmental protection audit for the electrical and mechanical engineering department	
2. Code	EMRASH501A	
3. Range	Master techniques for safety, health and environmental protection audit, and conduct safety, health and environmental protection audit for the electrical and mechanical engineering department.	
4. Level	5	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Techniques for conducting safety, health and environmental protection audit for the electrical and mechanical engineering department</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the work flow of the electrical and mechanical engineering departments and their requirements on safety, health and environmental protection management</li> <li>◆ Master the techniques for safety, health and environmental protection audit</li> <li>◆ Be familiar with important points and items related to safety, health and environmental protection of electrical and mechanical projects</li> <li>◆ Be familiar with the safety, health and environmental protection management system of the organization</li> </ul> <p>6.2 Methods and procedures of conducting safety, health and environmental protection audit for the electrical and mechanical engineering department</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate a safety, health and environmental protection audit scheme for the electrical and mechanical engineering department with the following procedures <ul style="list-style-type: none"> <li>• Formulate a departmental safety, health and environmental protection audit scheme according to the level of risk of work procedure, ordinances relevant to safety, health and environmental protection, in-house practice, accident/incident investigation reports, standard and record analysis, etc.</li> <li>• Formulate audit procedures</li> <li>• Formulate timetable of staff interview</li> </ul> </li> <li>◆ Capable to conduct safety, health and environmental protection audit with the following procedures <ul style="list-style-type: none"> <li>• Perform safety, health and environmental protection inspection for the department and identify non-conforming items</li> <li>• According to relevant records and documents, work procedure investigation and staff interviews, judge whether the departmental system operation complies with the requirements of the safety, health and environmental protection management system</li> </ul> </li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Master the techniques of handling non-conforming items with the following procedures <ul style="list-style-type: none"> <li>• Point out the deviation between the non-conforming items and standards, area of non-conformance and result likely to occur</li> <li>• Suggest improvements</li> </ul> </li> <li>◆ Capable to compile a audit report according to the observations based on audit procedures</li> <li>◆ Capable to follow up the improvements to the non-conforming items</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to formulate a safety, health and environmental protection audit scheme for the electrical and mechanical engineering department in compliance with relevant standards;</li> <li>(ii) Capable to conduct safety, health and environmental protection audit effectively for the electrical and mechanical engineering department; and</li> <li>(iii) Capable to handle non-conforming items effectively.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses safety, health and environmental protection management knowledge.</p>

1. Title	Formulate and implement quality management courses and training programmes
2. Code	EMCUQM503A
3. Range	Formulate and implement quality management courses and training programmes by targeting the weaknesses in electrical and mechanical engineering quality management so as to enhance the staff's awareness of quality management.
4. Level	5
5. Credit	4
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Electrical and mechanical engineering quality management concept and culture</p> <ul style="list-style-type: none"> <li>◆ Understand the electrical and mechanical engineering quality management concept and culture, including the 'Plan-Do-Check-Act' Quality Management Cycle</li> </ul> <p>6.2 Formulate and implement quality management courses and training programmes</p> <ul style="list-style-type: none"> <li>◆ Formulate and implement quality management courses and training programmes by targeting the weaknesses in electrical and mechanical engineering quality management such as the basic quality management in various procedures, including installation, checking, debugging, commissioning and repair, etc.</li> <li>◆ Formulate the basic course on 'Plan-Do-Check-Act' Quality Management Cycle</li> <li>◆ Formulate basic level quality management courses or training programmes</li> <li>◆ Implement quality management courses or training programmes to enhance the staff's awareness of quality management, including: <ul style="list-style-type: none"> <li>• Basic requirements and application of ISO 9000 quality management and quality assurance standards</li> <li>• Promoting quality management culture</li> <li>• Urging the staff to constantly review and improve the engineering process performance</li> </ul> </li> <li>◆ Review and improve the quality management courses regularly to enhance the effectiveness of staff training</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to formulate and implement quality management courses and training programmes effectively by targeting the weaknesses in electrical and mechanical engineering quality management, and review and improve the quality management courses effectively.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic concepts of quality management.

1. Title	Formulate and analyze quality assurance reports
2. Code	EMCUQM504A
3. Range	With regard to quality management of electrical and mechanical services, analyze information generated from quality monitoring points of each engineering procedure, quality issues and problems, and formulate quality assurance reports.
4. Level	5
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Format and key points of quality assurance report on electrical and mechanical services</p> <ul style="list-style-type: none"> <li>◆ Understand the format and key points of quality assurance report on electrical and mechanical services</li> </ul> <p>6.2 Formulate and analyze quality assurance reports</p> <ul style="list-style-type: none"> <li>◆ Base on records of the major monitoring points of each service procedure and all quality related issues, such as quality level for each action, non-compliance with regulations, errors, defects, deviation, excesses or shortfalls and other causes, etc., to quantify quality management issues and problems so as to provide sufficient data or information to produce the quality assurance reports <ul style="list-style-type: none"> <li>• Analyze all quality management issues and problems, formulate quality assurance reports and report to the management</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to effectively monitor each service procedure, quantify quality management issues and problems, analyze data and information, and formulate quality assurance reports.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic concepts of quality management.

1. Title	Formulate schemes to enhance staff's awareness of quality management
2. Code	EMCUQM505A
3. Range	Analyze what areas in quality management of electrical and mechanical services that the staff should improve, and formulate schemes to enhance staff's awareness of quality management.
4. Level	5
5. Credit	5
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Culture and targets of organization in quality management</p> <ul style="list-style-type: none"> <li>◆ Understand the culture and targets of the organization in quality management</li> </ul> <p>6.2 Plan to enhance staff's awareness of quality management and review the effectiveness of scheme</p> <ul style="list-style-type: none"> <li>◆ Collect staff's understanding and opinions on quality management</li> <li>◆ Identify the deviation between targets of the organization and staff's performance on quality management</li> <li>◆ Analyze the quality management culture of the organization, and draft forms of enhancement measures, such as training courses, quiz competitions and seminars, etc.</li> <li>◆ Collect staff's opinions on the enhancement scheme</li> <li>◆ Implement Quality Circle activities</li> <li>◆ Formulate suitable schemes to enhance staff's awareness of quality management, including the formulation of schemes' targets, implementation methods and schedule, expected performance, budget and means for measuring the effectiveness, etc.</li> <li>◆ Measure and review the effectiveness of the scheme after implementation</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to analyze the quality management culture of the organization, draft a proposal to enhance staff's awareness of quality management, and review the effectiveness of the enhancement scheme after implementation.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses a fair basis of quality management.

1. Title	Implement quality management training courses
2. Code	EMCUQM506A
3. Range	Master knowledge and skills in quality management of electrical and mechanical services to implement quality management courses.
4. Level	5
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Quality management system</p> <ul style="list-style-type: none"> <li>◆ Understand quality management system, such as: <ul style="list-style-type: none"> <li>• ISO 9000</li> <li>• Total quality management</li> <li>• Quality circle</li> <li>• Business Process Re-engineering</li> </ul> </li> </ul> <p>6.2 Implement quality management courses</p> <ul style="list-style-type: none"> <li>◆ Set targets for the courses <ul style="list-style-type: none"> <li>• Identify staff's training needs and formulate a training plan accordingly</li> <li>• Set targets for each course according to the training plan</li> </ul> </li> <li>◆ Apply the knowledge of quality management system and the pre-set quality standard and system of the organization when formulating courses, including: <ul style="list-style-type: none"> <li>• Working procedure system</li> <li>• Working instruction system</li> <li>• Document control system</li> </ul> </li> <li>◆ Set the teaching mode of the quality management courses, including: <ul style="list-style-type: none"> <li>• Lesson mode</li> <li>• Interactive mode</li> <li>• Workshop mode</li> <li>• Assessment mode</li> </ul> </li> <li>◆ Review the effectiveness of courses <ul style="list-style-type: none"> <li>• Use questionnaires to collect opinions of the staff concerned</li> <li>• Check with the department-in-charge the progress of the staff concerned after receiving the training</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply the knowledge of quality management system and the quality management policy of the organization to formulate effective quality management courses, and review the courses effectively after implementation.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses a fair basis of quality management.

1. Title	Implement quality management standards of International Organization for Standardization (ISO)
2. Code	EMCUQM507A
3. Range	Apply ISO quality management standards in quality management work of electrical and mechanical services.
4. Level	5
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 ISO quality management standards</p> <ul style="list-style-type: none"> <li>◆ Understand ISO 9000 Quality Management and Quality Assurance Standard Series, including the quality assurance system and management mechanism</li> </ul> <p>6.2 Implement ISO quality management standards</p> <ul style="list-style-type: none"> <li>◆ Implement ISO 9000 Quality Management and Quality Assurance Standard Series, including: <ul style="list-style-type: none"> <li>• Quality management responsibilities of staff at different levels</li> <li>• Quality assurance system</li> <li>• Inspection mechanism</li> <li>• Document and information management mechanism</li> <li>• Procurement management mechanism</li> <li>• Work process audit mechanism</li> <li>• Improper works control and correction system</li> <li>• Quality record control system</li> <li>• Internal quality audit system</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to implement effectively ISO 9000 Quality Management and Quality Assurance Standard Series and review its effectiveness.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic concepts of quality management.

1. Title	Conduct quality management audit for the electrical and mechanical engineering department	
2. Code	EMRAQM501A	
3. Range	Master techniques for quality management audit, and conduct quality management audit for the electrical and mechanical engineering department.	
4. Level	5	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Techniques for conducting quality management audit for the electrical and mechanical engineering department</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the work flow of the electrical and mechanical engineering departments and their requirements on quality management</li> <li>◆ Master the techniques for quality management audit</li> <li>◆ Be familiar with important points and items related to quality management of electrical and mechanical projects</li> <li>◆ Be familiar with the quality management system of the organization</li> </ul> <p>6.2 Methods and procedures of conducting quality management audit for the electrical and mechanical engineering department</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate a quality management audit scheme for the electrical and mechanical engineering department with the following procedures <ul style="list-style-type: none"> <li>• Identify the major responsibilities and duties of the department being audited</li> <li>• Analyze work procedures for major duties and the structure of job division</li> <li>• Be sure of the methods and procedures of controlling the flow of work procedures ( control mechanism ) including the quality control points</li> <li>• Be sure of the operating principles of the work procedure system, work instruction system and document control system</li> <li>• Formulate an audit scheme for the department</li> </ul> </li> <li>◆ Capable to make preparations for audit with the following procedures <ul style="list-style-type: none"> <li>• Formulate audit procedures</li> <li>• Formulate timetable of staff interview</li> </ul> </li> <li>◆ Capable to conduct audit with the following procedures <ul style="list-style-type: none"> <li>• Audit the department according to the audit scheme</li> <li>• According to relevant records and documents, current on-site operation, work procedure investigation and staff interviews, judge whether the departmental system operation complies with the requirements of the quality management system</li> </ul> </li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Master the techniques of handling non-conforming items with the following procedures <ul style="list-style-type: none"> <li>• Point out the deviation between the non-conforming items and standards, area of non-conformance and result likely to occur</li> <li>• Suggest improvements</li> </ul> </li> <li>◆ Capable to compile an audit report according to the observations based on audit procedures</li> <li>◆ Capable to follow up the improvements to the non-conforming items</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to formulate a systematic and efficient audit scheme for auditing the quality management of the electrical and mechanical engineering department;</li> <li>(ii) Capable to conduct quality management audit effectively for the electrical and mechanical engineering department; and</li> <li>(iii) Capable to handle non-conforming items effectively.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses quality management knowledge.</p>

# **Competency Level 6**

1. Title	Formulate overall design requirements for electric trains and diesel locomotives and coordinate the design requirements of all parts	
2. Code	EMRADE601A	
3. Range	Formulate overall design requirements for electric trains and diesel locomotives according to the overall railway system design, and coordinate different design units, according to the classification of equipment systems of electric trains and diesel locomotives, to formulate design requirements for the equipment systems	
4. Level	6	
5. Credits	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Review, integrate and apply the performance requirements and design guidance information for trains and diesel locomotives</p> <ul style="list-style-type: none"> <li>◆ Master the techniques of reviewing, assessing and integrating performance requirements for trains and diesel locomotives e.g. safety, reliability, comfort, etc., and overall design guidance information for trains and diesel locomotives</li> <li>◆ Analyze, integrate and develop the information on the overall railway system design into the basis of the overall design of electric trains and diesel locomotives</li> <li>◆ By applying specialized train and diesel locomotive engineering knowledge, develop the requirements for the overall design into performance requirements for various component system equipment</li> </ul> <p>6.2 Procedures of formulating overall design requirements for electric trains and diesel locomotives and coordinating the design requirements for various component systems</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate overall design requirements for electric trains according to overall design guidance information for electric trains and the requirements on safety, reliability, comfort, environmental protection and efficiency</li> <li>◆ Capable to coordinate and formulate the design requirements for various equipment systems according to the overall design requirements for electric trains and the classification of train equipment including electrical systems, power systems, mechanical systems, brake systems, pneumatic systems, auxiliary and air-conditioning systems, and control and protection systems</li> <li>◆ Capable to formulate overall design requirements for diesel locomotives according to overall design guidance information for diesel locomotives and the requirements on safety, reliability, environmental protection and efficiency</li> <li>◆ Capable to coordinate and formulate the design requirements for various equipment systems according to the overall design requirements for diesel locomotives and the classification of diesel locomotive equipment including diesel engines, generators, power systems, brake systems, pneumatic systems, auxiliary systems, and control and protection systems</li> </ul>	

	<p>6.3 Professionalism in formulating overall design requirements for electric trains and diesel locomotives and design requirements for various component systems</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate overall design requirements for electric trains and diesel locomotives and design requirements for various component systems according to the standards and requirements for safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating overall design requirements for electric trains and diesel locomotives and design requirements for various component systems</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to draft design requirements for specified major equipment systems of electric trains according to the overall design requirements for electric trains; and</li> <li>(ii) Capable to draft design requirements for specified major equipment systems of diesel locomotives according to the overall design requirements for diesel locomotives.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of train design engineering.</p>

1. Title	Design computer simulated tests for train operation and assess the performance of train equipment	
2. Code	EMRADE602A	
3. Range	Design and undertake simulated tests for train operation and assess the performance of train equipment based on the testing data.	
4. Level	6	
5. Credits	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Technology and working principles of computer simulated tests for train operation</p> <ul style="list-style-type: none"> <li>◆ Be familiar with train operation and its performance requirements</li> <li>◆ Master the special technology involved in computer simulated tests for train operation</li> <li>◆ Be familiar with the working principles of computer simulated tests for train operation</li> <li>◆ Master the techniques of analyzing train performance data</li> </ul> <p>6.2 Methods and procedures of designing computer simulated tests for train operation and assessing the performance of train equipment</p> <ul style="list-style-type: none"> <li>◆ Design computer simulated tests for train operation with the following procedures: <ul style="list-style-type: none"> <li>• Setting the scope for simulated tests, and specifying the information to be input and the specifications to be followed</li> <li>• Selecting appropriate performance simulation programs for the equipment and systems, such as the traction control performance simulation program \and the brake performance simulation program\</li> <li>• Identifying the discrepancies between the result from the program and the actual performance of the equipment/system</li> <li>• Compiling the whole set of programs and procedures for computer simulated tests for train operation</li> </ul> </li> <li>◆ Test the computer simulated tests with the following procedures: <ul style="list-style-type: none"> <li>• Undertaking thoroughly the whole set of procedures for computer simulated tests for train operation</li> <li>• Modifying the procedures for computer simulated tests for train operation according to observation and test results</li> </ul> </li> <li>◆ Undertake computer simulated tests for train operation with the following procedures: <ul style="list-style-type: none"> <li>• Undertaking computer simulated tests for train operation according to procedures</li> <li>• Managing the whole testing process so that it is completed under controlled environment</li> </ul> </li> </ul>	

	<ul style="list-style-type: none"> <li>• Recording the information from computer simulated train operation</li> <li>• Recording the conditions which are different from those of the preset procedures and environment</li> <li>• Recording the factors which may lead to data discrepancies</li> <li>◆ Analyze and assess the performance of computer simulated train operation, including: <ul style="list-style-type: none"> <li>• Analyzing the information collected from simulated tests</li> <li>• Assessing the performance of relevant train equipment</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to design a set of effective and accurate programs and procedures for computer simulated tests for train operation according to the topography of railway sections and the specifications of electric trains; and</p> <p>(ii) Capable to analyze and assess the performance of relevant train equipment according to the information collected from a set of computer simulated tests for train operation.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of computer programmes.</p>

1. Title	Manage the operation of the railway electrical and mechanical engineering designing teams	
2. Code	EMRADE603A	
3. Range	Apply the knowledge and techniques of managing, coordinating and supervising design work to manage the operation of designing teams according to the overall design concept of railway system and the specifications and quality required for the design work, ensuring the overall design quality and efficiency.	
4. Level	6	
5. Credits	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Principles and techniques of managing the operation of the railway electrical and mechanical engineering designing teams</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the work flow of railway electrical and mechanical engineering design and know how to choose the best quality check points</li> <li>◆ Be familiar with the overall design concept of railway system and the specifications and quality required for the design work</li> <li>◆ Master the manpower information arrangement and the training strategy</li> <li>◆ Master the techniques of reviewing comprehensively the design work flow, human resources and organizational re-engineering</li> </ul> <p>6.2 Methods and procedures of managing the operation of the railway electrical and mechanical engineering designing teams to ensure the overall design quality and efficiency</p> <ul style="list-style-type: none"> <li>◆ By applying the knowledge and techniques of coordination and supervision, and mastering the specifications and quality required for the overall design of the railway system, monitor the quality check points to ensure design quality and efficiency</li> <li>◆ Capable to maintain good communication and coordination among all the designing teams in the course of design</li> <li>◆ Capable to review and analyze the job division of the designing teams to enhance the overall design efficiency</li> <li>◆ Capable to review the design work flow to improve the structure of the designing teams</li> <li>◆ By referring to quality management model, capable to review and improve the structure of the designing teams</li> <li>◆ Formulate plans for persistently improving the design quality and efficiency, including <ul style="list-style-type: none"> <li>• Negotiating with staff on formulation of training programmes and providing adequate training for them</li> <li>• Establishing good communication channels</li> <li>• Planning equipment update and upgrade</li> </ul> </li> </ul>	

	<p>6.3 Professionalism in managing the operation of the railway electrical and mechanical engineering designing teams</p> <ul style="list-style-type: none"> <li>◆ Capable to manage the operation of the railway electrical and mechanical engineering designing teams according to the standards and requirements for safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in managing the operation of the railway electrical and mechanical engineering designing teams</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to supervise and coordinate the operation of the railway electrical and mechanical engineering designing teams effectively, ensuring the overall design quality and efficiency; and</li> <li>(ii) Capable to review and improve the operation of the railway electrical and mechanical engineering designing teams effectively, and formulate effective plans for persistently improving the design quality and efficiency.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of electrical and mechanical engineering design and management.</p>

1. Title	Review the design of railway electrical and mechanical engineering equipment that has applied new technology and make decisions
2. Code	EMRADE604A
3. Range	Under a series of conditions, change and apply differentiation and creative techniques to review equipment design that has applied new technology to enhance the safety, reliability, comfort, environmental protection and efficiency of railway electrical and mechanical systems.
4. Level	6
5. Credits	20
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Predicted performance data of the design of railway electrical and mechanical engineering equipment that has applied new technology</p> <ul style="list-style-type: none"> <li>◆ Master the techniques of screening and organizing valid data</li> <li>◆ Be familiar with the functions, working principles and performance standards of electrical and mechanical engineering equipment that has applied new technological design</li> <li>◆ Be familiar with the match of the new technological equipment design and connected equipment and the overall performance requirements</li> <li>◆ Capable to apply integrated engineering knowledge and technology to assess the performance of equipment of new technological design from different aspects</li> </ul> <p>6.2 Methods and procedures of reviewing the design of railway electrical and mechanical engineering equipment that has applied new technology and decision making</p> <ul style="list-style-type: none"> <li>◆ Capable to review the new technological railway electrical and mechanical engineering equipment with overseas application experience. The procedures include: <ul style="list-style-type: none"> <li>• Identify and confirm the actual benefits of introducing equipment of new technological design</li> <li>• Identify the similarities and differences in applying the newly introduced equipment of new technological design to local railway as compared with overseas applications</li> <li>• Analyze the performance records of overseas applications</li> <li>• Assess the risks of adopting the newly introduced new technological equipment</li> <li>• Compile assessment and review reports</li> </ul> </li> <li>◆ Capable to make decisions for the adoption of the new technological railway electrical and mechanical engineering equipment with overseas application experience. The procedures include: <ul style="list-style-type: none"> <li>• Analyze assessment and review reports, and capable to consider the overall system design and condition, and make decisions and plans for adopting the new technological railway engineering equipment with overseas application experience</li> <li>• Formulate follow-up and contingency plans</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>◆ Capable to review railway electrical and mechanical engineering equipment of new technological design. The procedures include: <ul style="list-style-type: none"> <li>• Identify and confirm the actual benefits of introducing equipment of new technological design</li> <li>• Analyze and assess the safety and reliability of equipment of new technological design</li> <li>• Analyze and assess the testing records of equipment of new technological design</li> <li>• Assess the risks of adopting equipment of new technological design</li> </ul> </li> <li>◆ Compile assessment and review reports for making decisions for adopting railway electrical and mechanical engineering equipment of new technological design. The procedures include: <ul style="list-style-type: none"> <li>• Analyze assessment and review reports, and capable to consider the overall system design and condition and make decisions and plans for adopting equipment of new technological design</li> </ul> </li> <li>◆ Formulate follow-up and contingency plans</li> </ul> <p>6.3 Professionalism in reviewing the design of railway electrical and mechanical engineering equipment that has applied new technology</p> <ul style="list-style-type: none"> <li>◆ Capable to review the design of railway electrical and mechanical engineering equipment that has applied new technology according to the standards and requirements for safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in reviewing the design of railway electrical and mechanical engineering equipment that has applied new technology</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to review effectively the design of railway electrical and mechanical engineering equipment that has applied new technology, analyze related testing and application data, and compile assessment and review reports;</li> <li>(ii) Capable to formulate correct decision-making procedures and plans, and decide whether the new technological design should be adopted according to procedures and actual situation; and</li> <li>(iii) Capable to formulate effective follow-up and contingency plans.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional electrical and mechanical engineering knowledge.</p>

1. Title	Revamp the design of railway overhead feeder systems by making use of new technological development	
2. Code	EMRADE605A	
3. Range	By applying professional knowledge of railway overhead feeder systems and the studies of new technological development, revamp the design of railway overhead feeder systems by making use of new technological development to enhance the safety, quality, environmental protection function and efficiency of railway operation.	
4. Level	6	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Techniques of revamping the design of railway overhead feeder systems by making use of new technological development</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the working principles and functional standards for railway overhead feeder systems</li> <li>◆ Master the techniques of screening, reviewing and integrating information about new technological development so as to assess and study the strategy of applying new technological development</li> <li>◆ Apply new technological development to revamp system design in coordination with relevant equipment</li> <li>◆ Master the techniques of designing simulated operational tests</li> </ul> <p>6.2 Method and procedures of revamping the design of railway overhead feeder systems by making use of new technological development</p> <ul style="list-style-type: none"> <li>◆ Capable to revamp the railway overhead feeder design by making use of new technological development according to the overall design requirements for railway overhead feeder systems</li> <li>◆ Assess, identify and confirm the benefits of revamping the design of railway overhead feeder systems by making use of new technological development</li> <li>◆ Assess the risks of adopting the revamped railway overhead feeder system design</li> <li>◆ Perform simulated operational tests for the new system design and assess the performance data of the system</li> <li>◆ Make decisions and plans for the new design, and formulate follow-up and contingency plans</li> </ul> <p>6.3 Professionalism in revamping the design of railway overhead feeder systems by making use of new technological development</p> <ul style="list-style-type: none"> <li>◆ Capable to revamp the design of railway overhead feeder systems according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in revamping the design of railway overhead feeder systems</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: <ul style="list-style-type: none"><li>(i) Capable to assess, identify and confirm effectively the benefits of “revamping the design of railway overhead feeder systems by making use of new technological development”; and</li><li>(ii) Capable to formulate effective decisions and plans for “revamping the design of railway overhead feeder systems by making use of new technological development”, and formulate effective follow-up and contingency plans.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of railway overhead feeder system design.

1. Title	Formulate overall design requirements for railway signal and control systems and coordinate the design requirements of all parts	
2. Code	EMRADE606A	
3. Range	Formulate overall design requirements for railway signal and control systems according to the overall railway system design, and coordinate different designing teams, according to the classification of railway signal and control system equipment, to formulate design requirements for the equipment and systems.	
4. Level	6	
5. Credits	10	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Review, integrate and apply the performance requirements and design guidance information for railway signal and control systems</p> <ul style="list-style-type: none"> <li>◆ Master the techniques of reviewing, assessing and integrating performance requirements for railway signal and control systems and overall design guidance information for railway signal and control systems</li> <li>◆ Analyze, integrate and develop the information on the overall railway system design into the basis of the overall design of railway signal and control systems</li> <li>◆ By applying specialized railway signal and control system engineering knowledge, develop the requirements for the overall design into performance requirements for various component system equipment</li> </ul> <p>6.2 Procedures of formulating overall design requirements for railway signal and control systems and coordinating the design requirements for various component systems</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate overall design requirements for railway signal and control systems according to overall design requirements for railway system and overall design guidance for signal and control systems</li> <li>◆ Capable to coordinate the design requirements for various component equipment, including traffic management system, interlock system, chain system, signal system, trackside equipment, track circuit and automatic train control, according to the overall design requirements for railway signal and control systems</li> </ul> <p>6.3 Professionalism in formulating overall design requirements for railway signal and control systems</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate overall design requirements for railway signal and control systems according to the standards and requirements for safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating overall design requirements for railway signal and control systems</li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: <ul style="list-style-type: none"><li>(i) Capable to draft design requirements for major equipment of railway signal and control systems according to the overall design requirements for the signal and control systems; and</li><li>(ii) Capable to coordinate the design requirements for various component systems so that the component systems can have good match.</li></ul>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of railway signal system engineering.

1. Title	Formulate an overall electric train and diesel locomotive design plan and standard	
2. Code	EMRADE607A	
3. Range	Formulate an overall electric train and diesel locomotive design plan and standard, including the overall design of the train fleet, according to the overall railway system design.	
4. Level	6	
5. Credits	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Basis and skills for an overall electric train and diesel locomotive design</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the concept, performance requirements and standard of the overall electric train and diesel locomotive design</li> <li>◆ Master the expertise, including electrical and mechanical knowledge, in railway works in various disciplines, and apply the expertise in design concept and operation by putting forward innovative ideas and transforming them into useful information</li> <li>◆ Master the knowledge and skills in studying, analyzing and judging the concept, information and performance requirement data of the overall electric train and diesel locomotive design; and calculate, consolidate and expand such data and information to become the basis and standard of the overall electric train and diesel locomotive design</li> <li>◆ Master the skills of analyzing, reorganizing and evaluating performance data of electrical and mechanical system equipment of the railway and the peripheral equipment so as to apply in judging, formulating and reviewing the overall electric train and diesel locomotive design plan and standard</li> <li>◆ Master the skills in analyzing, reviewing and judging the application of new technologies and equipment</li> </ul> <p>6.2 Methods and procedures of formulating overall electric train and diesel locomotive design plan and standard</p> <ul style="list-style-type: none"> <li>◆ Follow the overall railway system design concept, including the expected passenger volume, distribution, train frequency, journey time, route environment and station, as well as the requirements on safety, reliability, comfort, environmental protection and efficiency to formulate an overall electric train design plan, including the number of set of cars for the whole electric train fleet, the combination of the set of cars for each train, carrying capacity and guidelines for the overall design of each set of cars</li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Follow the overall railway system design concept, including the required dragging and driving power, the journey time and route environment, as well as the requirements on safety, reliability, environmental protection and efficiency to formulate an overall diesel locomotive design plan, including the number of diesel locomotives for the whole fleet, the dragging and driving power and working capacity and guidelines for the overall diesel locomotive design</li> <li>◆ Lay down design standard for the design plan of the train fleet for future expansion and in coordination with other vehicles using the railway</li> </ul> <p>6.3 Professionalism in formulating overall electric train and diesel locomotive design plan and standard</p> <ul style="list-style-type: none"> <li>◆ Formulate the overall electric train and diesel locomotive design plan and standard according to the standards and requirements for safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice when formulating the overall electric train and diesel locomotive design plan and standard</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to use the overall railway system design concept and follow relevant requirements to draft an overall design plan for electric trains, including the number of set of cars for the whole electric train fleet, the combination of the set of cars for each train, carrying capacity and guidelines for the overall design of each set of cars; and</p> <p>(ii) Capable to use the overall railway system design concept and follow relevant requirements to draft an overall design plan for diesel locomotives, including the number of diesel locomotives for the whole fleet, the dragging and driving power and working capacity and guidelines for the overall diesel locomotive design.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses the expertise in electrical and mechanical works in various disciplines and railway operation.</p>

1. Title	Formulate an overall railway signal and control system design plan and standard	
2. Code	EMRADE608A	
3. Range	Formulate a new plan and standard to improve the safety and increase the frequency of operation, according to the overall railway system design and the latest development of the railway signal and control system.	
4. Level	6	
5. Credits	10	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Basis and skills for overall railway signal and control system design</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the concept, performance requirements and standard of the overall railway signal and control system design</li> <li>◆ Master the expertise, including electrical and mechanical knowledge, in railway works in various disciplines, and apply the expertise in design concept and operation by putting forward innovative ideas and transforming them into useful information</li> <li>◆ Master the knowledge and skills in studying, analyzing and judging the concept, information and performance requirement data of the overall railway signal and control system design; and calculate, consolidate and expand such data and information to become the basis and standard of the overall railway signal and control system design</li> <li>◆ Master the skills of analyzing, reorganizing and evaluating performance data of the railway signal and control system equipment and the peripheral equipment so as to apply in judging, formulating and reviewing the overall railway signal and control system design solution and standard</li> <li>◆ Master the skills in analyzing, reviewing and judging the application of new technologies and equipment</li> </ul> <p>6.2 Methods and procedures of formulating overall railway signal and control system design plan and standard</p> <ul style="list-style-type: none"> <li>◆ Formulate a design plan and standard, and manage and coordinate works of different group leaders and department heads according to the overall railway signal and control system design concept and the requirements for railway system and design of trains as well as the requirements on safety, reliability, environmental protection and efficiency</li> <li>◆ Base on the passenger volume along the railway line, the design of tracks and geographical factor to formulate a new railway signal and control system plan and standard to improve the safety of operation and, with the help of the automatic train control system, increase the frequency of operation, and strengthen the communication between the train, the station and the control room</li> </ul>	

	<p>6.3 Professionalism in formulating overall railway signal and control system design solution and standard</p> <ul style="list-style-type: none"> <li>◆ Formulate the overall railway signal and control system design plan and standard according to the standards and requirements for safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice when formulating the overall railway signal and control system design plan and standard</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to use the overall railway system design concept to draft a new design solution and standard for the railway signal and control system, including the guidelines for the overall design of signal system, the control system, the interlock system and information display system, so as to improve the safety and frequency of train operation.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses the expertise in railway, including railway signal engineering.</p>

1. Title	Formulate instructions and plans for the overall inspection, testing and commissioning of trains	
2. Code	EMRAIT601A	
3. Range	Refer to the overall design of trains and review the scope of instructions for inspection, testing and commissioning of train systems to formulate instructions and plans for the overall inspection, testing and commissioning of trains.	
4. Level	6	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Overall design, performance requirements and overall commissioning of trains</p> <ul style="list-style-type: none"> <li>◆ Master the techniques of reviewing, assessing, integrating and developing performance requirements and overall design guidance information for trains</li> <li>◆ By applying specialized train electrical and mechanical engineering knowledge, integrate and develop the requirements for the overall design into performance standards for various component system equipment</li> <li>◆ Master the techniques of designing overall testing of trains according to performance standards</li> </ul> <p>6.2 Methods and procedures of formulating instructions and plans for the overall inspection, testing and commissioning of trains</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate the following testing instructions for train fleet type by referring to the overall railway design and the overall design of train fleet type, and by reviewing the scope of inspection, testing and commissioning of train systems: <ul style="list-style-type: none"> <li>• Full load test</li> <li>• Immunization test to verify that the interference of the electric current of trains to peripheral signal systems is within the specified range</li> <li>• Harmonic test to verify that the harmonic waves generated by the electric current of trains are within the specified range</li> </ul> </li> <li>◆ Capable to perform full load tests, immunization tests and harmonic tests according to testing instructions</li> <li>◆ Capable to analyze testing data</li> <li>◆ Capable to formulate commissioning procedures and verification reports required for trains, including <ul style="list-style-type: none"> <li>• Various system inspection, testing and commissioning reports</li> <li>• Comprehensive testing reports for train operation</li> <li>• Comprehensive testing reports for train types</li> </ul> </li> <li>◆ Capable to use general checking and testing instruments for electrical and electronic equipment, and some specialized instruments for checking and testing train equipment</li> </ul>	

	<p>6.3 Professionalism in formulating instructions and plans for the overall inspection, testing and commissioning of trains</p> <ul style="list-style-type: none"> <li>◆ Formulate instructions and plans for the inspection, testing and commissioning of trains according to the standards and requirements for safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating instructions and plans for the inspection, testing and commissioning of trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to draft an instruction for full load tests, immunization tests and harmonic tests of trains that complies with the requirements for testing train fleet type; and</li> <li>(ii) Capable to perform overall testing for train type and analyze testing data effectively, and capable to formulate requirements for overall commissioning procedures and verification reports for trains effectively.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of train electrical and mechanical engineering.</p>

1. Title	Formulate instructions and plans for the overall inspection, testing and commissioning of railway overhead feeder systems	
2. Code	EMRAIT602A	
3. Range	Refer to the overall design of railway overhead feeder systems and review the scope of instructions for inspection, testing and commissioning of overhead line and switch room devices of overhead feeder systems to formulate instructions and plans for the overall inspection, testing and commissioning of railway overhead feeder systems.	
4. Level	6	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Overall design, performance requirements and overall commissioning of railway overhead feeder systems</p> <ul style="list-style-type: none"> <li>◆ Master the techniques of reviewing, assessing, integrating and developing performance requirements and overall design guidance information for railway overhead feeder systems</li> <li>◆ By applying specialized power supply engineering knowledge, integrate and develop the requirements for the overall design of railway overhead feeder systems into performance standards for various component system equipment</li> <li>◆ Master the techniques of designing overall testing of railway overhead feeder systems according to performance standards</li> </ul> <p>6.2 Methods and procedures of formulating instructions and plans for the overall inspection, testing and commissioning of railway overhead feeder systems</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate the following testing instructions for railway overhead feeder systems by referring to the overall railway design and the overall design of railway overhead feeder systems: <ul style="list-style-type: none"> <li>• Full load test</li> <li>• Special loaded test when a particular power supply breaks down</li> <li>• Immunization test</li> <li>• Harmonic test</li> </ul> </li> <li>◆ Capable to perform full load tests, and loaded tests, immunization tests and harmonic tests under special conditions according to testing instructions</li> <li>◆ Capable to analyze testing data</li> <li>◆ Capable to formulate commissioning procedures and verification reports required for railway overhead feeder systems, including <ul style="list-style-type: none"> <li>• Various system inspection, testing and commissioning reports</li> <li>• Comprehensive testing reports for overhead feeder systems</li> </ul> </li> <li>◆ Capable to use the inspection instruments and tools for overhead feeder system effectively, including some high voltage testing instruments</li> </ul>	

	<p>6.3 Professionalism in formulating instructions and plans for the overall inspection, testing and commissioning of railway overhead feeder systems</p> <ul style="list-style-type: none"> <li>◆ Formulate instructions and plans for the inspection, testing and commissioning of railway overhead feeder systems according to the standards and requirements for safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating instructions and plans for the inspection, testing and commissioning of railway overhead feeder systems</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to draft an overall testing instruction for overhead feeder systems that complies with the commissioning requirements for power supply systems; and</li> <li>(ii) Capable to perform overall testing for railway overhead feeder systems and analyze testing data effectively, and capable to formulate requirements for overall commissioning procedures and verification reports for railway overhead feeder systems effectively.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of overhead feeder engineering and railway operation.</p>

1. Title	Formulate instructions and plans for the overall inspection, testing and commissioning of railway signal and control systems	
2. Code	EMRAIT603A	
3. Range	Refer to the overall design of railway signal and control systems and review the scope of instructions for inspection, testing and commissioning of signal and control systems to formulate instructions and plans for the overall inspection, testing and commissioning of railway signal and control systems.	
4. Level	6	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Overall design, performance requirements and overall commissioning of railway signal and control systems</p> <ul style="list-style-type: none"> <li>◆ Master the techniques of reviewing, assessing, integrating and developing performance requirements and overall design guidance information for railway signal and control system equipment</li> <li>◆ By applying specialized railway signal system engineering knowledge, integrate and develop the requirements for the overall design of railway signal and control systems into performance standards for various component system equipment</li> <li>◆ Master the techniques of designing overall testing of railway signal and control systems according to performance standards</li> </ul> <p>6.2 Methods and procedures of formulating instructions and plans for the overall inspection, testing and commissioning of railway signal and control systems</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate the following testing instructions for railway signal and control systems by referring to the overall railway design and the overall design of railway signal and control systems: <ul style="list-style-type: none"> <li>• Comprehensive testing of the control function of the signal and control system</li> <li>• Comprehensive testing of the interlocking functions of the signal and control system</li> <li>• Testing the operation of the signal and control system under special conditions such as single track running</li> <li>• Testing the operation of the signal and control system when part of the signal system breaks down</li> </ul> </li> <li>◆ Capable to perform comprehensive function tests, interlocking function tests and operation tests for signal control systems under special conditions according to testing instructions</li> <li>◆ Capable to analyze testing data</li> <li>◆ Capable to use the inspection instruments of railway signal equipment effectively, including some specialized testing instruments</li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Capable to formulate commissioning procedures and verification reports required for railway signal and control systems, including <ul style="list-style-type: none"> <li>• Various system inspection, testing and commissioning reports</li> <li>• Comprehensive control function and interlocking function testing reports for signal and control systems</li> </ul> </li> </ul> <p>6.3 Professionalism in formulating instructions and plans for the overall inspection, testing and commissioning of railway signal and control systems</p> <ul style="list-style-type: none"> <li>◆ Formulate instructions and plans for the inspection, testing and commissioning of railway signal and control systems according to the standards and requirements for safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating instructions and plans for the inspection, testing and commissioning of railway signal and control systems</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to draft an overall testing instruction for signal and control systems that complies with the commissioning requirements for signal and control systems; and</li> <li>(ii) Capable to perform overall testing for railway signal and control systems and analyze testing data effectively, and capable to formulate requirements for overall commissioning procedures and verification reports for railway signal and control systems effectively.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of railway signal engineering.</p>

1. Title	Formulate strategies and plans for reducing the faults in train fleet equipment	
2. Code	EMRAOR601A	
3. Range	Assess the development of new technologies in train fleet equipment and their maintenance and the change of railway environment, and formulate strategies and plans for reducing the faults in train fleet equipment according to the analysis of fault records.	
4. Level	6	
5. Credits	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Studies and techniques for reducing the faults in train fleet equipment</p> <ul style="list-style-type: none"> <li>◆ Analyze and assess from different aspects the information and records of the faults and performance of train fleet equipment and apply the electrical, mechanical and train-related engineering knowledge to formulate plans for reducing the faults in such equipment</li> <li>◆ Master the techniques of reviewing, integrating and extending the knowledge of new technologies and development and apply it to formulate plans for reducing the faults in train fleet equipment</li> <li>◆ Master the application of management knowledge and skills so as to formulate plans for improving persistently the performance of train fleet equipment</li> <li>◆ Analyze and assess the cost-effectiveness of improvement plans</li> </ul> <p>6.2 Methods and procedures of formulating strategies and plans for reducing the faults in train fleet equipment</p> <ul style="list-style-type: none"> <li>◆ Formulate the strategies for improving the reliability of trains based on the analysis of system fault records, including: <ul style="list-style-type: none"> <li>• Improving the design of train fleet equipment</li> <li>• Diversifying the load to enhance safety factor</li> <li>• Improving the methods of maintaining consumable parts</li> </ul> </li> <li>◆ Apply the instruments and equipment developed by new technologies to monitor the operation of the train fleet so as to reduce the faults in train fleet equipment</li> <li>◆ Apply the instruments and equipment developed by new technologies to improve the fault-alerting functions of train fleet equipment</li> <li>◆ Formulate strategies for persistently reducing the faults in train fleet equipment, including: <ul style="list-style-type: none"> <li>• Establishing good communication and cooperation with the design department and the servicing department</li> <li>• Negotiating with staff on formulation of training programmes and providing adequate and upgrading training for them</li> <li>• Formulating review mechanism for the operation and make improvements</li> </ul> </li> </ul>	

	<p>6.3 Professionalism in formulating strategies and plans for reducing the faults in train fleet equipment</p> <ul style="list-style-type: none"> <li>◆ Formulate strategies and plans for reducing the faults in train fleet equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating strategies and plans for reducing the faults in train fleet equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> <li>(i) Capable to formulate strategies and plans efficiently for reducing the faults in train fleet equipment; and</li> <li>(ii) Capable to formulate strategies and plans efficiently for persistently reducing the faults in train fleet equipment.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses the professional knowledge of electrical and mechanical engineering and management.</p>

1. Title	Formulate strategies and plans for reducing the faults in railway overhead feeder system equipment	
2. Code	EMRAOR602A	
3. Range	Assess the development of new technologies in power supply equipment and its maintenance and the change of railway environment, and formulate strategies and plans for reducing the faults in railway overhead feeder system equipment according to the analysis of fault records and operation performance of such system.	
4. Level	6	
5. Credits	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Studies and techniques for reducing the faults in railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ Analyze and assess from different aspects the information and records of the faults and performance of railway overhead feeder system equipment and apply the knowledge of railway overhead feeder works to formulate plans for reducing the faults in such system equipment</li> <li>◆ Master the techniques of reviewing, integrating and extending the knowledge of new technologies and development and apply it to formulate plans for reducing the faults in railway overhead feeder system equipment</li> <li>◆ Master the application of management knowledge and skills so as to formulate plans for improving persistently the performance of feeder system equipment</li> <li>◆ Analyze and assess the cost-effectiveness of improvement plans</li> </ul> <p>6.2 Methods and procedures of formulating strategies and plans for reducing the faults in railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ Formulate the strategies for improving the reliability of the railway overhead feeder system based on the analysis of system fault records, including: <ul style="list-style-type: none"> <li>• Improving the design of overhead feeder system equipment</li> <li>• Diversifying the load to enhance safety factor</li> <li>• Improving the power factor management equipment</li> <li>• Improving the methods of maintaining consumable parts</li> </ul> </li> <li>◆ Apply the instruments and equipment developed by new technologies to monitor the operation of the overhead feeder system so as to reduce the faults in power supply system equipment</li> <li>◆ Apply the instruments and equipment developed by new technologies to improve the fault-alerting functions of feeder system equipment</li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Formulate strategies for persistently reducing the faults in power supply system equipment, including: <ul style="list-style-type: none"> <li>• Establishing good communication and cooperation among departments</li> <li>• Negotiating with staff on formulation of training programmes and providing adequate and upgrading training for them</li> <li>• Formulating review mechanism for the operation and make improvements</li> </ul> </li> </ul>
6.3	<p>Professionalism in formulating strategies and plans for reducing the faults in railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ Formulate strategies and plans for reducing the faults in railway overhead feeder system equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating strategies and plans for reducing the faults in railway overhead feeder system equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to formulate strategies and plans efficiently for reducing the faults in railway overhead feeder system equipment; and</p> <p>(ii) Capable to formulate strategies and plans efficiently for persistently reducing the faults in overhead feeder system equipment.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses expertise in overhead feeder system works.</p>

1. Title	Formulate strategies and plans for reducing the faults in railway signal and control system equipment	
2. Code	EMRAOR603A	
3. Range	Assess the development of new technologies in signal and control system and its maintenance and the change of railway environment, and formulate strategies and plans for reducing the faults in railway signal and control system equipment according to the analysis of fault records and operation performance of such system.	
4. Level	6	
5. Credits	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Studies and techniques for reducing the faults in railway signal and control system equipment</p> <ul style="list-style-type: none"> <li>◆ Analyze and assess from different aspects the information and records of the faults and performance of railway signal and control system equipment and apply the railway signal and control engineering knowledge to formulate plans for reducing the faults in such system equipment</li> <li>◆ Master the techniques of reviewing, integrating and extending the knowledge of new technologies and development and apply it to formulate plans for reducing the faults in railway signal and control system equipment</li> <li>◆ Master the application of management knowledge and skills so as to formulate plans for improving persistently the performance of railway signal and control system equipment</li> <li>◆ Analyze and assess the cost-effectiveness of improvement plans</li> </ul> <p>6.2 Methods and procedures of formulating strategies and plans for reducing the faults in railway signal and control system equipment</p> <ul style="list-style-type: none"> <li>◆ Formulate the strategies for improving the reliability of the railway signal and control system based on the analysis of system fault records, including: <ul style="list-style-type: none"> <li>• Improving the design of signal and control system equipment</li> <li>• Improving the methods of maintaining the system and equipment</li> <li>• Improving the environment of railway signal operation so as to reduce the impact of the environmental factor</li> </ul> </li> <li>◆ Apply the instruments and equipment developed by new technologies as well as the improvements in network programmes to monitor the operation of the signal and control system so as to reduce the faults in such equipment</li> <li>◆ Apply the instruments and equipment developed by new technologies as well as computer and network programmes to upgrade the fault-alerting functions of signal and control equipment</li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Formulate strategies for persistently reducing the faults in signal and control system equipment, including: <ul style="list-style-type: none"> <li>• Establishing good communication and cooperation among departments</li> <li>• Negotiating with staff on formulation of training programmes and providing adequate and upgrading training for them</li> <li>• Formulating review mechanism for the operation and make improvements</li> </ul> </li> </ul>
6.3	<p>Professionalism in formulating strategies and plans for reducing the faults in railway signal and control system equipment</p> <ul style="list-style-type: none"> <li>◆ Formulate strategies and plans for reducing the faults in railway signal and control system equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating strategies and plans for reducing the faults in railway signal and control system equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to formulate strategies and plans efficiently for reducing the faults in railway signal and control system equipment; and</p> <p>(ii) Capable to formulate strategies and plans efficiently for persistently reducing the faults in signal and control system equipment.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses the professional knowledge of railway signal and control engineering.</p>

1. Title	Formulate maintenance plans for trains	
2. Code	EMRAMA601A	
3. Range	Calculate the wear rates of different spare parts of train equipment, compare the cost of the spare parts with the maintenance cost and consider the inspection cycle for the equipment, identify the critical factors in order to calculate the maintenance cycle and formulate maintenance plans for trains.	
4. Level	6	
5. Credits	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Studies and techniques of formulating maintenance cycles for train equipment</p> <ul style="list-style-type: none"> <li>◆ Select the best way of train maintenance such as regular maintenance, monitoring of operation condition, regular replacement, etc. by applying maintenance knowledge of electrical and mechanical engineering and considering the operation mode of trains</li> <li>◆ Master information about review, integration and development of the functional performance of train equipment and the wear of consumable parts so as to apply the information in formulating maintenance cycles</li> <li>◆ Master the calculation of the wear rate of equipment including the consideration of environmental factors</li> <li>◆ Calculate, analyze and assess the cost effectiveness of adopting different maintenance cycles</li> </ul> <p>6.2 Method and procedures of formulating maintenance cycles for trains</p> <ul style="list-style-type: none"> <li>◆ Capable to identify the critical factors for maintenance cycles of trains and calculate maintenance cycles for trains by fully considering factors like performance of train equipment, wear rates of critical spare parts, wear cost and maintenance cost</li> <li>◆ Capable to identify equipment parts of higher wear rates, and monitor and calculate their wear rates by applying knowledge and experience in maintaining electrical and mechanical equipment</li> <li>◆ Capable to calculate the cost of spare parts and the maintenance cost based on the equipment parts of higher wear rates</li> <li>◆ Capable to formulate basic maintenance plans based on the critical factors and the maintenance cycle calculated for the train</li> <li>◆ Capable to identify other factors of consideration and calculate the cycles for different levels of maintenance</li> <li>◆ Capable to formulate a comprehensive plan for different levels of train maintenance and formulate the basic content for the respective maintenance levels according to their maintenance cycles</li> </ul>	

	<p>6.3 Professionalism in formulating maintenance plans for trains</p> <ul style="list-style-type: none"> <li>◆ Formulate maintenance plans for trains according to the standards and requirements for safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating maintenance plans for trains</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to formulate maintenance cycles for different levels of train maintenance and the basic content of maintenance of related equipment effectively and accurately based on data about the wear of train equipment parts and some other critical factors.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of electrical and mechanical engineering and train maintenance.</p>

1. Title	Manage the operation of the railway electrical and mechanical system equipment maintenance teams	
2. Code	EMRAMA602A	
3. Range	Apply the knowledge and techniques of managing, coordinating and supervising maintenance work to manage the operation of maintenance teams according to the service quality required for the maintenance work, ensuring that the overall maintenance quality and efficiency complies with the standard.	
4. Level	6	
5. Credits	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Principles and techniques of managing the operation of the railway electrical and mechanical system equipment maintenance teams</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the work flow of railway electrical and mechanical system equipment maintenance and know how to choose the best quality control points</li> <li>◆ Be familiar with the performance requirements for system operation and the specifications and quality required for maintenance</li> <li>◆ Master the technical requirements for railway electrical and mechanical system equipment maintenance, the manpower information arrangement and the training strategy</li> <li>◆ Master the techniques of reviewing comprehensively the maintenance work flow, human resources and organizational re-engineering</li> </ul> <p>6.2 Methods and procedures of managing the operation of the railway electrical and mechanical system equipment maintenance teams to ensure the overall maintenance quality and efficiency</p> <ul style="list-style-type: none"> <li>◆ By applying the knowledge and techniques of coordination and supervision, and mastering the technical requirements, specifications and quality for the railway electrical and mechanical system equipment maintenance, monitor the quality check points to ensure maintenance quality and efficiency</li> <li>◆ Capable to maintain good communication and coordination among all the maintenance teams in the course of system maintenance</li> <li>◆ Capable to review and analyze the job division of the maintenance teams to enhance the overall maintenance efficiency</li> <li>◆ Capable to review and improve the structure of the maintenance teams. The procedures include <ul style="list-style-type: none"> <li>• Review the maintenance work flow to improve the structure of the maintenance teams</li> <li>• By referring to quality management model, capable to review and improve the structure of the maintenance teams</li> </ul> </li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Formulate plans for persistently improving the system maintenance quality and efficiency, including <ul style="list-style-type: none"> <li>• Coordinating all the maintenance teams in keeping the same direction and objective for maintenance</li> <li>• Negotiating with staff on formulation of training programmes and providing adequate training for them</li> <li>• Establishing good communication channels</li> <li>• Planning maintenance equipment update and upgrade</li> </ul> </li> </ul> <p>6.3 Professionalism in managing the operation of the railway electrical and mechanical system equipment maintenance teams</p> <ul style="list-style-type: none"> <li>◆ Manage the operation of the railway electrical and mechanical system equipment maintenance teams according to the standards and requirements for safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in managing the operation of the railway electrical and mechanical system equipment maintenance teams</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to manage the operation of the railway electrical and mechanical system equipment maintenance teams effectively, ensuring the overall maintenance quality and efficiency; and</p> <p>(ii) Capable to formulate effective plans for persistently improving the quality and efficiency of the railway electrical and mechanical system equipment maintenance.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of electrical and mechanical engineering and management.</p>

1. Title	Revamp the maintenance method for train equipment to enhance maintenance quality and efficiency	
2. Code	EMRAMA603A	
3. Range	Revamp the maintenance method for trains by making use of the development of new technology and maintenance methods and capable to examine the effectiveness of the new method in order to enhance the quality and efficiency of train maintenance	
4. Level	6	
5. Credits	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Studies and techniques of revamping the maintenance method for train equipment</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the operation mode, performance requirements and standards for train equipment</li> <li>◆ Master the techniques of screening, reviewing and integrating information about new technological development so as to assess and study the strategy and plans of applying the techniques and equipment of new technological development to the maintenance work of train equipment</li> <li>◆ Master data and information about analysis, review, integration and development of the new maintenance method so as to judge the feasibility and effectiveness of adopting the new maintenance method and perform risk assessment</li> <li>◆ Calculate, analyze and assess the cost effectiveness of adopting techniques and equipment of the new technological development and the new maintenance method</li> </ul> <p>6.2 Method and procedures of revamping maintenance methods for train equipment and enhancing maintenance quality and efficiency</p> <ul style="list-style-type: none"> <li>◆ Capable to study new technological development and the development of maintenance methods for train equipment so as to select a suitable new maintenance method such as <ul style="list-style-type: none"> <li>• Monitoring of new technological development and application of recording instrument</li> <li>• Condition monitoring maintenance method</li> <li>• Reliability-centred maintenance method</li> </ul> </li> <li>◆ Capable to identify the actual benefits of introducing the new maintenance method particularly in respect of maintenance quality and efficiency</li> <li>◆ Capable to analyze the performance history of the new maintenance method when it is applied outside</li> <li>◆ Capable to perform risk assessment for adopting the newly introduced maintenance method</li> <li>◆ Capable to compile assessment and review reports for adopting the new maintenance method</li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Capable to analyze the assessment and review reports and consider the overall condition of train maintenance and draft an implementation plan for adopting the new maintenance method including <ul style="list-style-type: none"> <li>• Pilot scheme</li> <li>• Review of the effectiveness of the pilot scheme</li> <li>• Expansion of the pilot scheme</li> <li>• Plan of full implementation of the new maintenance method</li> <li>• Contingency plans</li> </ul> </li> <li>◆ Capable to coordinate with the maintenance team and decide on the plan of implementing the new maintenance method</li> <li>◆ Capable to formulate strategies</li> </ul> <p>6.3 Professionalism in revamping maintenance methods for train equipment</p> <ul style="list-style-type: none"> <li>◆ Capable to revamp maintenance methods for train equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works so as to enhance maintenance quality and efficiency</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in revamping maintenance methods for train equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to assess and identify the actual benefits of revamping maintenance methods for trains effectively with regard to maintenance quality and efficiency; and</p> <p>(ii) Capable to formulate effective strategies and planning procedures for “revamped train maintenance methods”, and formulate effective follow-up and contingency plans.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of electrical and mechanical engineering and train equipments.</p>

1. Title	Formulate maintenance plans for railway overhead feeder system equipment	
2. Code	EMRAMA604A	
3. Range	Calculate the wear rates of different spare parts of power supply system equipment, compare the cost of the spare parts with the maintenance cost and consider the inspection cycle for the equipment and the requirements of the electricity regulations, identify the critical factors in order to calculate the maintenance cycle and formulate maintenance plans.	
4. Level	6	
5. Credits	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Studies and techniques of formulating maintenance cycles for railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ Select the best way of railway overhead feeder system equipment maintenance such as regular maintenance, monitoring of operation condition, regular replacement, etc. by applying maintenance knowledge of overhead feeder engineering and considering the operation mode of railway overhead feeder system equipment</li> <li>◆ Master information about review, integration and development of the functional performance of railway overhead feeder system equipment and the wear of consumable parts so as to apply the information in formulating maintenance cycles</li> <li>◆ Master the calculation of the deterioration rate of equipment including the consideration of environmental factors</li> <li>◆ Calculate, analyze and assess the cost effectiveness of adopting different maintenance cycles</li> </ul> <p>6.2 Method and procedures of formulating maintenance cycles for railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ Capable to identify power supply equipment parts of higher wear rates, and monitor and calculate their wear rates by applying knowledge and experience in maintaining electrical and mechanical equipment</li> <li>◆ Capable to calculate the cost of spare parts and the maintenance cost based on the equipment parts of higher wear rates</li> <li>◆ Capable to identify the critical factors for maintenance cycles of railway overhead feeder system equipment and calculate their maintenance cycles by fully considering factors like the equipment performance, wear rates of critical consumable parts, wear cost and maintenance cost</li> <li>◆ Capable to formulate basic maintenance plans based on the critical factors and the maintenance cycle calculated for the overhead line equipment</li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Capable to identify other factors of consideration and calculate the cycles for different levels of maintenance</li> <li>◆ Capable to formulate a basic maintenance plan according to critical factors and the maintenance cycles for power switches in the switch room, control and protection equipment and electricity quality improvement equipment based on the critical factors</li> <li>◆ Capable to identify other factors of consideration and calculate the cycles for different levels of maintenance and the basic content of maintenance</li> </ul> <p>6.3 Professionalism in formulating maintenance plans for railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ Formulate maintenance plans for railway overhead feeder system equipment according to the standards and requirements for safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating maintenance plans for railway overhead feeder system equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to formulate maintenance cycles for different levels of train maintenance and the basic content of maintenance of related equipment effectively and accurately based on data about the deterioration of railway overhead feeder system equipment parts and some other critical factors.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of overhead feeder system engineering and railway operation.</p>

1. Title	Revamp the maintenance method for railway overhead feeder system equipment to enhance maintenance quality and efficiency	
2. Code	EMRAMA605A	
3. Range	Revamp the maintenance method for railway overhead feeder system equipment by making use of the development of new technology and maintenance methods and capable to examine the effectiveness of the new method in order to enhance the quality and efficiency of system maintenance	
4. Level	6	
5. Credits	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Studies and techniques of revamping the maintenance method for railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the operation mode, performance requirements and standards for railway overhead feeder system equipment</li> <li>◆ Master the techniques of screening, reviewing and integrating information about new technological development so as to assess and study the strategy and plans of applying the techniques and equipment of new technological development to the maintenance work of railway overhead feeder system equipment</li> <li>◆ Master data and information about analysis, review, integration and development of the new maintenance method so as to judge the feasibility and effectiveness of adopting the new maintenance method and perform risk assessment</li> <li>◆ Calculate, analyze and assess the cost effectiveness of adopting techniques and equipment of the new technological development and the new maintenance method</li> </ul> <p>6.2 Method and procedures of revamping maintenance methods for railway overhead feeder system equipment and enhancing maintenance quality and efficiency</p> <ul style="list-style-type: none"> <li>◆ Capable to study new technological development and the development of maintenance methods for railway overhead feeder system equipment so as to select a suitable new maintenance method such as <ul style="list-style-type: none"> <li>• Monitoring of new technological development and application of recording instrument</li> <li>• Condition monitoring maintenance method</li> <li>• Reliability – centred maintenance method</li> </ul> </li> <li>◆ Capable to identify the actual benefits of introducing the new maintenance method particularly in respect of maintenance quality and efficiency</li> <li>◆ Capable to analyze the performance history of the new maintenance method when it is applied outside</li> <li>◆ Capable to perform risk assessment for adopting the newly introduced maintenance method</li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Capable to compile assessment and review reports for adopting the new maintenance method</li> <li>◆ Capable to analyze the assessment and review reports and consider the overall condition of power supply system maintenance and draft an implementation plan for adopting the new maintenance method including <ul style="list-style-type: none"> <li>• Pilot scheme</li> <li>• Review of the effectiveness of the pilot scheme</li> <li>• Expansion of the pilot scheme</li> <li>• Plan of full implementation of the new maintenance method</li> <li>• Contingency plans</li> </ul> </li> <li>◆ Capable to coordinate with the maintenance team and decide on the plan of implementing the new maintenance method</li> <li>◆ Capable to formulate strategies</li> </ul> <p>6.3 Professionalism in revamping maintenance methods for railway overhead feeder system equipment</p> <ul style="list-style-type: none"> <li>◆ Revamp maintenance methods for railway overhead feeder system equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works so as to enhance maintenance quality and efficiency</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in revamping maintenance methods for railway overhead feeder system equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to assess and identify the actual benefits of revamping maintenance methods for railway overhead feeder system effectively with regard to maintenance quality and efficiency; and</p> <p>(ii) Capable to formulate effective strategies and planning procedures for “revamped railway overhead feeder system maintenance methods”, and formulate effective follow-up and contingency plans.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of railway overhead feeder system engineering.</p>

1. Title	Formulate maintenance plans for railway signal and control system equipment	
2. Code	EMRAMA606A	
3. Range	Calculate the wear rates of different spare parts of railway signal and control system equipment, compare the cost of the spare parts with the maintenance cost and consider the inspection cycle for the equipment and the safety requirements for railway signal and control system, identify the critical factors in order to calculate the maintenance cycle and formulate maintenance plans.	
4. Level	6	
5. Credits	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Studies and techniques of formulating maintenance cycles for railway signal and control system equipment</p> <ul style="list-style-type: none"> <li>◆ Select the best way of railway signal and control system equipment maintenance such as regular maintenance, monitoring of operation condition, regular replacement, etc. by applying maintenance knowledge of signal and control system and considering the operation mode of railway signal and control system</li> <li>◆ Master information about review, integration and development of the functional performance of railway signal and control system equipment and the wear of consumable parts so as to apply the information in formulating maintenance cycles</li> <li>◆ Master the calculation of the deterioration rate of equipment including the consideration of environmental factors</li> <li>◆ Calculate, analyze and assess the cost effectiveness of adopting different maintenance cycles</li> </ul> <p>6.2 Method and procedures of formulating maintenance cycles for railway signal and control system equipment</p> <ul style="list-style-type: none"> <li>◆ Capable to identify signal and control equipment parts of higher wear rates, and monitor and calculate their wear rates by applying knowledge and experience in maintaining electrical and mechanical equipment and signal and control equipment</li> <li>◆ Capable to calculate the cost of spare parts and the maintenance cost based on the equipment parts of higher wear rates</li> <li>◆ Capable to identify the critical factors for maintenance cycles of railway signal and control system equipment and calculate their maintenance cycles by fully considering factors like the equipment performance, wear rates of critical consumable parts, wear cost and maintenance cost</li> <li>◆ Capable to formulate basic maintenance plans based on the critical factors and the maintenance cycle calculated for the signal and control system equipment</li> <li>◆ Capable to identify other factors of consideration and calculate the cycles for different levels of maintenance</li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Capable to formulate a comprehensive plan for various equipment of the railway signal and control system according to maintenance cycles for different levels</li> </ul>
6.3	<p>Professionalism in formulating maintenance plans for railway signal and control system equipment</p> <ul style="list-style-type: none"> <li>◆ Formulate maintenance plans for railway signal and control system equipment according to the standards and requirements for safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in formulating maintenance plans for railway signal and control system equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to formulate maintenance cycles for different levels of train maintenance and the basic content of maintenance of related equipment effectively and accurately based on data about the wear of railway signal and control system equipment parts and some critical factors.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of railway signal and control system engineering and railway operation.</p>

1. Title	Revamp the maintenance method for railway signal and control system equipment to enhance maintenance quality and efficiency
2. Code	EMRAMA607A
3. Range	Revamp the maintenance method for railway signal and control system equipment by making use of the development of new technology and maintenance methods and capable to examine the effectiveness of the new method in order to enhance the quality and efficiency of signal and control system maintenance
4. Level	6
5. Credits	20
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Studies and techniques of revamping the maintenance method for railway signal and control system equipment</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the operation mode, performance requirements and standards for railway signal and control system equipment</li> <li>◆ Master the techniques of screening, reviewing and integrating information about new technological development so as to assess and study the strategy and plans of applying the techniques and equipment of new technological development to the maintenance work of railway signal and control system equipment</li> <li>◆ Master data and information about analysis, review, integration and development of the new maintenance method so as to judge the feasibility and effectiveness of adopting the new maintenance method and perform risk assessment</li> <li>◆ Calculate, analyze and assess the cost effectiveness of adopting techniques and equipment of the new technological development and the new maintenance method</li> </ul> <p>6.2 Method and procedures of revamping maintenance methods for railway signal and control system equipment and enhancing maintenance quality and efficiency</p> <ul style="list-style-type: none"> <li>◆ Capable to study new technological development and the development of maintenance methods for railway signal and control system equipment so as to select a suitable new maintenance method such as <ul style="list-style-type: none"> <li>• Monitoring of new technological development and application of recording instrument</li> <li>• Condition monitoring maintenance method</li> <li>• Reliability – centred maintenance method</li> </ul> </li> <li>◆ Capable to identify the actual benefits of introducing the new maintenance method particularly in respect of maintenance quality and efficiency</li> <li>◆ Capable to analyze the performance history of the new maintenance method when it is applied outside</li> <li>◆ Capable to perform risk assessment for adopting the newly introduced maintenance method</li> </ul>

	<ul style="list-style-type: none"> <li>◆ Capable to compile assessment and review reports for adopting the new maintenance method</li> <li>◆ Capable to analyze the assessment and review reports and consider the overall condition of signal and control system maintenance and draft an implementation plan for adopting the new maintenance method including <ul style="list-style-type: none"> <li>• Pilot scheme</li> <li>• Review of the effectiveness of the pilot scheme</li> <li>• Expansion of the pilot scheme</li> <li>• Plan of full implementation of the new maintenance method</li> <li>• Contingency plans</li> </ul> </li> <li>◆ Capable to coordinate with the maintenance team and decide on the plan of implementing the new maintenance method</li> <li>◆ Capable to formulate strategies</li> </ul> <p>6.3 Professionalism in revamping maintenance methods for railway signal and control system equipment</p> <ul style="list-style-type: none"> <li>◆ Revamp maintenance methods for railway signal and control system equipment according to the standards and requirements for work safety, health, environmental protection and quality management of railway works so as to enhance maintenance quality and efficiency</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice in revamping maintenance methods for railway signal and control system equipment</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to assess and identify the actual benefits of revamping maintenance methods for railway signal and control system effectively with regard to maintenance quality and efficiency; and</p> <p>(ii) Capable to formulate effective strategies and planning procedures for “revamped railway signal and control system maintenance methods”, and formulate effective follow-up and contingency plans.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of railway signal and control system engineering.</p>

1. Title	Apply project management skills and professional knowledge to handle unfulfilled or unperformed contracts effectively
2. Code	EMCUPM601A
3. Range	Use professional knowledge to analyze the reasons and impact of non-fulfillment or non-performance of project contracts, as far as electrical and mechanical project management is concerned, and apply project management knowledge and skills to handle these contracts effectively.
4. Level	6
5. Credit	20
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Reasons for non-fulfillment or non-performance of contract</p> <ul style="list-style-type: none"> <li>◆ Use professional knowledge and knowledge of engineering environment to analyze the reasons of non-fulfilment or non-performance of project contracts by considering the following factors: <ul style="list-style-type: none"> <li>• Technical concerns</li> <li>• Cost effectiveness</li> <li>• Change in project environment</li> <li>• Political, social and legal concerns</li> <li>• Contractor-related concerns</li> </ul> </li> </ul> <p>6.2 Handle unfulfilled or unperformed project contracts</p> <ul style="list-style-type: none"> <li>◆ Consider all solutions according to the above concerns, and calculate the costs and price for each solution</li> <li>◆ Identify the most beneficiary solution to both sides and draft details of the solution</li> <li>◆ Base on the drafted solution to negotiate with the contractor in order to come up with a solution accepted by both sides</li> <li>◆ Know which part of the contract is unfulfilled or unperformed, and arrange to call for tender for that part again</li> <li>◆ Be capable to provide sufficient and clear information should legal actions are required to solve the contract issues</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply project management skills and professional knowledge to handle unfulfilled or unperformed project contracts, draft solutions effectively and calculate costs and prices for the solutions.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of engineering business management.

1. Title	Formulate strategies to maintain the safety, reliability, comfort, environmental protection and efficiency of various railway electrical and mechanical systems	
2. Code	EMRAOM601A	
3. Range	Formulate strategies to maintain the safety, reliability, comfort, environmental protection and efficiency of various electrical and mechanical systems in railway, including equipment renewal and upgrade, human resources training and coordination of relevant departments of the organization.	
4. Level	6	
5. Credits	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Studies and skills to maintain the safety, reliability, comfort, environmental protection and efficiency of various railway electrical and mechanical systems</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the operation mode, performance requirements and standards of various railway electrical and mechanical system equipment</li> <li>◆ Master specialized knowledge of railway electrical and mechanical works, apply such knowledge to review and analyze the performance and trend data of various railway electrical and mechanical systems, and formulate strategies to maintain the performance</li> <li>◆ Capable to study strategies to maintain the performance of various railway electrical and mechanical systems from different aspects including design, maintenance and management, etc.</li> <li>◆ Master the skills to screen, consolidate and analyze performance data of various railway electrical and mechanical systems, so as to study and formulate strategies to maintain the safety, reliability, comfort, environmental protection and efficiency of various railway electrical and mechanical system equipment</li> </ul> <p>6.2 Methods and procedures of formulating strategies to maintain the safety, reliability, comfort, environmental protection and efficiency of various railway electrical and mechanical systems</p> <ul style="list-style-type: none"> <li>◆ Capable to formulate strategies to maintain the performance of design of various railway electrical and mechanical systems, including <ul style="list-style-type: none"> <li>• Formulating plans to review the status of various railway electrical and mechanical systems and equipment, and renewing and upgrading systems and equipment to maintain the safety, reliability, comfort, environmental protection and efficiency of various railway electrical and mechanical systems</li> <li>• Formulating plans to review the performance trend of systems and equipment, and formulate strategies to maintain the quality and efficiency of the systems and equipment in respect of their design</li> </ul> </li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Capable to formulate strategies and plans to maintain the operation status of the systems and equipment, and review and assure the performance of the following so as to maintain the safety, reliability, comfort, environmental protection and efficiency of various systems and equipment <ul style="list-style-type: none"> <li>• Human resources and training</li> <li>• Staff communication</li> <li>• Maintenance and repair strategy</li> </ul> </li> <li>◆ Capable to coordinate the departments of design, engineering and relevant supporting units of the organization and goals of different departments, so as to maintain the safety, reliability, comfort, environmental protection and efficiency of various systems</li> <li>◆ Capable to formulate mechanisms to review the effectiveness of operation of various departments</li> </ul> <p>6.3 Professionalism in formulating strategies to maintain the performance of various railway electrical and mechanical systems</p> <ul style="list-style-type: none"> <li>◆ Formulate strategies to maintain the safety, reliability, comfort, environmental protection and efficiency of various railway electrical and mechanical systems according to the standards and requirements for safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice when formulating strategies to maintain the performance of various railway electrical and mechanical systems</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to formulate effective strategies and plans to maintain the safety, reliability, comfort, environmental protection and efficiency of various railway electrical and mechanical systems; and</p> <p>(ii) Capable to formulate effective mechanisms to coordinate and review the effectiveness of operation of various departments.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses the expertise in electrical and mechanical works and management.</p>

1. Title	Formulate overall safety, health and environmental protection policy	
2. Code	EMCUSH601A	
3. Range	Master comprehensive knowledge and techniques of safety, health and environmental protection; review comprehensively the organization's safety, health and environmental protection management system; and formulate a forward-looking, overall safety, health and environmental protection policy and management system.	
4. Level	6	
5. Credit	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Overall safety, health and environmental protection policy and management system of the organization</p> <ul style="list-style-type: none"> <li>◆ Understand the safety, health and environmental protection management system and policy goals of the organization, including: <ul style="list-style-type: none"> <li>• Long-term and short-term goals</li> <li>• Measurement of performance</li> <li>• Management system</li> <li>• Review mechanism</li> </ul> </li> </ul> <p>6.2 Overall safety, health and environmental protection policy of the organization</p> <ul style="list-style-type: none"> <li>◆ Formulate long-term and short-term goals for the overall safety, health and environmental protection policy <ul style="list-style-type: none"> <li>• Draw the experience of other organizations that have won safety, health and environmental protection awards, and formulate forward-looking, long-term and short-term goals for the overall safety, health and environmental protection management</li> </ul> </li> <li>◆ Identify the deviations between safety, health and environmental protection management goals and current performance <ul style="list-style-type: none"> <li>• Identify and confirm the deviations between safety, health and environmental protection management goals and current performance of the organizational management system, including the items and operating mode</li> </ul> </li> <li>◆ Formulate and implement safety, health and environmental protection management policy <ul style="list-style-type: none"> <li>• Analyze deviations between safety, health and environmental protection goals and current system performance, staff's awareness of safety, health and environmental protection, and formulate an overall safety, health and environmental protection management policy, including: <ul style="list-style-type: none"> <li>▸ Safety, health and environmental protection policy</li> <li>▸ Long-term and short-term goals for safety, health and environmental protection</li> </ul> </li> </ul> </li> </ul>	

	<ul style="list-style-type: none"> <li>▶ Resources arrangement for implementation of the safety, health and environmental protection policy and performance review</li> <li>▶ Operating mode of the management system for the safety, health and environmental protection policy</li> <li>▶ Measurement of performance of the safety, health and environmental protection management system</li> <li>▶ Review mechanism</li> <li>▶ Improvement mechanism</li> <li>▶ Communication channels</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to identify the deviations between safety, health and environmental protection goals and current performance of the organization according to activities and nature of the organization; and</p> <p>(ii) Capable to formulate a forward-looking safety, health and environmental protection management policy and system according to deviations identified and other factors of consideration, and review its performance and make modifications after implementation.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of occupational safety management.</p>

1. Title	Formulate improvement plans for occupational safety and health	
2. Code	EMCUSH602A	
3. Range	Formulate improvement plans for working procedures and mechanical protection and systems that do not comply with the safety and health management standards, and to do so continuously according to views and recommendations generated after the reviews on safety and health policy and management system.	
4. Level	6	
5. Credit	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Occupational safety and health policy and management system</p> <ul style="list-style-type: none"> <li>◆ Understand the occupational safety and health policy and management system of the enterprise, such as: <ul style="list-style-type: none"> <li>• Work safety and health pledge made by the enterprise and its safety policy</li> <li>• Framework for the implementation of the work safety and health pledge</li> <li>• Staff trained with the knowledge of working safely in conditions not hazardous to their health</li> <li>• Internal safety regulations to attain the goal of safety management</li> <li>• Identify dangers and conduct remedial inspection schemes accordingly on a regular basis or as deemed necessary</li> <li>• Identify potential dangers to workers and work out plans to deal with these dangers</li> <li>• Safety committee</li> <li>• Enhance, develop and maintain the awareness of safety and health at work site</li> </ul> </li> </ul> <p>6.2 Improvement plans for occupational safety and health</p> <ul style="list-style-type: none"> <li>◆ Formulate improvement plans for working procedures and mechanical protection and systems that do not comply with the safety and health management standards <ul style="list-style-type: none"> <li>• Formulate improvement plans which include the goals, operating modes, training, implementation and monitoring, according to the investigation as well as the safety and health audit results; and formulate improvement plans for system management with respect to the overall system, financial estimates, performance measurement and review, workflow and schedule of implementation</li> </ul> </li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Formulate improvement plans according to views and recommendations generated after the reviews on safety and health policy and management system <ul style="list-style-type: none"> <li>• Identify and confirm items or operating mode of the system that need to be improved according to views and recommendations generated after the reviews on safety and health policy and management system</li> <li>• Formulate an overall management system improvement plan for items or operating mode of the system that need to be improved</li> </ul> </li> <li>◆ Formulate improvement plans for the occupational safety and health management system for benchmarking enhancement <ul style="list-style-type: none"> <li>• Identify and confirm items or operating mode of the system that need to be improved for benchmarking enhancement</li> <li>• Formulate an overall management system improvement plan for items or operating mode of the system that need to be improved</li> </ul> </li> <li>◆ Consult and communicate sufficiently when formulating improvement plans <ul style="list-style-type: none"> <li>• Consult the staff and stakeholders extensively and establish good communication channels with them during the formulation of the improvement plans</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> <li>(i) Capable to formulate effective improvement plans for working procedures and mechanical protection and systems that do not comply with the safety and health management standards; and</li> <li>(ii) Capable to formulate effective improvement plans for benchmarking enhancement of the organization.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of occupational safety management.</p>

1. Title	Formulate environmental protection improvement plans	
2. Code	EMCUSH603A	
3. Range	Formulate improvement plans for working procedures and mechanical protection that do not comply with the environmental protection management standards, and to do so continuously according to views and recommendations generated after the reviews on environmental protection policy and management system.	
4. Level	6	
5. Credit	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Environmental protection policy and management system</p> <ul style="list-style-type: none"> <li>◆ Understand the environmental protection policy and management system of the organization, including: <ul style="list-style-type: none"> <li>• Policy goals</li> <li>• Operating mode of the management system</li> <li>• Monitoring procedures</li> <li>• Measurement of performance</li> </ul> </li> </ul> <p>6.2 Environmental protection improvement plans</p> <ul style="list-style-type: none"> <li>◆ Formulate improvement plans for areas of emissions, waste water, light pollution, noise, solid waste, chemical waste, ecological environment, etc. that do not comply with the environmental protection management standards: <ul style="list-style-type: none"> <li>• Operating mode</li> <li>• Implementation and monitoring</li> <li>• System management</li> <li>• budgeting</li> <li>• Measurement of performance</li> <li>• Review, workflow and schedule for implementation</li> </ul> </li> <li>◆ Formulate improvement plans according to views and recommendations generated after the reviews on environmental protection policy and management system <ul style="list-style-type: none"> <li>• Identify and confirm items or operating mode of the system that need to be improved</li> <li>• Formulate an overall management system improvement plan for items or operating mode of the system that need to be improved</li> </ul> </li> <li>◆ Consult and communicate sufficiently when formulating improvement plans <ul style="list-style-type: none"> <li>• Consult the staff and stakeholders extensively and establish good communication channels with them during the formulation of the improvement plans</li> </ul> </li> </ul>	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is:  (i) Capable to formulate improvement plans for the organization for areas that do not comply with the environmental protection management standards.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of environmental protection.

1. Title	Formulate quality management strategy
2. Code	EMCUQM601A
3. Range	Fully master the knowledge and techniques of quality management as well as business strategy and quality management culture of the organization and be able to formulate a forward-looking quality management strategy applicable to electrical and mechanical workplaces.
4. Level	6
5. Credit	20
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Quality management goals</p> <ul style="list-style-type: none"> <li>◆ Understand the concept of excellent quality management awards such as: <ul style="list-style-type: none"> <li>• Deming Prize</li> <li>• Baldrige Quality Award</li> <li>• European Quality Award</li> <li>• Hong Kong Award for Industry</li> </ul> </li> </ul> <p>6.2 Formulation of quality management strategy</p> <ul style="list-style-type: none"> <li>◆ Identify the deviations between quality management goals and the current quality management system</li> <li>◆ Identify the deviations between quality management goals and the performance of current quality management system</li> <li>◆ Formulate quality management strategy <ul style="list-style-type: none"> <li>• Analyze the deviations between quality management goals and the current quality management system, and quality management culture and quality costs of the organization in order to formulate the quality management strategy including: <ul style="list-style-type: none"> <li>▸ Quality management policy</li> <li>▸ Quality management goals</li> <li>▸ Operating mode of the quality management system under the quality management policy</li> <li>▸ Measurement of the quality management system performance</li> <li>▸ Review mechanism</li> <li>▸ Improvement mechanism</li> <li>▸ Communication channels</li> </ul> </li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to formulate an effective quality management strategy according to the deviations between quality management goals and the current quality management system as well as other factors of consideration.</p>
8. Remarks	This unit of competency is suitable for quality management staff enhancement. The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of quality management.

1. Title	Implement total quality management plan
2. Code	EMCUQM602A
3. Range	Master the knowledge and techniques of total quality management as well as business strategy and quality management culture of the organization so as to implement the total quality management plan properly for electrical and mechanical works.
4. Level	6
5. Credit	20
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Total quality management theory</p> <ul style="list-style-type: none"> <li>◆ Understand total quality management (TQM) methods and techniques such as: <ul style="list-style-type: none"> <li>• Quality Function Deployment</li> <li>• Business Process Reengineering</li> <li>• Process Improvement</li> <li>• Strategic Outsourcing</li> <li>• Rapid Product Development</li> </ul> </li> <li>◆ Understand the concepts of quality economics, including: <ul style="list-style-type: none"> <li>• Quality costs</li> <li>• Quality costs calculation system of quality economics</li> </ul> </li> </ul> <p>6.2 Implementation of total quality management</p> <ul style="list-style-type: none"> <li>◆ Implement total quality management <ul style="list-style-type: none"> <li>• Apply the following TQM methods to assist the implementation of total quality management strategy <ul style="list-style-type: none"> <li>▸ Quality Function Deployment</li> <li>▸ Business Process Reengineering</li> <li>▸ Process Improvement</li> <li>▸ Strategic Outsourcing</li> <li>▸ Rapid Product Development</li> </ul> </li> </ul> </li> <li>◆ Build up the concept of catering customers' needs in a correct way <ul style="list-style-type: none"> <li>• implement the concept of catering customers' needs in a correct way, including: <ul style="list-style-type: none"> <li>▸ Internal and external customers</li> <li>▸ Customers' voices</li> <li>▸ Customers' level of satisfaction</li> <li>▸ Customers' loyalty</li> <li>▸ The importance of customers to the organization</li> </ul> </li> </ul> </li> <li>◆ Apply the concept of quality economics to analyze quality costs <ul style="list-style-type: none"> <li>• Apply the concept of quality economics to analyze quality costs and implement quality costs system calculated by quality economics, in which the economic value of customers' loyalty is also included</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>◆ Improve the quality management system continuously through learning and growth <ul style="list-style-type: none"> <li>• Improve the quality management system continuously through quality management learning and upgrade provided by the organization</li> <li>• Improve the quality management system continuously through improvement of management method and employee empowerment</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> <li>(i) Capable to use TQM methods to formulate and implement effective quality management plans for the organization;</li> <li>(ii) Capable to apply the concept of quality economics to analyze quality costs for a specific organization; and</li> <li>(iii) Capable to formulate a mechanism to continuously improve the quality management system of the organization.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of quality management.</p>

# **Competency Level 7**

1. Title	Formulate an overall railway system design plan	
2. Code	EMRADE701A	
3. Range	Use the expertise in railway system and its development to formulate an overall railway system design plan according to the corporate direction and strategy of operation as well as the social requirements and standard for railway transportation.	
4. Level	7	
5. Credits	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Basis and skills for an overall railway system design</p> <ul style="list-style-type: none"> <li>◆ Be familiar with the corporate direction, long-term and short-term strategies for development, and economic resources</li> <li>◆ Master the skills in studying, analyzing and judging the social expectation, requirements and standard for railway transportation</li> <li>◆ Be familiar with the concept, performance requirements and standard of overall railway system design</li> <li>◆ Master the expertise, including electrical and mechanical knowledge, in railway works in various disciplines, and apply the expertise in design concept and operation by putting forward innovative ideas and transforming them into useful information</li> <li>◆ Master the knowledge and skills in studying, analyzing and judging the concept, information and performance requirement data of overall railway system design; and calculate, consolidate and expand such data and information to become the basis and standard of the overall railway system design</li> <li>◆ Master the skills in studying, reviewing and judging the application of new technologies and equipment</li> </ul> <p>6.2 Methods and procedures of formulating overall railway system design solution and standard</p> <ul style="list-style-type: none"> <li>◆ Follow the corporate direction and strategy of operation as well as the social requirements and standard for railway system, use the expertise in railway system, and study and analyze relevant data, to draft the overall design requirements for the railway system</li> <li>◆ Capable to review and approve the draft overall design requirements for the railway system</li> <li>◆ Capable to formulate an overall railway system design plan, including the requirements and standards of various systems in the railway system, according to the overall design requirements for the railway system, including the expected passenger volume, distribution, train frequency, journey time, route environment and station, as well as the requirements on safety, reliability, comfort, environmental protection and efficiency, and with economic constraints</li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Lay down design standard for the design plan as the basis to coordinate the design of various systems in the railway system equipment</li> </ul> <p>6.3 Professionalism in formulating overall railway system design solution and standard</p> <ul style="list-style-type: none"> <li>◆ Formulate the overall railway system design solution and standard according to the standards and requirements for safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice when formulating the overall railway system design solution and standard</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to analyze effectively requirements for railway transportation and to draft the overall design requirements for railway system accordingly; and</p> <p>(ii) Capable to draft the overall railway system design plan according to the overall design requirements for railway system.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses the expertise in electrical and mechanical works in various disciplines and railway operation.</p>

1. Title	Formulate an overall operation and repair policy and plan for the railway system	
2. Code	EMRAOR701A	
3. Range	Formulate an overall operation and repair policy and plan for the railway system, including the design and division of work of its overall operation and repair system, so as to respond to the requirements on the overall quality and efficiency, especially the safety and reliability, of the railway transportation service.	
4. Level	7	
5. Credits	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Studies and skills to formulate an overall operation and repair policy and plan for the railway system</p> <ul style="list-style-type: none"> <li>◆ Analyze and evaluate the data and impact of main line failures</li> <li>◆ Master the expertise, including electrical and mechanical knowledge, in railway works in various disciplines, and apply the expertise to review, analyze, consolidate and evaluate the performance and trend data of the entire railway system, and to formulate an overall operation and repair policy and plan</li> <li>◆ Master the skills in analyzing customers' requirements, development trend and culture of railway transportation service</li> <li>◆ Master the expertise in professional management and human relationship and the skills in coordinating railway operational departments</li> <li>◆ Master the skills in analyzing, reformatting and evaluating performance data of railway system equipment, and apply such skills to judge, formulate and review the effectiveness of the overall operation and repair policy and plan</li> </ul> <p>6.2 Methods and procedures of formulating an overall operation and repair policy and plan for the railway system</p> <ul style="list-style-type: none"> <li>◆ Use the analyzed and evaluated data to coordinate the railway engineering and transport operation departments to formulate strategies to reduce main line operation failures</li> <li>◆ Apply electrical and mechanical maintenance techniques and management knowledge to analyze the requirements on the overall quality and efficiency of the railway transportation service, including the requirements on operation frequency, journey time, safety, reliability, comfort, environmental protection and efficiency, so as to set the goal for the overall quality and efficiency of the railway system</li> <li>◆ Apply electrical and mechanical engineering techniques and management skills to formulate an overall operation and repair policy and plan for the railway system according to the goal for the quality and efficiency of the railway system maintenance and repair, with the following included: <ul style="list-style-type: none"> <li>• Strategy to continuously improve the methods of operation and repair</li> </ul> </li> </ul>	

	<ul style="list-style-type: none"> <li>• Strategy of maintenance and repair unit structure management</li> <li>• Human resources management strategy</li> <li>• Strategy to introduce and apply new technologies</li> <li>• Cost-effectiveness strategy</li> <li>• Risk management strategy</li> <li>• Communication channels</li> </ul> <ul style="list-style-type: none"> <li>◆ Formulate mechanisms to measure, review and improve the railway system operation and repair management policy and plan</li> </ul>
6.3	<p>Professionalism in formulating an overall operation and repair policy and plan for the railway system</p> <ul style="list-style-type: none"> <li>◆ Formulate an overall operation and repair policy and plan for the railway system according to the standards and requirements for safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice when formulating an overall operation and repair policy and plan for the railway system</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to analyze and evaluate effectively data of railway main line failures, and formulate an overall operation and repair policy and plan for the railway system; and</p> <p>(ii) Capable to formulate effective mechanisms to measure, review and improve the overall operation and repair policy and plan for the railway system.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses the expertise in electrical and mechanical works in various disciplines and operation management.</p>

1. Title	Formulate an overall maintenance policy and plan for the railway system	
2. Code	EMRAMA701A	
3. Range	Formulate an overall maintenance policy and plan for the railway system, including the design and division of work of its overall maintenance system, so as to respond to the requirements on the overall quality and efficiency of the railway transportation service.	
4. Level	7	
5. Credits	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Studies and skills to formulate an overall maintenance policy and plan for the railway system</p> <ul style="list-style-type: none"> <li>◆ Master the expertise, including electrical and mechanical knowledge, in railway works in various disciplines, and apply the expertise to review, analyze, consolidate and evaluate the performance and trend data of the entire railway system, and to formulate an overall maintenance policy and plan</li> <li>◆ Master the skills in analyzing customers' requirements, development trend and culture of railway transportation service</li> <li>◆ Master the expertise in professional management and human relationship and the skills in coordinating railway operational departments</li> <li>◆ Master the skills in analyzing, reformatting and evaluating performance data of railway system equipment, and apply such skills to judge, formulate and review the effectiveness of the train maintenance policy and plan</li> </ul> <p>6.2 Methods and procedures of formulating an overall maintenance policy and plan for the railway system</p> <ul style="list-style-type: none"> <li>◆ Apply electrical and mechanical maintenance techniques and management knowledge to analyze the requirements on the overall quality and efficiency of the railway transportation service, including the requirements on operation frequency, journey time, safety, reliability, comfort, environmental protection and efficiency, so as to set the goal for the overall quality and efficiency of train maintenance</li> <li>◆ Master the development trend of customers' requirements on railway service quality and efficiency</li> <li>◆ Apply electrical and mechanical engineering techniques and management skills to formulate an innovative overall maintenance policy and plan for the railway system according to the goal for the quality and efficiency of railway system maintenance, with the following included: <ul style="list-style-type: none"> <li>• Strategy to continuously improve the methods of maintenance</li> </ul> </li> </ul>	

	<ul style="list-style-type: none"> <li>• Strategy of maintenance unit structure management</li> <li>• Human resources management strategy</li> <li>• Strategy to introduce and apply new technologies</li> <li>• Cost-effectiveness strategy</li> <li>• Risk management strategy</li> <li>• Communication channels</li> </ul> <ul style="list-style-type: none"> <li>◆ Formulate mechanisms to measure, review and improve the maintenance management policy and plan</li> </ul>
6.3	<p>Professionalism in formulating an overall maintenance policy and plan for the railway system</p> <ul style="list-style-type: none"> <li>◆ Formulate an overall maintenance policy and plan for the railway system according to the standards and requirements for safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice when formulating an overall maintenance policy and plan for the railway system</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to formulate an innovative overall maintenance policy and plan for the railway system; and</p> <p>(ii) Capable to formulate effective mechanisms to measure, review and improve the overall maintenance policy and plan for the railway system.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses the expertise in electrical and mechanical works in various disciplines and operation management.</p>

1. Title	Formulate overall operation development direction and strategy	
2. Code	EMCUOM701A	
3. Range	With regard to electrical and mechanical engineering operation management, understand the social conditions, fully master the development trend of the industry as well as the goals and present situation of the organization so as to formulate an overall operation development direction and strategy for the organization; handle very complex / new issues in the absence of complete/consistent data/information, and develop creative response.	
4. Level	7	
5. Credit	20	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of social, electrical and mechanical industry's environment</p> <ul style="list-style-type: none"> <li>◆ Understand the development trends of society and the electrical and mechanical trade</li> <li>◆ Understand clearly the influence of legislations, especially ordinances related to safety, health and environmental protection, on the industry</li> <li>◆ Master social and economic information</li> </ul> <p>6.2 Formulate overall operation development direction and strategy</p> <ul style="list-style-type: none"> <li>◆ Analyze strengths of the organization <ul style="list-style-type: none"> <li>• Use analytical tools to analyze strengths of the organization in operation management, occupational safety and health and environmental protection, quality management, human resources management, financial management, product development management and risk management</li> <li>• Use internal questionnaire survey for analysis and reference</li> <li>• Use the comparison with industrial benchmarking for analysis and reference</li> </ul> </li> <li>◆ Formulate development goals for the organization according to the analysis of the its strengths, the social and industrial environment and trend, and stakeholders' needs</li> <li>◆ Use operation management techniques to formulate an overall operation development direction and strategy according to development goals, including: <ul style="list-style-type: none"> <li>• Business development strategy</li> <li>• Business operation strategy</li> <li>• Human resources management strategy</li> <li>• Financial strategy</li> <li>• Product development strategy</li> <li>• Risk management strategy</li> <li>• Communication channels</li> </ul> </li> </ul>	

	<ul style="list-style-type: none"> <li>◆ Formulate mechanisms to measure, review and improve the operation development direction and strategy</li> <li>◆ Lead the organization for a forward-looking development according to the following social and industrial changes <ul style="list-style-type: none"> <li>• Product or service requirements</li> <li>• Technological development</li> <li>• Human resources and all kinds of costs in comparison with competitors or the region</li> </ul> </li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> <li>(i) Capable to formulate an overall operation development direction and strategy according to the situation of an electrical and mechanical organization;</li> <li>(ii) Capable to formulate for the organization mechanisms to measure, review and improve the operation development direction and strategy; and</li> <li>(iii) Capable to lead the organization for a forward-looking development according to social and industrial changes.</li> </ul>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses knowledge of engineering operation management.</p>

1. Title	Formulate policies on the safety, reliability, comfort, environmental protection and efficiency of the entire railway system	
2. Code	EMRAOM701A	
3. Range	Analyze customers' requirements and development trend of railway transportation service; draw up development goals for the railway system; and formulate policies on the safety, reliability, comfort, environmental protection and efficiency of the entire railway system.	
4. Level	7	
5. Credits	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Studies and skills to enhance the safety, reliability, comfort, environmental protection and efficiency of the entire railway system</p> <ul style="list-style-type: none"> <li>◆ Master the expertise, including electrical and mechanical knowledge, in railway works in various disciplines, and apply the expertise to review, analyze, consolidate and evaluate the performance and trend data of the entire railway system, in order to formulate a policy on performance enhancement</li> <li>◆ Master the skills in analyzing customers' requirements, development trend and culture of railway transportation service</li> <li>◆ Master the expertise in professional management and human relationship and the skills in coordinating railway operational departments</li> <li>◆ Master the skills in analyzing, reformatting and evaluating performance data of various railway system equipment, and apply such skills to judge, formulate and review the effectiveness of the enhancement plan</li> </ul> <p>6.2 Methods and procedures of formulating a policy on the safety, reliability, comfort, environmental protection and efficiency of the entire railway system</p> <ul style="list-style-type: none"> <li>◆ Capable to analyze customers' requirements and development trend of railway transportation service and, considering the capability of the organization, draw up the development goals for the entire railway system with relevant departments</li> <li>◆ Capable to identify and confirm the deviations between the development goals and the existing level of the entire railway system</li> <li>◆ Capable to review, analyze, consolidate and evaluate the deviations between the development goals and the existing level of the entire railway system as well as the capability of the organization; apply the knowledge of railway works and operation management to formulate a policy for the entire railway system, including: <ul style="list-style-type: none"> <li>• Strategy to upgrade system design</li> <li>• Strategy to upgrade maintenance method</li> </ul> </li> </ul>	

	<ul style="list-style-type: none"> <li>• Strategy to improve departmental structure</li> <li>• Cost-effectiveness strategy</li> <li>• Manpower training strategy</li> <li>• Risk management strategy</li> <li>• Communication channels</li> </ul> <ul style="list-style-type: none"> <li>◆ Capable to formulate mechanisms to measure, review and improve the maintenance management policy and plan</li> </ul> <p>6.3 Professionalism in formulating performance a policy for the entire railway system</p> <ul style="list-style-type: none"> <li>◆ Formulate a policy on the safety, reliability, comfort, environmental protection and efficiency of the entire railway system according to the standards and requirements for safety, health, environmental protection and quality management of railway works</li> <li>◆ Understand the safety guidelines as required by the law and codes of practice when formulating a policy on the safety, reliability, comfort, environmental protection and efficiency of the entire railway system</li> </ul>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to formulate an effective policy on the safety, reliability, comfort, environmental protection and efficiency of the entire railway system; and</p> <p>(ii) Capable to formulate effective mechanisms to measure, review and improve the effectiveness of the entire railway system policy.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses the expertise in electrical and mechanical works in various disciplines and operation management.</p>

# **Appendix I**

## **Generic Level Descriptors**

**Generic Level Descriptors**

<b>Level</b>	<b>Knowledge &amp; Intellectual Skills</b>	<b>Processes</b>	<b>Application, Autonomy &amp; Accountability</b>	<b>Communications, IT &amp; Numeracy</b>
1	<ul style="list-style-type: none"> <li>- Employ recall and demonstrate elementary comprehension in a narrow range of areas with dependency on ideas of others</li> <li>- Exercise basic skills</li> <li>- Receive and pass on information</li> <li>- Use, under supervision or prompting, basic tools and materials.</li> <li>- Apply learnt responses to solve problems</li> <li>- Operate in familiar, personal and/or everyday contexts</li> <li>- Take some account, with prompting, of identified consequences of actions.</li> </ul>	<ul style="list-style-type: none"> <li>- Operate mainly in closely defined and highly structured contexts</li> <li>- Carry out processes that are repetitive and predictable</li> <li>- Undertake the performance of clearly defined tasks</li> <li>- Assume a strictly limited range of roles.</li> </ul>	<ul style="list-style-type: none"> <li>- The ability to perform tasks of routine and repetitive nature given clear direction</li> <li>- Carry out directed activity under close supervision</li> <li>- Rely entirely on external monitoring of output and quality</li> </ul>	<ul style="list-style-type: none"> <li>- Use very simple skills with assistance — for example:</li> <li>- Take some part in discussions about straightforward subjects</li> <li>- Read and identify the main points and ideas from documents about straightforward subjects</li> <li>- Produce and respond to a limited range of simple, written and oral communications, in familiar/routine contexts</li> <li>- Carry out a limited range of simple tasks to process data and access information</li> <li>- Use a limited range of very simple and familiar numerical and pictorial data</li> <li>- Carry out calculations, using whole numbers and simple decimals to given levels of accuracy.</li> </ul>

**Generic Level Descriptors**

<b>Level</b>	<b>Knowledge &amp; Intellectual Skills</b>	<b>Processes</b>	<b>Application, Autonomy &amp; Accountability</b>	<b>Communications, IT &amp; Numeracy</b>
2	<ul style="list-style-type: none"> <li>- Apply knowledge based on an underpinning comprehension in a selected number of areas</li> <li>- Make comparisons with some valuation and interpret available information</li> <li>- Apply basic tools and materials and use rehearsed stages for solving problems.</li> <li>- Operate in familiar, personal and/or everyday contexts</li> <li>- Take account the identified consequences of actions.</li> </ul>	<ul style="list-style-type: none"> <li>- Choose from a range of procedures performed in a number of contexts, a few of which may be non-routine</li> <li>- Co-ordinate with others to achieve common goals.</li> </ul>	<ul style="list-style-type: none"> <li>- The ability to perform a range of tasks in predictable and structured contexts</li> <li>- Undertake directed activity with a degree of autonomy</li> <li>- Achieve outcomes within time constraints</li> <li>- Accept defined responsibility for quantity and quality of output subject to external quality checking.</li> </ul>	<ul style="list-style-type: none"> <li>- Use skills with some assistance—for example:</li> <li>- Take active part in discussions about identified subjects</li> <li>- Identify the main points and ideas from documents and reproduce them in other contexts</li> <li>- Produce and respond to a specified range of written and oral communications, in familiar/routine contexts</li> <li>- Carry out a defined range of tasks to process data and access information</li> <li>- Use a limited range of familiar numerical and graphical data in everyday contexts</li> <li>- Carry out calculations, using percentages and graphical data to given levels of accuracy.</li> </ul>

**Generic Level Descriptors**

<b>Level</b>	<b>Knowledge &amp; Intellectual Skills</b>	<b>Processes</b>	<b>Application, Autonomy &amp; Accountability</b>	<b>Communications, IT &amp; Numeracy</b>
3	<ul style="list-style-type: none"> <li>- Apply knowledge and skills in a range of activities, demonstrating comprehension of relevant theories</li> <li>- Access, organize and evaluate information independently and make reasoned judgements in relation to a subject or discipline</li> <li>- Employ a range of responses to well defined, but sometimes unfamiliar or unpredictable, problems</li> <li>- Make generalizations and predictions in familiar contexts.</li> </ul>	<ul style="list-style-type: none"> <li>- Operate in a variety of familiar and some unfamiliar contexts, using a known range of technical or learning skills</li> <li>- Select from a considerable choice of predetermined procedures</li> <li>- Give presentations to an audience</li> </ul>	<ul style="list-style-type: none"> <li>- The ability to perform tasks in a broad range of predictable and structured contexts which may also involve some non-routine activities requiring a degree of individual responsibility</li> <li>- Engage in self-directed activity with guidance/evaluation</li> <li>- Accept responsibility for quantity and quality of output</li> <li>- Accept well defined but limited responsibility for the quantity and quality of the output of others</li> </ul>	<ul style="list-style-type: none"> <li>- Use a wide range of largely routine and well practiced skills — for example:</li> <li>- Produce and respond to detailed and complex written and oral communication in familiar contexts, and use a suitable structure and style when writing extended documents.</li> <li>- Select and use standard applications to obtain, process and combine information</li> <li>- Use a wide range of numerical and graphical data in routine contexts, which may have some non-routine elements.</li> </ul>

**Generic Level Descriptors**

<b>Level</b>	<b>Knowledge &amp; Intellectual Skills</b>	<b>Processes</b>	<b>Application, Autonomy &amp; Accountability</b>	<b>Communications, IT &amp; Numeracy</b>
4	<ul style="list-style-type: none"> <li>- Develop a rigorous approach to the acquisition of a broad knowledge base, with some specialist knowledge in selected areas</li> <li>- Present and evaluate information, using it to plan and develop investigative strategies</li> <li>- Deal with well defined issues within largely familiar contexts, but extend this to some unfamiliar problems</li> <li>- Employ a range of specialised skills and approaches to generate a range of responses.</li> </ul>	<ul style="list-style-type: none"> <li>- Operate in a range of varied and specific contexts involving some creative and non-routine activities</li> <li>- Exercise appropriate judgement in planning, selecting or presenting information, methods or resources</li> <li>- Carry out routine lines of enquiry, development of investigation into professional level issues and problems.</li> </ul>	<ul style="list-style-type: none"> <li>- The ability to perform skilled tasks requiring some discretion and judgement, and undertake a supervisory role</li> <li>- Undertake self-directed and a some directive activity</li> <li>- Operate within broad general guidelines or functions</li> <li>- Take responsibility for the nature and quantity of own outputs</li> <li>- Meet specified quality standards</li> <li>- Accept some responsibility for the quantity and quality of the output of others.</li> </ul>	<ul style="list-style-type: none"> <li>- Use a wide range of routine skills and some advanced skills associated with the subject/discipline — for example:</li> <li>- Present using a range of techniques to engage the audience in both familiar and some new contexts</li> <li>- Read and synthesize extended information from subject documents; organize information coherently, convey complex ideas in well-structured form</li> <li>- Use a range of IT applications to support and enhance work</li> <li>- Plan approaches to obtaining and using information, choose appropriate methods and data to justify results &amp; choices</li> <li>- Carry out multi-stage calculations.</li> </ul>

**Generic Level Descriptors**

<b>Level</b>	<b>Knowledge &amp; Intellectual Skills</b>	<b>Processes</b>	<b>Application, Autonomy &amp; Accountability</b>	<b>Communications, IT &amp; Numeracy</b>
5	<ul style="list-style-type: none"> <li>- Generate ideas through the analysis of abstract information and concepts</li> <li>- Command wide ranging, specialized technical, creative and/or conceptual skills</li> <li>- Identify and analyse both routine and abstract professional problems and issues, and formulate evidence-based responses</li> <li>- Analyse, reformat and evaluate a wide range of information</li> <li>- Critically analyse, evaluate and/or synthesize ideas, concepts, information and issues</li> <li>- Draw on a range of sources in making judgments.</li> </ul>	<ul style="list-style-type: none"> <li>- Utilise diagnostic and creative skills in a range of technical, professional or management functions</li> <li>- Exercise appropriate judgement in planning, design, technical and/or supervisory functions related to products, services, operations or processes.</li> </ul>	<ul style="list-style-type: none"> <li>- Perform tasks involving planning, design, and technical skills, and involving some management functions</li> <li>- Accept responsibility and accountability within broad parameters for determining and achieving personal and/or group outcomes</li> <li>- Work under the mentoring of senior qualified practitioners</li> <li>- Deal with ethical issues, seeking guidance of others where appropriate.</li> </ul>	<ul style="list-style-type: none"> <li>- Use a range of routine skills and some advanced and specialized skills in support of established practices in a subject/discipline, for example:</li> <li>- Make formal and informal presentations on standard/mainstream topics in the subject/discipline to a range of audiences</li> <li>- Participate in group discussions about complex subjects; create opportunities for others to contribute</li> <li>- Use a range of IT applications to support and enhance work</li> <li>- Interpret, use and evaluate numerical and graphical data to achieve goals/targets.</li> </ul>

**Generic Level Descriptors**

<b>Level</b>	<b>Knowledge &amp; Intellectual Skills</b>	<b>Processes</b>	<b>Application, Autonomy &amp; Accountability</b>	<b>Communications, IT &amp; Numeracy</b>
6	<ul style="list-style-type: none"> <li>- Critically review, consolidate, and extend a systematic, coherent body of knowledge</li> <li>- Utilise highly specialised technical research or scholastic skills across an area of study</li> <li>- Critically evaluate new information, concepts and evidence from a range of sources and develop creative responses</li> <li>- Critically review, consolidate and extend knowledge, skills practices and thinking in a subject/discipline</li> <li>- Deal with complex issues and make informed judgements in the absence of complete or consistent data/information.</li> </ul>	<ul style="list-style-type: none"> <li>- Transfer and apply diagnostic and creative skills in a range of situations</li> <li>- Exercise appropriate judgement in complex planning, design, technical and/or management functions related to products, services operations or processes, including resourcing and evaluation</li> <li>- Conduct research, and/or advanced technical or professional activity</li> <li>- Design and apply appropriate research methodologies.</li> </ul>	<ul style="list-style-type: none"> <li>- Apply knowledge and skills in a broad range of professional work activities</li> <li>- Practice significant autonomy in determining and achieving personal and/or group outcomes</li> <li>- Accept accountability in related decision making including use of supervision</li> <li>- Demonstrate leadership and /or make an identifiable contribution to change and development.</li> </ul>	<ul style="list-style-type: none"> <li>- Communicate, using appropriate methods, to a range of audiences including peers, senior colleagues, specialists</li> <li>- Use a wide range of software to support and enhance work; identify refinements to existing software to increase effectiveness or specify new software</li> <li>- Undertake critical evaluations of a wide range of numerical and graphical data, and use calculations at various stages of the work.</li> </ul>

**Generic Level Descriptors**

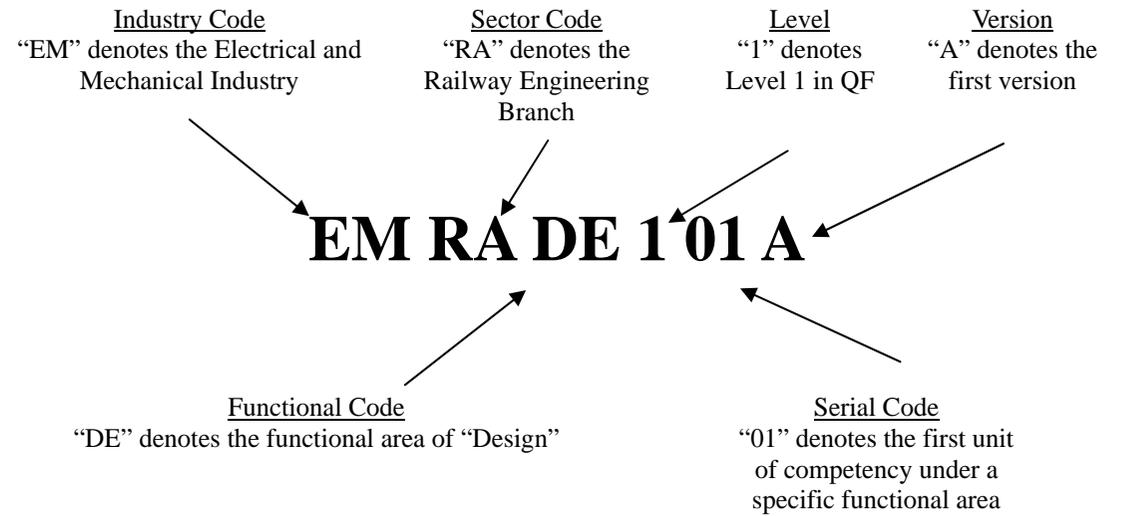
<b>Level</b>	<b>Knowledge &amp; Intellectual Skills</b>	<b>Processes</b>	<b>Application, Autonomy &amp; Accountability</b>	<b>Communications, IT &amp; Numeracy</b>
7	<ul style="list-style-type: none"> <li>- Demonstrate and work with a critical overview of a subject or discipline, including an evaluative understanding of principal theories and concepts, and of its broad relationships with other disciplines</li> <li>- Identify, conceptualise and offer original and creative insights into new, complex and abstract ideas and information</li> <li>- Deal with very complex and/or new issues and make informed judgements in the absence of complete or consistent data/information</li> <li>- Make a significant and original contribution to a specialised field of inquiry, or to broader interdisciplinary relationships.</li> </ul>	<ul style="list-style-type: none"> <li>- Demonstrate command of research and methodological issues and engage in critical dialogue</li> <li>- Develop creative and original responses to problems and issues in the context of new circumstances.</li> </ul>	<ul style="list-style-type: none"> <li>- Apply knowledge and skills in a broad range of complex and professional work activities, including new and unforeseen circumstances</li> <li>- Demonstrate leadership and originality in tackling and solving problems</li> <li>- Accept accountability in related decision making</li> <li>- High degree of autonomy, with full responsibility for own work, and significant responsibility for others</li> <li>- Deal with complex ethical and professional issues.</li> </ul>	<ul style="list-style-type: none"> <li>- Strategically use communication skills, adapting context and purpose to a range of audiences</li> <li>- Communicate at the standard of published academic work and/or critical dialogue</li> <li>- Monitor, review and reflect on own work and skill development, and change and adapt in the light of new demands</li> <li>- Use a range of software and specify software requirements to enhance work, anticipating future requirements</li> <li>- Critically evaluate numerical and graphical data, and employ such data extensively.</li> </ul>

# **Appendix II**

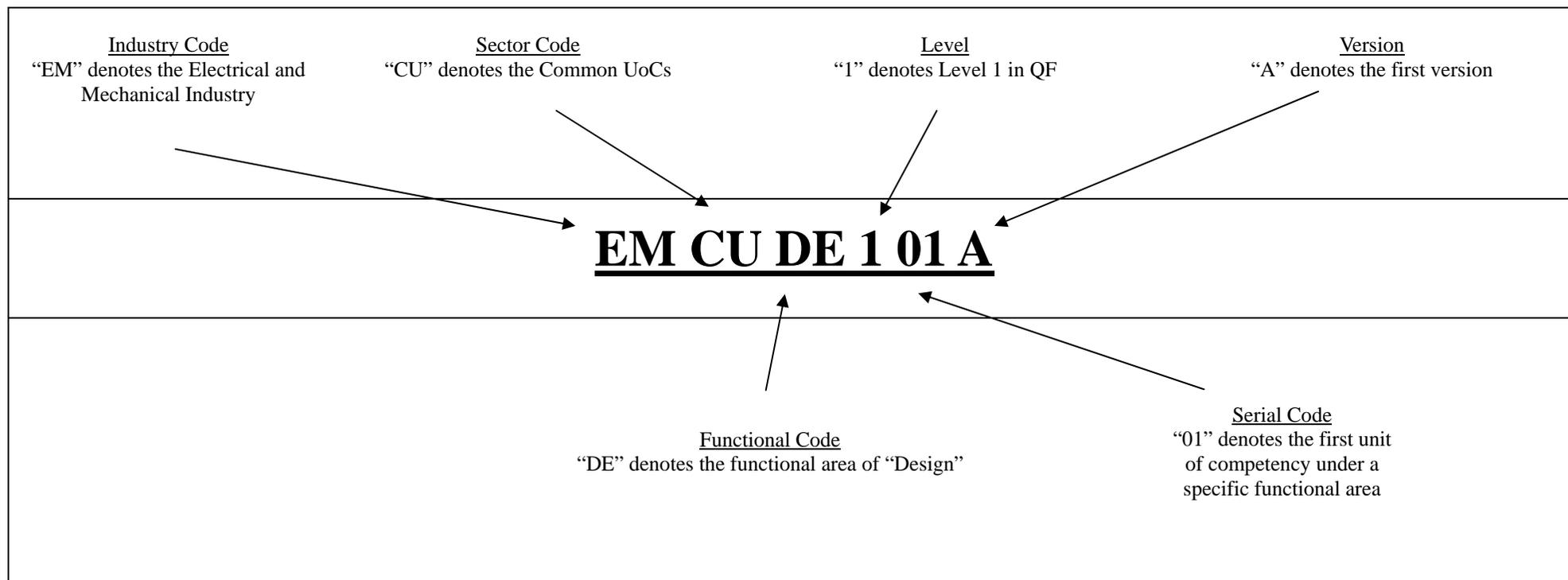
## **Coding Criteria**

**Coding Criteria**

	<b>Major Functional areas</b>	<b>Codes</b>
(i)	Design	DE
(ii)	Installation	IN
(iii)	Inspection, Testing and Commissioning	IT
(iv)	Operation and Repair	OR
(v)	Maintenance	MA
(vi)	Project Management	PM
(vii)	Operation Management	OM
(viii)	Safety, Health and Environment	SH
(ix)	Quality Management	QM



**Common UoCs Coding Criteria (The Common UoCs are applicable to other branches)**



- Remarks: 1) There is not space in the code.  
2) The code must be underlined.