

**Electrical & Mechanical Services
Industry**

**Air-conditioning and Refrigeration
Engineering Branch**

**Specification of Competency
Standards**

1st Edition

March 2009

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Chapter 1

Preface

Background of the Industry

Hong Kong is located at the sub-tropical region. It has a climate with high temperatures and humidity for most of the time and so the demand for air-conditioning and refrigeration equipment is very great. Along with the economic surge of the society and people's rising demand on living standard, air-conditioning and refrigeration engineering started to develop progressively since the 70's. Nowadays, practitioners of air-conditioning and refrigeration engineering play a vital role in regard to the socio-economic development of Hong Kong and the development of people's living quality.

2. Air-conditioning and refrigeration engineering is one of the major engineering branches of the electrical and mechanical industry in Hong Kong. Its scope of service includes the design, installation, maintenance and operation management of central air-conditioning systems, ventilation systems, large refrigeration systems and cold storage; and the installation and maintenance of unitary air-conditioners and small refrigeration systems.

3. In Hong Kong, there are no plants for manufacturing unitary air-conditioners, refrigerators, and air-conditioning and refrigeration equipment. Most of the air-conditioning and refrigeration equipment and parts are imported from abroad. The practitioners of the air-conditioning and refrigeration engineering branch in Hong Kong are mainly engaged in the design, installation, repair, maintenance, and operation of central air-conditioning systems and ventilation systems; installation and repair of unitary air-conditioners and refrigeration equipment; and the design, installation, repair, maintenance and operation of large refrigeration equipment and cold storage, etc.

Current Situation of the Industry

4. Air-conditioning and refrigeration engineering is one of the major branches of the electrical and mechanical industry in Hong Kong. Persons engaged in this branch account for a very large proportion of those engaged in the electrical and mechanical industry. Although the factories of the manufacturing industry in Hong Kong have migrated to the north in recent years, it has not affected the practitioners much because the branch of air-conditioning and refrigeration engineering belongs to service engineering. In fact, air-conditioning and refrigeration systems and equipment have become part of our daily life as people's demand for a comfortable living environment has been increasing with the rapid socio-economic development in recent years. In the past few decades, the vigorous development of the construction of real estates has brought about the rapid development of the discipline of air-conditioning and refrigeration engineering. With the endeavours of people engaged in the Industry, the quality of air-conditioning and refrigeration engineering works has reached the international standard and even comes first in Asia.

5. Along with the development of technology, the demand for energy-saving, environmental protection, indoor air quality management has been increasing in the society of Hong Kong. This brings about new business opportunities

for the branch of air-conditioning and refrigeration engineering. It also widens and consolidates the space for its development. The demand for different levels of professional and technical experts in the design, installation, maintenance and operation management of air-conditioning and refrigeration facilities is also increasing in Hong Kong.

Specification of Competency Standards

6. 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.

7. 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.

8. 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.

9. 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 –Air-conditioning and Refrigeration 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

10. 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.

11. 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.

12. 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.

13. 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

14. 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 to note 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.

15. 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 Air-conditioning and Refrigeration Sector

16. As proposed by the Electrical and Mechanical ITAC, functional areas of the air-conditioning and refrigeration Sector should focus on the professional skills of air-conditioning and refrigeration. The Specification of Competency Standards (SCS) may consist of the following major functional areas:

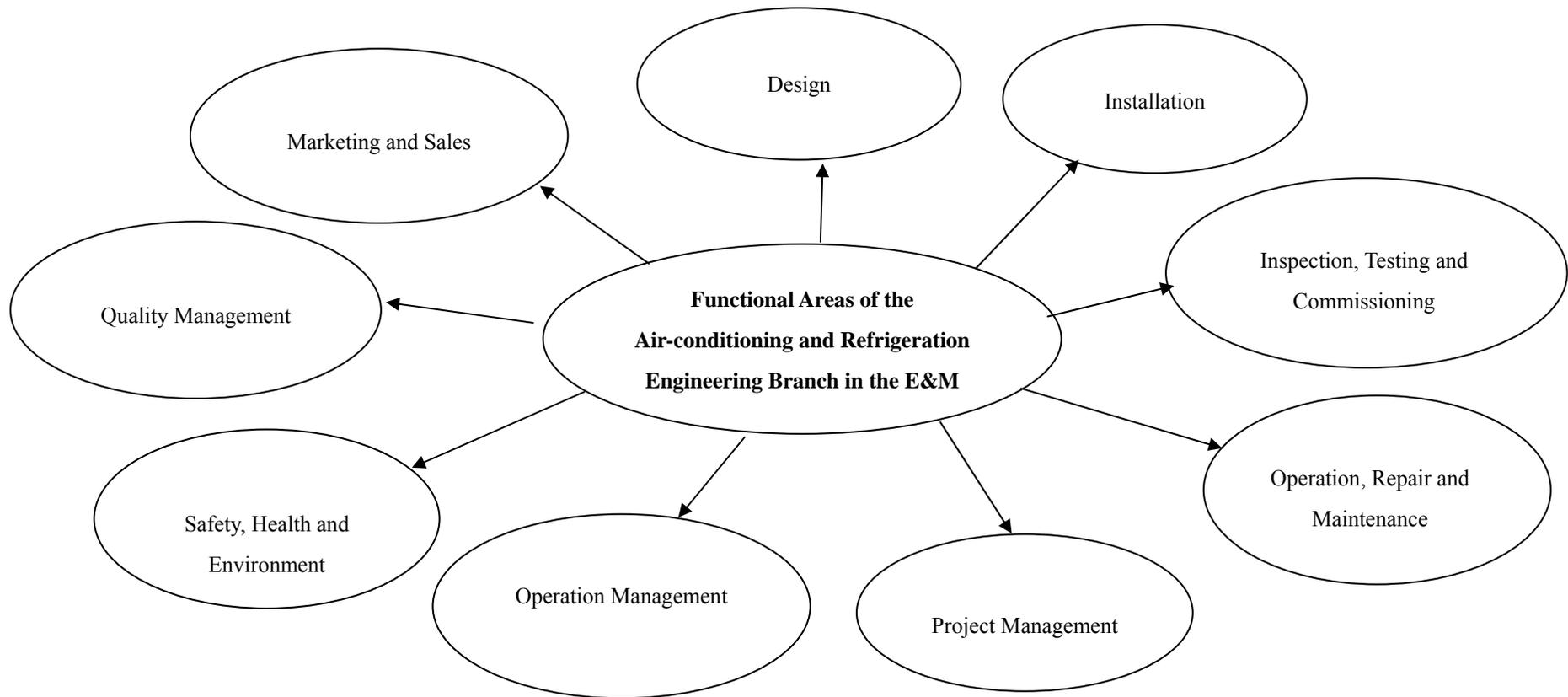
- (i) **Design**
This functional area covers the application of air-conditioning and refrigeration as well as electrical and mechanical related knowledge, technology, skills, design technique, and technical standards and parameters. Practitioners should be able to design, according to customer's requirements, environmental factors and legal requirements, highly effective, safe, reliable, healthy, environmental friendly and energy-saving air-conditioning and refrigeration systems and equipment that can fit in with relevant engineering facilities and systems. These air-conditioning and refrigeration systems and equipment include refrigerating, air-handling and electrical control systems, water systems, ventilation systems and equipment, cold storage, ice making and other refrigeration systems and equipment.
- (ii) **Installation**
This functional area requires practitioners to apply air-conditioning and refrigeration as well as electrical and mechanical related knowledge and installation skills to install various kinds of air-conditioning and refrigeration systems and equipment according to parameters and drawings of design, installation standards and specifications, codes of practice and regulations related to air-conditioning and refrigeration as well as electrical and mechanical engineering, so as to comply with the requirements of the law, customers and design.
- (iii) **Inspection, Testing and Commissioning**
This functional area requires practitioners to formulate and carry out testing procedures, to examine and commission system's functions and interlocking safety protection devices, and to adjust and set the systems and equipment so as to achieve the best performance and comply with the safety standard.
- (iv) **Operation, Repair and Maintenance**
This functional area requires practitioners to analyze the performance of the equipment components, and to apply air-conditioning and refrigeration as well as electrical and mechanical related knowledge in safe operation and monitoring of electrical and mechanical systems and equipment for air-conditioning and refrigeration. 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 also be able to analyze maintenance records and the condition of damaged components in order to formulate proposals on the enhancement of systems and equipment. They should make suitable arrangements to reduce the damage caused by equipment failure, and to master the troubleshooting technique and use testing instruments and equipment to locate the problems when there are any irregularities. They should be able to analyze fault records and phenomena and formulate proposals on the enhancement of systems and equipment.
- (v) **Project Management**
This functional area requires practitioners to apply knowledge of air-conditioning and refrigeration as well as electrical and mechanical project management in preparing cost estimates and tender documents, handling project contracts, formulating and controlling engineering processes and plans for air-conditioning and refrigeration projects, controlling the costs and resources, and enabling the project to complete within budget on time and meeting the pre-set quality requirements while conforming with the policies on environmental protection, energy saving and occupational safety and health.

- (vi) **Operation Management**
This functional area requires practitioners to apply enterprise management skills and follow the code of operation for the air-conditioning and refrigeration branch in formulating air-conditioning and refrigeration operation management system, manpower training schemes and environmental protection and safety policies so as to achieve effective enterprise management and to provide safe, healthy, environmental friendly and high quality air-conditioning and refrigeration engineering services.
- (vii) **Safety, Health and Environmental Protection**
This functional area requires practitioners to apply safety, health and environmental protection management knowledge and skills in formulating and implementing policies and codes of safety, health and environment protection according to relevant rules and regulations and the working environment of the sector, so as provide a safe, health and environmental friendly working and living environment for the staff, the users and the general public.
- (viii) **Quality Management**
This functional area requires practitioners to apply quality management knowledge and skills, air-conditioning and refrigeration engineering knowledge, and quality control and assurance methods to formulate and implement quality management systems and procedures for air-conditioning and refrigeration works, so as to ensure the quality of the air-conditioning and refrigeration engineering services.
- (ix) **Marketing and sales**
This functional area involves the application of specialized knowledge of air-conditioning and refrigeration engineering services and equipment. Practitioners should understand product performance, working plan and working process of the service, market demand and customer needs. They should also master marketing technique in order to formulate and implement effective marketing and promotion plans for sales and promotion of products and engineering services. They should be able to apply professional knowledge and skills in air-conditioning and refrigeration to provide product operation demonstration and after-sales service to customers.

Please refer to Diagram 1 for further information.

17. 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 Air-conditioning and Refrigeration Engineering Branch in the Electrical & Mechanical Services Industry



Competency Standards

18. 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

19. 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

20. 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.

21. Since in-house training has long been the major training opportunity for employees of the E&M industry, it is extremely difficult to determine whether such training has met the competency standards. Therefore, the ITAC will consult members of the industry to develop an appropriate RPL mechanism.

Chapter 4

Units of Competencies of the Air-conditioning and Refrigeration Engineering Branch in the Electrical & Mechanical Services Industry

List of Competencies of the Air-conditioning and Refrigeration Engineering Branch in the Electrical & Mechanical Services Industry

<u>Functional Areas</u>	<u>Design</u> <u>(DE)</u>	<u>Installation</u> <u>(IN)</u>	<u>Inspection, Testing and Commissioning</u> <u>(IT)</u>	<u>Operation, Repair and Maintenance</u> <u>(OR)</u>	<u>Project Management</u> <u>(PM)</u>	<u>Operation Management</u> <u>(OM)</u>	<u>Safety, Health and Environment</u> <u>(SH)</u>	<u>Quality Management</u> <u>(QM)</u>	<u>Marketing and Sales</u> <u>(MS)</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>
1		Use general personal protective equipment (3 Credits) <u>EMCUSH108A</u> (P.47)	Use general personal protective equipment (3 Credits) <u>EMCUSH108A</u> (P.47)	Use general personal protective equipment (3 Credits) <u>EMCUSH108A</u> (P.47)			Use general personal protective equipment (3 Credits) <u>EMCUSH108A</u> (P.47)		
		Perform manual handling operation (3 Credits) <u>EMCUSH109A</u> (P.48)	Perform manual handling operation (3 Credits) <u>EMCUSH109A</u> (P.48)	Perform manual handling operation (3 Credits) <u>EMCUSH109A</u> (P.48)			Perform manual handling operation (3 Credits) <u>EMCUSH109A</u> (P.48)		
		Comply with the legal requirements on electrical and mechanical occupational safety and health (3 Credits) <u>EMCUSH111A</u> (P.49)	Comply with the legal requirements on electrical and mechanical occupational safety and health (3 Credits) <u>EMCUSH111A</u> (P.49)	Comply with the legal requirements on electrical and mechanical occupational safety and health (3 Credits) <u>EMCUSH111A</u> (P.49)			Comply with the legal requirements on electrical and mechanical occupational safety and health (3 Credits) <u>EMCUSH111A</u> (P.49)		
		Comply with the legal requirements on environmental protection (3 Credits) <u>EMCUSH112A</u> (P.50)	Comply with the legal requirements on environmental protection (3 Credits) <u>EMCUSH112A</u> (P.50)	Comply with the legal requirements on environmental protection (3 Credits) <u>EMCUSH112A</u> (P.50)			Comply with the legal requirements on environmental protection (3 Credits) <u>EMCUSH112A</u> (P.50)		

Functional Areas	Design	Installation	Inspection, Testing and Commissioning	Operation, Repair and Maintenance	Project Management	Operation Management	Safety, Health and Environment	Quality Management	Marketing and Sales
	(DE)	(IN)	(IT)	(OR)	(PM)	(OM)	(SH)	(QM)	(MS)
QF Levels	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency
1		Handle general chemicals safely (3 Credits) <u>EMCUSH113A</u> (P.51)		Handle general chemicals safely (3 Credits) <u>EMCUSH113A</u> (P.51)			Handle general chemicals safely (3 Credits) <u>EMCUSH113A</u> (P.51)		
		Use general loading and lifting equipment (9 Credits) <u>EMCUIN102A</u> (P.52)		Use general loading and lifting equipment (9 Credits) <u>EMCUIN102A</u> (P.52)					
		Apply basic bench fitting techniques and use small typical hand tools (9 Credits) <u>EMCUIN106A</u> (P.54)	Apply basic bench fitting techniques and use small typical hand tools (9 Credits) <u>EMCUIN106A</u> (P.54)	Apply basic bench fitting techniques and use small typical hand tools (9 Credits) <u>EMCUIN106A</u> (P.54)					
		Use air-conditioning and refrigeration instruments and tools (3 Credits) <u>EMCUMA101A</u> (P.56)	Use air-conditioning and refrigeration instruments and tools (3 Credits) <u>EMCUMA101A</u> (P.56)	Use air-conditioning and refrigeration instruments and tools (3 Credits) <u>EMCUMA101A</u> (P.56)					
		Use typical electrical meters (3 Credits) <u>EMCUDE101A</u> (P.42)	Use typical electrical meters (3 Credits) <u>EMCUDE101A</u> (P.42)	Use typical electrical meters (3 Credits) <u>EMCUDE101A</u> (P.42)	Use typical electrical meters (3 Credits) <u>EMCUDE101A</u> (P.42)				

Functional Areas	Design	Installation	Inspection, Testing and Commissioning	Operation, Repair and Maintenance	Project Management	Operation Management	Safety, Health and Environment	Quality Management	Marketing and Sales
	(DE)	(IN)	(IT)	(OR)	(PM)	(OM)	(SH)	(QM)	(MS)
QF Levels	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency
1	Identify general properties of different types of typical electrical and mechanical engineering materials (3 Credits) <u>EMCUDE109A</u> (P.43)	Identify general properties of different types of typical electrical and mechanical engineering materials (3 Credits) <u>EMCUDE109A</u> (P.43)	Identify general properties of different types of typical electrical and mechanical engineering materials (3 Credits) <u>EMCUDE109A</u> (P.43)	Identify general properties of different types of typical electrical and mechanical engineering materials (3 Credits) <u>EMCUDE109A</u> (P.43)					
						Basic knowledge of electrical and mechanical services management (6 Credits) <u>EMCUOM102A</u> (P.59)		Perform quality assurance (3 Credits) <u>EMCUOM101A</u> (P.60)	
	Apply basic knowledge of air-conditioning and refrigeration systems (5 Credits) <u>EMACDE101A</u> (P.44)	Apply basic knowledge of air-conditioning and refrigeration systems (5 Credits) <u>EMACDE101A</u> (P.44)	Apply basic knowledge of air-conditioning and refrigeration systems (5 Credits) <u>EMACDE101A</u> (P.44)	Apply basic knowledge of air-conditioning and refrigeration systems (5 Credits) <u>EMACDE101A</u> (P.44)	Apply basic knowledge of air-conditioning and refrigeration systems (5 Credits) <u>EMACDE101A</u> (P.44)	Apply basic knowledge of air-conditioning and refrigeration systems (5 Credits) <u>EMACDE101A</u> (P.44)	Apply basic knowledge of air-conditioning and refrigeration systems (5 Credits) <u>EMACDE101A</u> (P.44)		Apply basic knowledge of air-conditioning and refrigeration systems (5 Credits) <u>EMACDE101A</u> (P.44)
	Apply basic knowledge of ventilation systems (3 Credits) <u>EMACDE102A</u> (P.46)	Apply basic knowledge of ventilation systems (3 Credits) <u>EMACDE102A</u> (P.46)	Apply basic knowledge of ventilation systems (3 Credits) <u>EMACDE102A</u> (P.46)	Apply basic knowledge of ventilation systems (3 Credits) <u>EMACDE102A</u> (P.46)	Apply basic knowledge of ventilation systems (3 Credits) <u>EMACDE102A</u> (P.46)	Apply basic knowledge of ventilation systems (3 Credits) <u>EMACDE102A</u> (P.46)	Apply basic knowledge of ventilation systems (3 Credits) <u>EMACDE102A</u> (P.46)		Apply basic knowledge of ventilation systems (3 Credits) <u>EMACDE102A</u> (P.46)

Functional Areas	Design	Installation	Inspection, Testing and Commissioning	Operation, Repair and Maintenance	Project Management	Operation Management	Safety, Health and Environment	Quality Management	Marketing and Sales
	(DE)	(IN)	(IT)	(OR)	(PM)	(OM)	(SH)	(QM)	(MS)
QF Levels	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency
1		Perform basic fabrication of metallic air ducts (3 Credits) EMACIN101A (P.58)							
2	Use computer to draw mechanical drawings (8 Credits) EMCUDE212A (P.62)	Use computer to draw mechanical drawings (8 Credits) EMCUDE212A (P.62)	Use computer to draw mechanical drawings (8 Credits) EMCUDE212A (P.62)	Use computer to draw mechanical drawings (8 Credits) EMCUDE212A (P.62)	Use computer to draw mechanical drawings (8 Credits) EMCUDE212A (P.62)				
		Perform general electrical assembly and fitting (6 Credits) EMCUIN201A (P.63)							
				Non-destructive test (NDT) - magnetic particle inspection (2 Credits) EMCUMA201A (P.64)					
				Non-destructive test (NDT) - ultrasonic testing (3 Credits) EMCUMA202A (P.65)					

Functional Areas	<u>Design</u>	<u>Installation</u>	<u>Inspection, Testing and Commissioning</u>	<u>Operation, Repair and Maintenance</u>	<u>Project Management</u>	<u>Operation Management</u>	<u>Safety, Health and Environment</u>	<u>Quality Management</u>	<u>Marketing and Sales</u>
	<u>(DE)</u>	<u>(IN)</u>	<u>(IT)</u>	<u>(OR)</u>	<u>(PM)</u>	<u>(OM)</u>	<u>(SH)</u>	<u>(QM)</u>	<u>(MS)</u>
QF Levels	<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>				
2	Apply commonly used regulations and international standards relevant to electrical installations (6 Credits) <u>EMCUIT203A</u> (P.66)	Apply commonly used regulations and international standards relevant to electrical installations (6 Credits) <u>EMCUIT203A</u> (P.66)	Apply commonly used regulations and international standards relevant to electrical installations (6 Credits) <u>EMCUIT203A</u> (P.66)	Apply commonly used regulations and international standards relevant to electrical installations (6 Credits) <u>EMCUIT203A</u> (P.66)	Apply commonly used regulations and international standards relevant to electrical installations (6 Credits) <u>EMCUIT203A</u> (P.66)				
	Apply effective communication skills in discussions of electrical and mechanical issues (3 Credits) <u>EMCUOM204A</u> (P.67)	Apply effective communication skills in discussions of electrical and mechanical issues (3 Credits) <u>EMCUOM204A</u> (P.67)	Apply effective communication skills in discussions of electrical and mechanical issues (3 Credits) <u>EMCUOM204A</u> (P.67)	Apply effective communication skills in discussions of electrical and mechanical issues (3 Credits) <u>EMCUOM204A</u> (P.67)	Apply effective communication skills in discussions of electrical and mechanical issues (3 Credits) <u>EMCUOM204A</u> (P.67)	Apply effective communication skills in discussions of electrical and mechanical issues (3 Credits) <u>EMCUOM204A</u> (P.67)	Apply effective communication skills in discussions of electrical and mechanical issues (3 Credits) <u>EMCUOM204A</u> (P.67)	Apply effective communication skills in discussions of electrical and mechanical issues (3 Credits) <u>EMCUOM204A</u> (P.67)	Apply effective communication skills in discussions of electrical and mechanical issues (3 Credits) <u>EMCUOM204A</u> (P.67)
							Apply basic risk assessment methods (3 Credits) <u>EMCUSH205A</u> (P.107)		
							Implement work site occupational health and safety management (3 Credits) <u>EMCUSH206A</u> (P.108)		

Functional Areas	Design	Installation	Inspection, Testing and Commissioning	Operation, Repair and Maintenance	Project Management	Operation Management	Safety, Health and Environment	Quality Management	Marketing and Sales
	(DE)	(IN)	(IT)	(OR)	(PM)	(OM)	(SH)	(QM)	(MS)
QF Levels	Unit of Competency	Unit of Competency	Unit of Competency						
2							Handle general industrial accidents (3 Credits) <u>EMCUSH208A</u> (P.109)		
							Obtain data and information of occupational safety and health and environmental protection to compile relevant statistics (3 Credits) <u>EMCUSH211A</u> (P.110)		
							Implement preventive measures on general occupational safety and health (3 Credits) <u>EMCUSH212A</u> (P.111)		
	Draw simple air-conditioning and refrigeration engineering drawings (9 Credits) <i>EMACDE201A</i> (P.68)	Draw simple air-conditioning and refrigeration engineering drawings (9 Credits) <i>EMACDE201A</i> (P.68)	Draw simple air-conditioning and refrigeration engineering drawings (9 Credits) <i>EMACDE201A</i> (P.68)	Draw simple air-conditioning and refrigeration engineering drawings (9 Credits) <i>EMACDE201A</i> (P.68)	Draw simple air-conditioning and refrigeration engineering drawings (9 Credits) <i>EMACDE201A</i> (P.68)	Draw simple air-conditioning and refrigeration engineering drawings (9 Credits) <i>EMACDE201A</i> (P.68)			Draw simple air-conditioning and refrigeration engineering drawings (9 Credits) <i>EMACDE201A</i> (P.68)

Functional Areas	Design	Installation	Inspection, Testing and Commissioning	Operation, Repair and Maintenance	Project Management	Operation Management	Safety, Health and Environment	Quality Management	Marketing and Sales
	(DE)	(IN)	(IT)	(OR)	(PM)	(OM)	(SH)	(QM)	(MS)
QF Levels	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency
2	Apply basic knowledge of central air-conditioning systems (6 Credits) <i>EMACDE202A</i> (P.70)	Apply basic knowledge of central air-conditioning systems (6 Credits) <i>EMACDE202A</i> (P.70)	Apply basic knowledge of central air-conditioning systems (6 Credits) <i>EMACDE202A</i> (P.70)	Apply basic knowledge of central air-conditioning systems (6 Credits) <i>EMACDE202A</i> (P.70)	Apply basic knowledge of central air-conditioning systems (6 Credits) <i>EMACDE202A</i> (P.70)				
	Apply basic knowledge of automatic control for air-conditioning and refrigeration systems (6 Credits) <i>EMACDE203A</i> (P.72)	Apply basic knowledge of automatic control for air-conditioning and refrigeration systems (6 Credits) <i>EMACDE203A</i> (P.72)	Apply basic knowledge of automatic control for air-conditioning and refrigeration systems (6 Credits) <i>EMACDE203A</i> (P.72)	Apply basic knowledge of automatic control for air-conditioning and refrigeration systems (6 Credits) <i>EMACDE203A</i> (P.72)					
		Perform refrigeration copper tubing work (4 Credits) <i>EMACIN201A</i> (P.77)		Perform refrigeration copper tubing work (4 Credits) <i>EMACIN201A</i> (P.77)					
		Wire up electrical control circuit of a fan coil unit (6 Credits) <i>EMACIN202A</i> (P.78)		Wire up electrical control circuit of a fan coil unit (6 Credits) <i>EMACIN202A</i> (P.78)					

<u>Functional Areas</u>	<u>Design</u>	<u>Installation</u>	<u>Inspection, Testing and Commissioning</u>	<u>Operation, Repair and Maintenance</u>	<u>Project Management</u>	<u>Operation Management</u>	<u>Safety, Health and Environment</u>	<u>Quality Management</u>	<u>Marketing and Sales</u>
	<u>(DE)</u>	<u>(IN)</u>	<u>(IT)</u>	<u>(OR)</u>	<u>(PM)</u>	<u>(OM)</u>	<u>(SH)</u>	<u>(QM)</u>	<u>(MS)</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>
2		Perform basic installation of condensate drain pipes for air-conditioning and refrigeration systems (3 Credits) <i>EMACIN208A</i> (P.80)		Perform basic installation of condensate drain pipes for air-conditioning and refrigeration systems (3 Credits) <i>EMACIN208A</i> (P.80)					
		Perform basic wiring up of electrical control circuit of air-handling units (3 Credits) <i>EMACIN209A</i> (P.81)		Perform basic wiring up of electrical control circuit of air-handling units (3 Credits) <i>EMACIN209A</i> (P.81)					
		Perform basic wiring of electric motor starting circuits for air-conditioning and refrigeration (3 Credits) <i>EMACIN210A</i> (P.82)		Perform basic wiring of electric motor starting circuits for air-conditioning and refrigeration (3 Credits) <i>EMACIN210A</i> (P.82)					
		Wire up pressure control and pump down control circuits of refrigeration system (3 Credits) <i>EMACIN211A</i> (P.83)		Wire up pressure control and pump down control circuits of refrigeration system (3 Credits) <i>EMACIN211A</i> (P.83)					

Functional Areas	Design	Installation	Inspection, Testing and Commissioning	Operation, Repair and Maintenance	Project Management	Operation Management	Safety, Health and Environment	Quality Management	Marketing and Sales
	(DE)	(IN)	(IT)	(OR)	(PM)	(OM)	(SH)	(QM)	(MS)
QF Levels	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency
2		Perform basic testing of electrical wiring for air-conditioning and refrigeration (3 Credits) <i>EMACIT201A</i> (P.84)	Perform basic testing of electrical wiring for air-conditioning and refrigeration (3 Credits) <i>EMACIT201A</i> (P.84)	Perform basic testing of electrical wiring for air-conditioning and refrigeration (3 Credits) <i>EMACIT201A</i> (P.84)					
		Perform basic testing and measuring of air-conditioning and refrigeration systems (5 Credits) <i>EMACIT202A</i> (P.85)	Perform basic testing and measuring of air-conditioning and refrigeration systems (5 Credits) <i>EMACIT202A</i> (P.85)	Perform basic testing and measuring of air-conditioning and refrigeration systems (5 Credits) <i>EMACIT202A</i> (P.85)					
		Wire up and repair electrical control components and starting circuits for air-conditioning and refrigeration (6 Credits) <i>EMACOR203A</i> (P.87)		Wire up and repair electrical control components and starting circuits for air-conditioning and refrigeration (6 Credits) <i>EMACOR203A</i> (P.87)					
		Apply knowledge of safety, health and environmental protection for air-conditioning and refrigeration engineering branch (6 Credits) <i>EMACSH201A</i> (P.74)	Apply knowledge of safety, health and environmental protection for air-conditioning and refrigeration engineering branch (6 Credits) <i>EMACSH201A</i> (P.74)	Apply knowledge of safety, health and environmental protection for air-conditioning and refrigeration engineering branch (6 Credits) <i>EMACSH201A</i> (P.74)	Apply knowledge of safety, health and environmental protection for air-conditioning and refrigeration engineering branch (6 Credits) <i>EMACSH201A</i> (P.74)	Apply knowledge of safety, health and environmental protection for air-conditioning and refrigeration engineering branch (6 Credits) <i>EMACSH201A</i> (P.74)	Apply knowledge of safety, health and environmental protection for air-conditioning and refrigeration engineering branch (6 Credits) <i>EMACSH201A</i> (P.74)	Apply knowledge of safety, health and environmental protection for air-conditioning and refrigeration engineering branch (6 Credits) <i>EMACSH201A</i> (P.74)	Apply knowledge of safety, health and environmental protection for air-conditioning and refrigeration engineering branch (6 Credits) <i>EMACSH201A</i> (P.74)

<u>Functional Areas</u>	<u>Design</u>	<u>Installation</u>	<u>Inspection, Testing and Commissioning</u>	<u>Operation, Repair and Maintenance</u>	<u>Project Management</u>	<u>Operation Management</u>	<u>Safety, Health and Environment</u>	<u>Quality Management</u>	<u>Marketing and Sales</u>
	<u>(DE)</u>	<u>(IN)</u>	<u>(IT)</u>	<u>(OR)</u>	<u>(PM)</u>	<u>(OM)</u>	<u>(SH)</u>	<u>(QM)</u>	<u>(MS)</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>
2		Perform basic installation of thermal insulation materials for air-conditioning and refrigeration system (5 Credits) EMACIN203A (P.88)		Perform basic service work of air-conditioning and refrigeration systems (5 Credits) EMACOR201A (P.94)					
		Perform basic installation of window-type and split-type air-conditioners (5 Credits) EMACIN204A (P.89)		Clean and wash window-type and split-type air-conditioners (5 Credits) EMACOR202A (P.95)					
		Perform basic installation of water systems for air-conditioning and refrigeration system (5 Credits) EMACIN205A (P.90)		Perform basic repair of electric motors for air-conditioning and refrigeration (3 Credits) EMACOR204A (P.96)					
		Perform basic installation of air duct systems (6 Credits) EMACIN206A (P.91)		Perform basic repair and maintenance of refrigerators, freezers and display coolers (5 Credits) EMACOR205A (P.97)					

<u>Functional Areas</u>	<u>Design</u>	<u>Installation</u>	<u>Inspection, Testing and Commissioning</u>	<u>Operation, Repair and Maintenance</u>	<u>Project Management</u>	<u>Operation Management</u>	<u>Safety, Health and Environment</u>	<u>Quality Management</u>	<u>Marketing and Sales</u>
	<u>(DE)</u>	<u>(IN)</u>	<u>(IT)</u>	<u>(OR)</u>	<u>(PM)</u>	<u>(OM)</u>	<u>(SH)</u>	<u>(QM)</u>	<u>(MS)</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>
2		Perform basic installation of electrical wiring for air-conditioning and refrigeration (12 Credits) EMACIN207A (P.92)		Perform basic repair and maintenance of ice makers, beverage coolers and dehumidifiers (7 Credits) EMACOR206A (P.98)					
		Perform basic installation of packaged air-conditioning systems (7 Credits) EMACIN212A (P.93)		Perform basic repair and maintenance of packaged air-conditioning systems (7 Credits) EMACOR207A (P.99)					
				Perform basic operation of central air-conditioning systems (5 Credits) EMACOR208A (P.101)					
				Perform basic repair and maintenance of water systems of central air-conditioning systems (6 Credits) EMACOR209A (P.102)					

<u>Functional Areas</u>	<u>Design</u>	<u>Installation</u>	<u>Inspection, Testing and Commissioning</u>	<u>Operation, Repair and Maintenance</u>	<u>Project Management</u>	<u>Operation Management</u>	<u>Safety, Health and Environment</u>	<u>Quality Management</u>	<u>Marketing and Sales</u>
	<u>(DE)</u>	<u>(IN)</u>	<u>(IT)</u>	<u>(OR)</u>	<u>(PM)</u>	<u>(OM)</u>	<u>(SH)</u>	<u>(QM)</u>	<u>(MS)</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>
2				Perform basic repair and maintenance of air system of central air-conditioning systems (6 Credits) EMACOR210A (P.103)					
				Perform basic repair and maintenance of reciprocating chiller plants (6 Credits) EMACOR211A (P.104)					
				Perform basic operation of central control and monitoring system (CCMS) of air-conditioning and refrigeration systems (6 Credits) EMACOR212A (P.105)					
				Perform basic repair and maintenance of heat-pump type air-conditioners (3 Credits) EMACOR213A (P.106)					

Functional Areas	Design	Installation	Inspection, Testing and Commissioning	Operation, Repair and Maintenance	Project Management	Operation Management	Safety, Health and Environment	Quality Management	Marketing and Sales
	(DE)	(IN)	(IT)	(OR)	(PM)	(OM)	(SH)	(QM)	(MS)
QF Levels	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency
3	Use computer to draw complicated mechanical engineering drawings (5 Credits) <u>EMCUDE315A</u> (P.113)	Use computer to draw complicated mechanical engineering drawings (5 Credits) <u>EMCUDE315A</u> (P.113)	Use computer to draw complicated mechanical engineering drawings (5 Credits) <u>EMCUDE315A</u> (P.113)	Use computer to draw complicated mechanical engineering drawings (5 Credits) <u>EMCUDE315A</u> (P.113)	Use computer to draw complicated mechanical engineering drawings (5 Credits) <u>EMCUDE315A</u> (P.113)				
	Use computer to draw combined services drawings of building services (5 Credits) <u>EMCUDE317A</u> (P.114)	Use computer to draw combined services drawings of building services (5 Credits) <u>EMCUDE317A</u> (P.114)	Use computer to draw combined services drawings of building services (5 Credits) <u>EMCUDE317A</u> (P.114)	Use computer to draw combined services drawings of building services (5 Credits) <u>EMCUDE317A</u> (P.114)	Use computer to draw combined services drawings of building services (5 Credits) <u>EMCUDE317A</u> (P.114)				
	Choose typical materials for electrical and mechanical work (3 Credits) <u>EMCUDE318A</u> (P.115)	Choose typical materials for electrical and mechanical work (3 Credits) <u>EMCUDE318A</u> (P.115)		Choose typical materials for electrical and mechanical work (3 Credits) <u>EMCUDE318A</u> (P.115)					
		Perform electrical and mechanical installation and testing according to the drawings and specifications of electrical devices and wiring (4 Credits) <u>EMCUIN306A</u> (P.132)	Perform electrical and mechanical installation and testing according to the drawings and specifications of electrical devices and wiring (4 Credits) <u>EMCUIN306A</u> (P.132)	Perform electrical and mechanical installation and testing according to the drawings and specifications of electrical devices and wiring (4 Credits) <u>EMCUIN306A</u> (P.132)					

<u>Functional Areas</u>	<u>Design</u>	<u>Installation</u>	<u>Inspection, Testing and Commissioning</u>	<u>Operation, Repair and Maintenance</u>	<u>Project Management</u>	<u>Operation Management</u>	<u>Safety, Health and Environment</u>	<u>Quality Management</u>	<u>Marketing and Sales</u>
	<u>(DE)</u>	<u>(IN)</u>	<u>(IT)</u>	<u>(OR)</u>	<u>(PM)</u>	<u>(OM)</u>	<u>(SH)</u>	<u>(QM)</u>	<u>(MS)</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									Apply sales and marketing techniques (3 Credits) <u>EMCUMS301A</u> (P.195)
	Design air-conditioning systems and equipment (6 Credits) <u>EMCUDE303A</u> (P.116)			Repair air-conditioning and refrigeration systems (6 Credits) <u>EMCUMA304A</u> (P.157)			Investigate general industrial accidents (3 Credits) <u>EMCUSH305A</u> (P.189)	Handle and review customers' complaints about electrical and mechanical product or service quality (3 Credits) <u>EMCUQM302A</u> (P.191)	
				Apply fault finding techniques to find the root causes of fault (3 Credits) <u>EMCUOR301A</u> (P.159)			Perform occupational safety and health supervision (3 Credits) <u>EMCUSH308A</u> (P.190)	Implement quality control and quality assurance (4 Credits) <u>EMCUQM303A</u> (P.192)	
				Repair air-conditioning system and control equipment (6 Credits) <u>EMCUOR305A</u> (P.160)				Formulate simple quality assurance plan and quality assurance reports (6 Credits) <u>EMCUQM304A</u> (P.193)	

Functional Areas	Design	Installation	Inspection, Testing and Commissioning	Operation, Repair and Maintenance	Project Management	Operation Management	Safety, Health and Environment	Quality Management	Marketing and Sales
	(DE)	(IN)	(IT)	(OR)	(PM)	(OM)	(SH)	(QM)	(MS)
QF Levels	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency				
3								Record quality issues on electrical and mechanical services (3 Credits) <u>EMCUQM306A</u> (P.194)	
	Apply the knowledge of air and water systems of central air-conditioning system (6 Credits) <u>EMACDE301A</u> (P.118)	Apply the knowledge of air and water systems of central air-conditioning system (6 Credits) <u>EMACDE301A</u> (P.118)	Apply the knowledge of air and water systems of central air-conditioning system (6 Credits) <u>EMACDE301A</u> (P.118)	Apply the knowledge of air and water systems of central air-conditioning system (6 Credits) <u>EMACDE301A</u> (P.118)	Apply the knowledge of air and water systems of central air-conditioning system (6 Credits) <u>EMACDE301A</u> (P.118)				Apply the knowledge of air and water systems of central air-conditioning system (6 Credits) <u>EMACDE301A</u> (P.118)
	Apply the knowledge of centrifugal water pumps and fans (6 Credits) <u>EMACDE302A</u> (P.120)	Apply the knowledge of centrifugal water pumps and fans (6 Credits) <u>EMACDE302A</u> (P.120)	Apply the knowledge of centrifugal water pumps and fans (6 Credits) <u>EMACDE302A</u> (P.120)	Apply the knowledge of centrifugal water pumps and fans (6 Credits) <u>EMACDE302A</u> (P.120)					
	Apply the knowledge of refrigerants, secondary refrigerants and refrigerant oil (6 Credits) <u>EMACDE303A</u> (P.122)	Apply the knowledge of refrigerants, secondary refrigerants and refrigerant oil (6 Credits) <u>EMACDE303A</u> (P.122)	Apply the knowledge of refrigerants, secondary refrigerants and refrigerant oil (6 Credits) <u>EMACDE303A</u> (P.122)	Apply the knowledge of refrigerants, secondary refrigerants and refrigerant oil (6 Credits) <u>EMACDE303A</u> (P.122)	Apply the knowledge of refrigerants, secondary refrigerants and refrigerant oil (6 Credits) <u>EMACDE303A</u> (P.122)				
				Analysis of non-destructive test (NDT) - Ultrasonic Testing (3 Credits) <u>EMCUMA311A</u> (P.134)					

Functional Areas	Design	Installation	Inspection, Testing and Commissioning	Operation, Repair and Maintenance	Project Management	Operation Management	Safety, Health and Environment	Quality Management	Marketing and Sales
	(DE)	(IN)	(IT)	(OR)	(PM)	(OM)	(SH)	(QM)	(MS)
QF Levels	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency
3				Analysis of non-destructive test (NDT) - magnetic particle testing (3 Credits) <u>EMCUMA313A</u> (P.136)					
	Apply the knowledge of the building construction of cold storage (6 Credits) <i>EMACDE304A</i> (P.124)	Apply the knowledge of the building construction of cold storage (6 Credits) <i>EMACDE304A</i> (P.124)	Apply the knowledge of the building construction of cold storage (6 Credits) <i>EMACDE304A</i> (P.124)	Apply the knowledge of the building construction of cold storage (6 Credits) <i>EMACDE304A</i> (P.124)					
	Apply the knowledge of refrigeration system of cold storage (6 Credits) <i>EMACDE305A</i> (P.125)	Apply the knowledge of refrigeration system of cold storage (6 Credits) <i>EMACDE305A</i> (P.125)	Apply the knowledge of refrigeration system of cold storage (6 Credits) <i>EMACDE305A</i> (P.125)	Apply the knowledge of refrigeration system of cold storage (6 Credits) <i>EMACDE305A</i> (P.125)					
	Apply the knowledge of ventilation systems (6 Credits) <i>EMACDE306A</i> (P.127)	Apply the knowledge of ventilation systems (6 Credits) <i>EMACDE306A</i> (P.127)	Apply the knowledge of ventilation systems (6 Credits) <i>EMACDE306A</i> (P.127)	Apply the knowledge of ventilation systems (6 Credits) <i>EMACDE306A</i> (P.127)	Apply the knowledge of ventilation systems (6 Credits) <i>EMACDE306A</i> (P.127)				

Functional Areas	Design	Installation	Inspection, Testing and Commissioning	Operation, Repair and Maintenance	Project Management	Operation Management	Safety, Health and Environment	Quality Management	Marketing and Sales
	(DE)	(IN)	(IT)	(OR)	(PM)	(OM)	(SH)	(QM)	(MS)
QF Levels	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency
3	Apply the knowledge of refrigeration compressors and major refrigeration equipment (6 Credits) <i>EMACDE307A</i> (P.128)	Apply the knowledge of refrigeration compressors and major refrigeration equipment (6 Credits) <i>EMACDE307A</i> (P.128)	Apply the knowledge of refrigeration compressors and major refrigeration equipment (6 Credits) <i>EMACDE307A</i> (P.128)	Apply the knowledge of refrigeration compressors and major refrigeration equipment (6 Credits) <i>EMACDE307A</i> (P.128)					
		Wire up electrical control circuits for air-conditioning and refrigeration (9 Credits) <i>EMACIN301A</i> (P.138)	Wire up electrical control circuits for air-conditioning and refrigeration (9 Credits) <i>EMACIN301A</i> (P.138)						
	Apply the knowledge of installation and related legislations of ventilation systems (6 Credits) <i>EMACIN302A</i> (P.130)	Apply the knowledge of installation and related legislations of ventilation systems (6 Credits) <i>EMACIN302A</i> (P.130)	Apply the knowledge of installation and related legislations of ventilation systems (6 Credits) <i>EMACIN302A</i> (P.130)	Apply the knowledge of installation and related legislations of ventilation systems (6 Credits) <i>EMACIN302A</i> (P.130)					
		Assemble pipings for air-conditioning and refrigeration engineering (6 Credits) <i>EMACIN308A</i> (P.140)		Assemble pipings for air-conditioning and refrigeration engineering (6 Credits) <i>EMACIN308A</i> (P.140)					

Functional Areas	Design	Installation	Inspection, Testing and Commissioning	Operation, Repair and Maintenance	Project Management	Operation Management	Safety, Health and Environment	Quality Management	Marketing and Sales
	(DE)	(IN)	(IT)	(OR)	(PM)	(OM)	(SH)	(QM)	(MS)
QF Levels	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency
3				Apply knowledge of safety operation of air-conditioning and refrigeration system (6 Credits) <i>EMACSH301A</i> (P.161)			Apply knowledge of safety operation of air-conditioning and refrigeration system (6 Credits) <i>EMACSH301A</i> (P.161)		
		Apply knowledge of environmental impact of refrigerants and foamers (6 Credits) <i>EMACSH302A</i> (P.141)		Apply knowledge of environmental impact of refrigerants and foamers (6 Credits) <i>EMACSH302A</i> (P.141)			Apply knowledge of environmental impact of refrigerants and foamers (6 Credits) <i>EMACSH302A</i> (P.141)		
		Install window type and split type air-conditioners (6 Credits) <i>EMACIN303A</i> (P.143)	Test and measure operating parameters of air-conditioning and refrigeration systems (6 Credits) <i>EMACIT301A</i> (P.153)	Operate central control and monitoring system (CCMS) of air-conditioning and refrigeration systems (6 Credits) <i>EMACOR301A</i> (P.163)					
		Install chilled water system equipment for air-conditioning and refrigeration (12 Credits) <i>EMACIN304A</i> (P.145)	Measure noise and vibration of air-conditioning and refrigeration systems (6 Credits) <i>EMACIT302A</i> (P.155)	Repair and maintain window type and split type air-conditioners (6 Credits) <i>EMACOR302A</i> (P.165)					

<u>Functional Areas</u>	<u>Design</u>	<u>Installation</u>	<u>Inspection, Testing and Commissioning</u>	<u>Operation, Repair and Maintenance</u>	<u>Project Management</u>	<u>Operation Management</u>	<u>Safety, Health and Environment</u>	<u>Quality Management</u>	<u>Marketing and Sales</u>
	<u>(DE)</u>	<u>(IN)</u>	<u>(IT)</u>	<u>(OR)</u>	<u>(PM)</u>	<u>(OM)</u>	<u>(SH)</u>	<u>(QM)</u>	<u>(MS)</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		Install air duct systems (9 Credits) EMACIN305A (P.147)		Repair and maintain packaged air-conditioning systems (9 Credits) EMACOR303A (P.167)					
		Install thermal insulation materials for air-conditioning and refrigeration systems (6 Credits) EMACIN306A (P.149)		Repair and maintain refrigerators, freezers and display coolers (9 Credits) EMACOR304A (P.169)					
		Install packaged air-conditioning systems (9 Credits) EMACIN307A (P.151)		Repair and maintain ice makers, beverage coolers and dehumidifiers (9 Credits) EMACOR305A (P.171)					
				Operate the refrigeration equipment of the cold storage (9 Credits) EMACOR306A (P.173)					

<u>Functional Areas</u>	<u>Design</u>	<u>Installation</u>	<u>Inspection, Testing and Commissioning</u>	<u>Operation, Repair and Maintenance</u>	<u>Project Management</u>	<u>Operation Management</u>	<u>Safety, Health and Environment</u>	<u>Quality Management</u>	<u>Marketing and Sales</u>
	<u>(DE)</u>	<u>(IN)</u>	<u>(IT)</u>	<u>(OR)</u>	<u>(PM)</u>	<u>(OM)</u>	<u>(SH)</u>	<u>(QM)</u>	<u>(MS)</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 and maintain the refrigeration equipment of the cold storage (9 Credits) EMACOR307A (P.175)					
				Operate central air-conditioning systems (9 Credits) EMACOR308A (P.177)					
				Repair and maintain water systems of central air-conditioning systems (9 Credits) EMACOR309A (P.179)					
				Repair and maintain air system of central air-conditioning system (9 Credits) EMACOR310A (P.181)					

<u>Functional Areas</u>	<u>Design</u>	<u>Installation</u>	<u>Inspection, Testing and Commissioning</u>	<u>Operation, Repair and Maintenance</u>	<u>Project Management</u>	<u>Operation Management</u>	<u>Safety, Health and Environment</u>	<u>Quality Management</u>	<u>Marketing and Sales</u>
	<u>(DE)</u>	<u>(IN)</u>	<u>(IT)</u>	<u>(OR)</u>	<u>(PM)</u>	<u>(OM)</u>	<u>(SH)</u>	<u>(QM)</u>	<u>(MS)</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 and maintain electrical control system of central air-conditioning systems (9 Credits) EMACOR311A (P.183)					
				Repair and maintain reciprocating chiller plants (9 Credits) EMACOR312A (P.185)					
				Repair and maintain screw-type chiller plants (9 Credits) EMACOR313A (P.186)					
				Repair and maintain centrifugal chiller plants (9 Credits) EMACOR314A (P.187)					
				Repair and maintain heat-pump type air-conditioners (6 Credits) EMACOR315A (P.188)					

Functional Areas	Design	Installation	Inspection, Testing and Commissioning	Operation, Repair and Maintenance	Project Management	Operation Management	Safety, Health and Environment	Quality Management	Marketing and Sales
	(DE)	(IN)	(IT)	(OR)	(PM)	(OM)	(SH)	(QM)	(MS)
QF Levels	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency
4	Formulate effective storage and updating system for drawings (3 Credits) <u>EMCUDE405A</u> (P.197)			Supervise equipment maintenance work to ensure its quality, standard and efficiency (9 Credits) <u>EMCUMA401A</u> (P.215)	Plan the finance, accounts and insurance of engineering projects (6 Credits) <u>EMCUPM401A</u> (P.220)				
								Implement quality management in electrical and mechanical engineering services (6 Credits) <u>EMCUQM402A</u> (P.226)	
								Promote quality management culture at working level (3 Credits) <u>EMCUQM403A</u> (P.227)	
	Design central air-conditioning control systems (9 Credits) <u>EMACDE401A</u> (P.198)	Design central air-conditioning control systems (9 Credits) <u>EMACDE401A</u> (P.198)	Design central air-conditioning control systems (9 Credits) <u>EMACDE401A</u> (P.198)	Design central air-conditioning control systems (9 Credits) <u>EMACDE401A</u> (P.198)				Conduct site survey and quality control (3 Credits) <u>EMCUQM404A</u> (P.228)	

Functional Areas	Design	Installation	Inspection, Testing and Commissioning	Operation, Repair and Maintenance	Project Management	Operation Management	Safety, Health and Environment	Quality Management	Marketing and Sales
	(DE)	(IN)	(IT)	(OR)	(PM)	(OM)	(SH)	(QM)	(MS)
QF Levels	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency
4	Perform energy audits of air-conditioning systems (9 Credits) <i>EMACDE402A</i> (P.200)		Perform energy audits of air-conditioning systems (9 Credits) <i>EMACDE402A</i> (P.200)						
	Design air-conditioning and ventilation systems for prevention of smoke and fire in buildings (9 Credits) <i>EMACDE403A</i> (P.202)	Design air-conditioning and ventilation systems for prevention of smoke and fire in buildings (9 Credits) <i>EMACDE403A</i> (P.202)	Design air-conditioning and ventilation systems for prevention of smoke and fire in buildings (9 Credits) <i>EMACDE403A</i> (P.202)	Design air-conditioning and ventilation systems for prevention of smoke and fire in buildings (9 Credits) <i>EMACDE403A</i> (P.202)					
	Determine air-conditioning load (9 Credits) <i>EMACDE404A</i> (P.204)		Test and commission water systems of central air-conditioning systems (9 Credits) <i>EMACIT401A</i> (P.205)	Measure indoor air quality parameters (9 Credits) <i>EMACOR401A</i> (P.217)	Supervise on-site air-conditioning and refrigeration works (15 Credits) <i>EMACPM401A</i> (P.221)		Perform refrigeration system safety management (9 Credits) <i>EMACSH401A</i> (P.224)		Sell air-conditioning and refrigeration equipment (12 Credits) <i>EMACMS401A</i> (P.229)
			Test and commission air system of central air-conditioning systems (9 Credits) <i>EMACIT402A</i> (P.207)	Supervise air-conditioning and refrigeration system operation, repair and maintenance (12 Credits) <i>EMACOR402A</i> (P.218)	Perform air-conditioning and refrigeration engineering contract administration (9 Credits) <i>EMACPM402A</i> (P.223)				

<u>Functional Areas</u>	<u>Design</u>	<u>Installation</u>	<u>Inspection, Testing and Commissioning</u>	<u>Operation, Repair and Maintenance</u>	<u>Project Management</u>	<u>Operation Management</u>	<u>Safety, Health and Environment</u>	<u>Quality Management</u>	<u>Marketing and Sales</u>
	<u>(DE)</u>	<u>(IN)</u>	<u>(IT)</u>	<u>(OR)</u>	<u>(PM)</u>	<u>(OM)</u>	<u>(SH)</u>	<u>(QM)</u>	<u>(MS)</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>
4			Test and commission chiller plant (12 Credits) EMACIT403A (P.209)						
			Test and commission automatic control system for air-conditioning and refrigeration (9 Credits) EMACIT404A (P.211)						
			Assess noise of air-conditioning and refrigeration system (9 Credits) EMACIT405A (P.213)						
5	Write all kinds of electrical and mechanical engineering reports in Chinese (6 Credits) <u>EMCUDE506A</u> (P.232)			Write all kinds of electrical and mechanical engineering reports in Chinese (6 Credits) <u>EMCUDE506A</u> (P.232)	Write all kinds of electrical and mechanical engineering reports in Chinese (6 Credits) <u>EMCUDE506A</u> (P.232)	Write all kinds of electrical and mechanical engineering reports in Chinese (6 Credits) <u>EMCUDE506A</u> (P.232)	Write all kinds of electrical and mechanical engineering reports in Chinese (6 Credits) <u>EMCUDE506A</u> (P.232)		

Functional Areas	Design	Installation	Inspection, Testing and Commissioning	Operation, Repair and Maintenance	Project Management	Operation Management	Safety, Health and Environment	Quality Management	Marketing and Sales
	(DE)	(IN)	(IT)	(OR)	(PM)	(OM)	(SH)	(QM)	(MS)
QF Levels	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency
5	Write all kinds of electrical and mechanical engineering reports in English (6 Credits) <u>EMCUDE507A</u> (P.233)			Write all kinds of electrical and mechanical engineering reports in English (6 Credits) <u>EMCUDE507A</u> (P.233)	Write all kinds of electrical and mechanical engineering reports in English (6 Credits) <u>EMCUDE507A</u> (P.233)	Write all kinds of electrical and mechanical engineering reports in English (6 Credits) <u>EMCUDE507A</u> (P.233)	Write all kinds of electrical and mechanical engineering reports in English (6 Credits) <u>EMCUDE507A</u> (P.233)		
					Formulate project procedures and schedule (9 Credits) <u>EMCUPM501A</u> (P.244)				
						Implement engineering operation and supervisory management (6 Credits) <u>EMCUOM502A</u> (P.257)	Implement risk management for electrical and mechanical services (9 Credits) <u>EMCUSH502A</u> (P.258)		
								Formulate and implement quality management courses and training programmes (4 Credits) <u>EMCUQM503A</u> (P.267)	

Functional Areas	<u>Design</u>	<u>Installation</u>	<u>Inspection, Testing and Commissioning</u>	<u>Operation, Repair and Maintenance</u>	<u>Project Management</u>	<u>Operation Management</u>	<u>Safety, Health and Environment</u>	<u>Quality Management</u>	<u>Marketing and Sales</u>
	<u>(DE)</u>	<u>(IN)</u>	<u>(IT)</u>	<u>(OR)</u>	<u>(PM)</u>	<u>(OM)</u>	<u>(SH)</u>	<u>(QM)</u>	<u>(MS)</u>
QF Levels	<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							Formulate occupational safety and health management system (3 Credits) <u>EMCUSH504A</u> (P.260)	Formulate and analyze quality assurance reports (3 Credits) <u>EMCUQM504A</u> (P.268)	
							Formulate occupational safety and health and environmental protection schemes (6 Credits) <u>EMCUSH505A</u> (P.261)	Formulate schemes to enhance staff's awareness of quality management (5 Credits) <u>EMCUQM505A</u> (P.269)	
							Perform risk assessment for electrical and mechanical work (3 Credits) <u>EMCUSH506A</u> (P.263)	Implement quality management training courses (9 Credits) <u>EMCUQM506A</u> (P.270)	
							Formulate environmental protection management system (3 Credits) <u>EMCUSH507A</u> (P.264)	Implement quality management standards of International Organization for Standardization (ISO) (3 Credits) <u>EMCUQM507A</u> (P.271)	

Functional Areas	Design	Installation	Inspection, Testing and Commissioning	Operation, Repair and Maintenance	Project Management	Operation Management	Safety, Health and Environment	Quality Management	Marketing and Sales
	(DE)	(IN)	(IT)	(OR)	(PM)	(OM)	(SH)	(QM)	(MS)
QF Levels	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency
5							Implement occupational safety and health and environmental protection courses and training programmes (3 Credits) <u>EMCUSH508A</u> (P.265)		
	Design air system of central air-conditioning system (12 Credits) EMACDE501A (P.234)		Prepare documents for air-conditioning and refrigeration system testing and commissioning (12 Credits) EMACIT501A (P.239)	Assess indoor air quality (9 Credits) EMACOR501A (P.243)	Check engineering drawings and documents of air-conditioning and ventilation systems for Fire Services Department's approval (9 Credits) EMACPM501A (P.245)				Carry out market analysis and forecast for air-conditioning and refrigeration equipment (12 Credits) EMACMS501A (P.272)
	Design water systems of central air-conditioning system (12 Credits) EMACDE502A (P.236)		Test overall performance of central air-conditioning systems (12 Credits) EMACIT502A (P.241)		Perform management for air-conditioning and refrigeration project tender bids (15 Credits) EMACPM502A (P.247)				

Functional Areas	<u>Design</u>	<u>Installation</u>	<u>Inspection, Testing and Commissioning</u>	<u>Operation, Repair and Maintenance</u>	<u>Project Management</u>	<u>Operation Management</u>	<u>Safety, Health and Environment</u>	<u>Quality Management</u>	<u>Marketing and Sales</u>
	<u>(DE)</u>	<u>(IN)</u>	<u>(IT)</u>	<u>(OR)</u>	<u>(PM)</u>	<u>(OM)</u>	<u>(SH)</u>	<u>(QM)</u>	<u>(MS)</u>
QF Levels	<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	Design chiller plant machine room (9 Credits) EMACDE503A (P.238)				Perform cost management for an air-conditioning and refrigeration project (15 Credits) EMACPM503A (P.249)				
					Perform risk assessment for air-conditioning and refrigeration projects (12 Credits) EMACPM504A (P.251)				
					Perform quality management for air-conditioning and refrigeration projects (12 Credits) EMACPM505A (P.252)				
					Conduct feasibility studies for air-conditioning and refrigeration projects (9 Credits) EMACPM506A (P.254)				

<u>Functional Areas</u>	<u>Design</u>	<u>Installation</u>	<u>Inspection, Testing and Commissioning</u>	<u>Operation, Repair and Maintenance</u>	<u>Project Management</u>	<u>Operation Management</u>	<u>Safety, Health and Environment</u>	<u>Quality Management</u>	<u>Marketing and Sales</u>
	<u>(DE)</u>	<u>(IN)</u>	<u>(IT)</u>	<u>(OR)</u>	<u>(PM)</u>	<u>(OM)</u>	<u>(SH)</u>	<u>(QM)</u>	<u>(MS)</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					Perform completion commissioning management for air-conditioning and refrigeration projects (12 Credits) <u>EMACPM507A</u> (P.255)				
6					Apply project management skills and professional knowledge to handle unfulfilled or unperformed contracts effectively (20 Credits) <u>EMCUPM601A</u> (P.290)		Formulate overall safety, health and environmental protection policy (20 Credits) <u>EMCUSH601A</u> (P.295)	Formulate quality management strategy (20 Credits) <u>EMCUQM601A</u> (P.301)	
							Formulate improvement plans for occupational safety and health (20 Credits) <u>EMCUSH602A</u> (P.297)	Implement total quality management plan (20 Credits) <u>EMCUQM602A</u> (P.302)	
							Formulate environmental protection improvement plans (20 Credits) <u>EMCUSH603A</u> (P.299)		

Functional Areas	Design	Installation	Inspection, Testing and Commissioning	Operation, Repair and Maintenance	Project Management	Operation Management	Safety, Health and Environment	Quality Management	Marketing and Sales
	(DE)	(IN)	(IT)	(OR)	(PM)	(OM)	(SH)	(QM)	(MS)
QF Levels	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency
6	Design silencing and vibration reduction measures for air-conditioning systems (12 Credits) EMACDE601A (P.275)			Formulate indoor air quality improvements (12 Credits) EMACOR601A (P.287)	Manage feasibility studies for air-conditioning and refrigeration projects (9 Credits) EMACPM601A (P.291)				Formulate air-conditioning and refrigeration equipment sales strategies (9 Credits) EMACMS601A (P.304)
	Select chiller plants (9 Credits) EMACDE602A (P.278)			Manage the operation, repair and maintenance of air-conditioning and refrigeration systems (12 Credits) EMACOR602A (P.288)	Perform risk management for air-conditioning and refrigeration projects (9 Credits) EMACPM602A (P.292)				Manage air-conditioning and refrigeration equipment sales (12 Credits) EMACMS602A (P.306)
	Select air-handling equipment (12 Credits) EMACDE603A (P.280)				Perform post-project management for air-conditioning and refrigeration projects (9 Credits) EMACPM603A (P.294)				
	Design smoke prevention, smoke extraction, staircase pressurization and VAC systems for buildings (12 Credits) EMACDE604A (P.281)								

Functional Areas	Design	Installation	Inspection, Testing and Commissioning	Operation, Repair and Maintenance	Project Management	Operation Management	Safety, Health and Environment	Quality Management	Marketing and Sales
	(DE)	(IN)	(IT)	(OR)	(PM)	(OM)	(SH)	(QM)	(MS)
QF Levels	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency	Unit of Competency
6	Design refrigeration systems for the cold storage (12 Credits) EMACDE605A (P.283)								
	Design ventilation systems (12 Credits) EMACDE606A (P.285)								
7						Formulate overall operation development direction and strategy (20 Credits) <u>EMCUOM701A</u> (P.309)			
	Apply building physics to sustainable architectural design (36 Credits) EMACDE701A (P.311)								
	Design advanced and highly-efficient air-conditioning systems (36 Credits) EMACDE702A (P.312)								

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"> ◆ Understand basic electrical concepts, including: <ul style="list-style-type: none"> • Stating briefly the names and uses of typical electrical components from distribution board to all final circuits • 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 ◆ Understand the working principles of typical meters, including: <ul style="list-style-type: none"> • Structure and working principles of moving coil, moving iron and electric meter • Uses and the pros and cons of the above three types of meters • Structure, working principles and uses of traditional multimeter ◆ Understand the code of safety and operation for using typical meters <p>6.2 Use of meters</p> <ul style="list-style-type: none"> ◆ Use typical meters <ul style="list-style-type: none"> • Capable to use multimeters safely and correctly to measure electric current, electric voltage and electric resistance of simple circuits • Capable to use appropriate typical meters safely and correctly to measure electric energy (kWH) and electric power (kW) • Know how to maintain typical meters
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	Identify general properties of different types of typical electrical and mechanical engineering materials
2. Code	EMCUDE109A
3. Range	Capable to identify the general properties and range of application of different types of typical electrical and mechanical engineering materials for electrical and mechanical design, installation, repair and maintenance.
4. Level	1
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 General properties of typical electrical and mechanical engineering materials</p> <ul style="list-style-type: none"> ◆ Understand the general properties of typical electrical and mechanical engineering materials including metals and non-metals: <ul style="list-style-type: none"> • Mechanical properties such as strength, hardness, resilience, etc. • Density • Electric conductivity • Thermal conductivity • Melt ability <p>6.2 Identify properties and range of application of typical electrical and mechanical engineering materials</p> <ul style="list-style-type: none"> ◆ Capable to identify different types of typical electrical and mechanical engineering materials, including metal type: steel, copper, aluminium, iron, etc., and non-metal type: wood, plastic, resin, etc. ◆ Capable to identify basic range of application of different types of typical electrical and mechanical engineering materials ◆ Capable to perform simple design, installation, repair and maintenance engineering works according to the general properties and range of application of different types of typical electrical and mechanical engineering materials
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to identify the general properties and range of application of different types of typical electrical and mechanical engineering materials.</p>
8. Remarks	This unit of competency is applicable to new entrants of electrical and mechanical engineering services.

1. Title	Apply basic knowledge of air-conditioning and refrigeration systems
2. Code	EMACDE101A
3. Range	Apply basic knowledge of air-conditioning and refrigeration system, at design studios, air-conditioning and refrigeration system work sites or sales outlets, in the basic design, installation, commissioning, maintenance, testing, project management, operation management, marketing and sales of air-conditioning and refrigeration systems.
4. Level	1
5. Credit	5
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Basic knowledge of air-conditioning and refrigeration system</p> <ul style="list-style-type: none"> ◆ Understand code of industry safety and working procedures of air-conditioning and refrigeration engineering ◆ Understand definition of basic air-conditioning and refrigeration units, including: <ul style="list-style-type: none"> • Temperature • Heat • Specific heat • Latent heat ◆ Calculate the heat exchange problem of water, including: <ul style="list-style-type: none"> • Conversions of Fahrenheit degree, Celsius degree and absolute temperature • Conditions for the formation of three states of matter • Calculation of heat released after water has changed from vapour to solid state and cooled down ◆ Understand the working principles of the four major components for compression refrigeration cycle and the process of the compression refrigeration cycle ◆ Understand the classification of general air-conditioning systems, including unitary air-conditioners and different types of central air-conditioning systems ◆ Understand the nomenclatures and functions of typical air-conditioning equipment ◆ Understand the properties, codes and classification of typical refrigerants, including: <ul style="list-style-type: none"> • Properties of refrigerants • Nomenclatures and codes of typical refrigerants • Colours of cylinders for different types of refrigerants

	6.2 Application of basic knowledge of air-conditioning and refrigeration system	◆ Apply basic knowledge of air-conditioning and refrigeration system to solve the problems involved in design, installation, commissioning, maintenance, project management, operation management and sales of air-conditioning and refrigeration works; communicate with the sector and clients
7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: (i) Capable to apply basic knowledge to solve the problems involved in air-conditioning and refrigeration system ; have general communication with the sector and clients.	
8. Remarks	This unit of competency is applicable to practitioners of general air-conditioning and refrigeration works.	

1. Title	Apply basic knowledge of ventilation systems
2. Code	EMACDE102A
3. Range	Apply the basic knowledge of ventilation systems, at design studios, ventilation system work sites or sales outlets, in the basic design, installation, commissioning, testing, maintenance, project management, operation management, marketing and sales of ventilation systems.
4. Level	1
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Basic knowledge of ventilation system</p> <ul style="list-style-type: none"> ◆ Understand general concepts of ventilation system, including: <ul style="list-style-type: none"> • Definition of natural ventilation, mechanical ventilation, spot ventilation, and total ventilation • Functions of ventilation • Construction and functions of central ventilation duct system • Typical terms for ventilation systems <p>6.2 Application of basic knowledge of ventilation system</p> <ul style="list-style-type: none"> ◆ Apply the basic knowledge of ventilation systems to handle the problems involved in the design, installation, commissioning, maintenance, project management, operation management and sales of ventilation works; communicate with the sector and clients
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply the basic knowledge of ventilation systems in ventilation works; communicate with the sector and clients.</p>
8. Remarks	This unit of competency is applicable to practitioners of general ventilation system works.

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"> ◆ 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. ◆ Understand the basic maintenance of personal protective equipment <p>6.2 Use of personal protective equipment</p> <ul style="list-style-type: none"> ◆ Capable to use general personal protection device such as safety belt, eye protector, safety shoes, insulating gloves, protective guard, helmet and ear plug, etc. ◆ Capable to choose and use general personal protection device correctly by following systematic safety procedures for the best protection ◆ Capable to use and maintain personal protection device correctly according to safety guidelines and procedures so as to comply with the law
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"> ◆ Understand the effects of incorrect lifting and handling, including: <ul style="list-style-type: none"> • The impact on the waist and the back • Causes of manual lifting injuries • Basic knowledge of waist and back care <p>6.2 Application of the correct way of manual lifting and handling</p> <ul style="list-style-type: none"> ◆ Capable to apply the way of manual lifting and handling correctly and properly to avoid bodily injuries ◆ Capable to implement the recommendations of the risk assessment for the manual handling operation
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	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"> ◆ 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"> • Occupational Safety and Health ordinance and Regulations • Factories and Industrial Undertakings Ordinance and Regulations • Factories and Industrial Undertakings (Electricity) Regulations • Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations <p>6.2 Comply with codes of practice and ordinances for occupational safety and health</p> <ul style="list-style-type: none"> ◆ 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
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"> ◆ Understand the legal requirements for electrical and mechanical engineering work on environmental protection, such as: <ul style="list-style-type: none"> • Noise Control Ordinance • Waste Disposal Ordinance • Water Pollution Control Ordinance • Ozone Layer Protection Ordinance • Dumping at Sea Ordinance • Air Pollution Control Ordinance <p>6.2 Application of environmental protection legislations</p> <ul style="list-style-type: none"> ◆ Capable to comply with the legal requirements on environmental protection to carry out routine, repetitive or clearly defined electrical and mechanical engineering work
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"> ◆ Possess basic knowledge of handling chemicals safely, including: <ul style="list-style-type: none"> • Hazards of chemicals • Labelling of chemicals • Ways of chemicals entering human bodies • Safety measures for handling chemicals • Personal protective equipment • Compliance of contingency measures ◆ Understand the classification of general chemical substances, including: <ul style="list-style-type: none"> • Explosive substance • Flammable substance • Strong supporter of combustion • Gas • Harmful or poisonous substance • Organic solvent • Corrosive fluid <p>6.2 Way of handling general chemicals</p> <ul style="list-style-type: none"> ◆ Handle chemicals correctly and prevent chemical hazards, including making use of personal protection device ◆ Capable to prevent occupational health hazards caused by chemicals
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.

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 typical lifting machines and devices operation</p> <ul style="list-style-type: none"> ◆ 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"> • Lifting machines include: crane, gin block, winch, rolling wheel, lift purchase and gin wheel • Lifting devices include: hook, chain, rope and overhead conveyor <p>6.2 Understand the code of safety and legal requirements for goods handling</p> <ul style="list-style-type: none"> ◆ Understand the code of safety and legal requirements for goods handling <ul style="list-style-type: none"> • Understand the danger of moving and using lifting machines and devices • Understand the safety inspection requirements for handling goods • Understand the safety operation of lifting device and sling, and the requirements for pre-use inspection • Understand the code of safety for using lifting machines and the requirements for pre-use inspection ◆ 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 <p>6.3 Apply general loading methods and lifting equipment correctly</p> <ul style="list-style-type: none"> ◆ Use general loading and lifting machines and devices correctly <ul style="list-style-type: none"> • Use general loading and lifting machines and devices correctly under clear instruction, including: <ul style="list-style-type: none"> ▸ Using chains and ropes to tie the goods ▸ Using lifting devices such as ropes, chain, hook and overhead conveyor to lift up and convey the goods ▸ Using hydraulic lifting machines to handle heavy goods ▸ Using electric lifting machines to handle goods ▸ operating truck lifting platform ◆ Use general loading methods correctly <ul style="list-style-type: none"> • Carry out basic manual handling operation correctly • Simple ways of using ropes, such as tying knots and rings 		

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"> ◆ Understand basic bench fitting techniques, including marking, sawing, filing, grinding, drilling and chiselling ◆ 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 <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"> ◆ Understand the correct use of small typical hand tools <ul style="list-style-type: none"> • Capable to use various types of cutting tools correctly, such as bow saws and shears • Capable to use metric and imperial measuring instruments correctly, such as steel rules, venires, inside callipers and outside callipers • Capable to use steel rules and beam squares to measure the length and to check horizontal, vertical and curved surfaces correctly • 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 • Capable to select and use scrapers correctly • 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 • Capable to use various types of marking-out tools correctly, such as line needle, hook needle, centre punches, pin punches and dividers • Capable to use portable power drills and drilling machines correctly

	<ul style="list-style-type: none"> ◆ Apply basic bench fitting techniques and use small typical hand tools <ul style="list-style-type: none"> • Identify and select typical metals <ul style="list-style-type: none"> ▸ Capable to identify various types of typical metals ▸ Capable to select suitable typical metals according to uses • 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
6.3	<p>Code of practice for bench fitting</p> <ul style="list-style-type: none"> ◆ 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
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 air-conditioning and refrigeration instruments and tools
2. Code	EMCUMA101A
3. Range	Use typical 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"> ◆ Understand basic working principles of instruments and tools, including: <ul style="list-style-type: none"> • Functions and working principles of dry-bulb thermometer, web-bulb thermometer, anemometer, vacuum pump, gauge manifold and vacuum pressure gauge, etc. • Functions of copper tubing tools • Functions of insulation work tools <p>6.2 Operation method of air-conditioning and refrigeration instruments and tools</p> <ul style="list-style-type: none"> ◆ Use air-conditioning and refrigeration instruments, including: <ul style="list-style-type: none"> • Anemometer • Vacuum pump • Gauge manifold • Vacuum pressure gauge • Use dry-bulb thermometer and web-bulb thermometer to measure the dry-bulb temperature and web-bulb temperature of objects ◆ Use copper tubing tools <ul style="list-style-type: none"> • know how to use tube cutter, flaring tool, swaging tool and tube bender for cutting, flaring , swaging and bending copper tubes • know how to fabricate simple copper tube assemblies, including cutting, flaring,swaging, bending, flare joining , and performing leak checking for copper tube assemblies ◆ Use refrigerant leak detector <ul style="list-style-type: none"> • Know how to use soap solution and electronic leak detector to detect refrigerant leaks from the refrigeration system ◆ Identify and handle refrigerant cylinders <ul style="list-style-type: none"> • Identify the types of refrigerant according to different colours of the refrigerant cylinders • Understand how to use refrigerant cylinders • Capable to store and transport refrigerant cylinders safely

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	Perform basic fabrication of metallic air ducts
2. Code	EMACIN101A
3. Range	Perform basic fabrication of metallic air ducts at production or installation sites.
4. Level	1
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of typical air-conditioning metals, tools and instruments</p> <ul style="list-style-type: none"> ◆ Understand the types and properties of typical air-conditioning metals ◆ Understand the methods of using typical air-conditioning tools and instruments ◆ Understand the fabrication methods of typical metallic air ducts ◆ Understand the code of safety and practice for the fabrication of metallic air ducts <p>6.2 Basic methods and procedures of fabricating metallic air ducts</p> <ul style="list-style-type: none"> ◆ Identify galvanized steel sheet, stainless steel sheet and aluminium sheet correctly ◆ Use snips, riveter, hammer, leveller, tape rule, steel rule, shear machine for simple fabrication work ◆ Fabricate straight rectangular air duct and square bend ◆ Use single seam method to join two sections of straight rectangular air ducts <p>6.3 Professionalism in basic fabrication of metallic air ducts</p> <ul style="list-style-type: none"> ◆ Perform basic fabrication of metallic air ducts according to the code of safety
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to complete basic fabrication of metallic air ducts systematically, efficiently and safely.</p>
8. Remarks	This unit of competency is applicable to practitioners of air duct installation in general.

1. Title	Basic knowledge of electrical and mechanical services management
2. Code	EMCUOM102A
3. Range	Capable to understand the basic concepts of electrical and mechanical services management, to build up team spirit and to assist the company to perform routine duties.
4. Level	1
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Know about basic management theory</p> <ul style="list-style-type: none"> ◆ Understand team building and maintain team spirit, including: <ul style="list-style-type: none"> • Building of working team • Definition of working team • Classification of working team • Formulating clear and tangible goals • Trusting each other • Taking the initiative to listen carefully • Formulating practical and challenging goals ◆ Understand organization's basic way of operation, including: <ul style="list-style-type: none"> • Engineering workforce organizational chart • Engineering project schedules • Working procedure flow chart • Basic concept of logistics management for materials, tools, instruments, etc <p>6.2 Apply basic management theory in daily electrical and mechanical engineering works</p> <ul style="list-style-type: none"> ◆ Know how to apply basic management theory in daily electrical and mechanical engineering works, including: <ul style="list-style-type: none"> • Enhancing the efficiency of company's daily work • Fostering the spirit of cooperation among staff members • Minimizing misunderstanding of work • Strengthening self-confidence
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to know about basic theory of electrical and mechanical services management, to build up team spirit and to enhance the efficiency of organizational routines.</p>
8. Remarks	This unit of competency is applicable to electrical and mechanical practitioners in general.

1. Title	Perform quality assurance
2. Code	EMCUQM101A
3. Range	With regard to electrical and mechanical engineering quality assurance, assist to control and monitor the engineering quality under supervision.
4. Level	1
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Know about quality assurance standards and rules</p> <ul style="list-style-type: none"> ◆ Understand the organizational quality management scheme, including: <ul style="list-style-type: none"> • Mode of quality management such as the implementation of ISO 9000, quality circle, etc. • Duties of quality management committee • Quality management training ◆ Understand the organizational and international quality assurance standards and rules <p>6.2 Perform quality assurance and monitoring procedures</p> <ul style="list-style-type: none"> ◆ Assist to perform quality assurance and monitoring for the electrical and mechanical engineering works under supervision according to organizational instructions and international standards ◆ Capable to record quality test results
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to master and apply the organizational and international quality management standards and rules, and assist in quality assurance and monitoring of the electrical and mechanical engineering works under supervision.</p>
8. Remarks	This unit of competency is applicable to electrical and mechanical practitioners in general.

Competency Level 2

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"> ◆ Understand the computer drawing techniques and methods, including the knowledge of drawing specifications, machinery to be drawn and pneumatic symbols <p>6.2 Application of computer drawing</p> <ul style="list-style-type: none"> ◆ Use the computer to set the drawing specifications <ul style="list-style-type: none"> • Set the drawing specifications • Use all types of lines, layers and typeface • Open and save file ◆ Use the computer to draw geometric figures, including mechanical and pneumatic symbols ◆ Use the computer to draw mechanical drawings according to design <ul style="list-style-type: none"> • Draw mechanical layouts • Draw projected mechanical parts • Draw sectional views for mechanical parts ◆ Use the computer to draw the pneumatic system according to design <ul style="list-style-type: none"> • Draw the pneumatic system's layout according to the pneumatic design • Draw the electric control circuit of the pneumatic system according to the circuit design
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	Perform general electrical assembly and fitting
2. Code	EMCUIN201A
3. Range	Capable to perform general electrical assembly and fitting for electrical and mechanical engineering installation.
4. Level	2
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Requirements on general electrical assembly and fitting craftmanship</p> <ul style="list-style-type: none"> ◆ Understand the requirements on general electrical assembly and fitting craftmanship, including: <ul style="list-style-type: none"> • Mastering general electrical assembly and fitting craftmanship • Knowing how to use general electrical fitting tools • Understanding the physical properties and fitting methods of different metals <p>6.2 Implement general electrical assembly and fitting</p> <ul style="list-style-type: none"> ◆ Assist in general electrical assembly and fitting work in non live conditions under supervision by using all kinds of basis electrical materials, electrical equipment, tools, etc. ◆ Implement general electrical equipment assembly and fitting for low-voltage power supply system, such as: <ul style="list-style-type: none"> • Main switch and distribution board assembly • Power unit installation and base adjustment • Dismantlement, assembly and calibration of low-voltage cabinet • Busbar system assembly, etc.
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to understand the technical requirements on general electrical assembly and fitting craftmanship; and</p> <p>(ii) Capable to implement general electrical assembly and fitting.</p>
8. Remarks	This unit of competency is applicable to electrical and mechanical 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"> ◆ Understand the principles of magnetic particle inspection used to inspect equipment or materials for surface and sub-surface cracks ◆ Understand that the magnetic particle inspection method is applicable to magnetic metals or materials only ◆ Understand the advantages and limitations of using dry particles, wet particles and fluorescent particles in magnetic particle inspection <p>6.2 Methods and procedures of inspecting equipment and materials for cracks</p> <ul style="list-style-type: none"> ◆ 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 ◆ Capable to use different magnetic particle inspection tools for testing according to work pieces and cracks ◆ Capable to inspect different positions for surface and sub-surface cracks ◆ Select dry particles, wet particles or fluorescent particles for inspection according to work pieces and required precision ◆ Capable to mark the position with cracks clearly
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"> ◆ Understand the principles of ultrasonic detection and examination technology used to inspect internal damages of metallic equipment and material thickness ◆ Understand the processing requirements for work piece surface before conducting ultrasonic inspection <p>6.2 Methods and procedures of inspecting internal damages of metallic equipment and material thickness</p> <ul style="list-style-type: none"> ◆ Capable to process work piece surface properly according to work pieces that need ultrasonic inspection ◆ Capable to use ultrasonic testing instruments to detect and examine internal damages of metallic equipment and material thickness ◆ Capable to use ultrasonic testing instruments to measure and calculate crack positions and size ◆ Capable to mark the position with cracks clearly
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	Apply commonly used regulations and international standards relevant to electrical installations
2. Code	EMCUIT203A
3. Range	Apply the Electricity (Wiring) Regulations and their Code of Practice, the power supply regulations of the electricity company, and relevant international standards for electrical installations to arrange for simple electricity supply equipment installation where the electrical and mechanical inspection, commissioning and testing works are involved.
4. Level	2
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Commonly used regulations and international standards relevant to electrical installations</p> <ul style="list-style-type: none"> ◆ Understand commonly used regulations and international standards relevant to electrical installations, such as: <ul style="list-style-type: none"> • Electricity Ordinance of Hong Kong, Electricity (Registration) Regulations, Electricity (Wiring) Regulations and their Code of Practice, Electrical Products (Safety) Regulation, etc. <p>6.2 Apply commonly used regulations and international standards relevant to electrical installations to perform electrical and mechanical work</p> <ul style="list-style-type: none"> ◆ Understand all contract terms and drawings, and apply commonly used regulations and international standards relevant to electrical installations to perform the installation of low-voltage distribution underground cable direct electricity supply system, including the design, installation, inspection, commissioning, testing, running, repair and maintenance, etc.
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply commonly used regulations and international standards relevant to electrical installations to arrange for the design, installation, inspection, commissioning, testing, running, repair and maintenance, etc. of the electricity supply network and installation work.</p>
8. Remarks	This unit of competency is applicable to electrical and mechanical practitioners in general.

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"> ◆ Understand effective communication skills, including speaking skill, listening skill, summarizing skill and interpersonal skill ◆ Understand the functions of different communication media / tools <ul style="list-style-type: none"> • Using email or fax • Using telephone for liaison and communication • Holding meetings, etc. ◆ Understand common terminology and technical terms used in the electrical and mechanical engineering services industry <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"> ◆ 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
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	Draw simple air-conditioning and refrigeration engineering drawings	
2. Code	EMACDE201A	
3. Range	Draw simple air-conditioning and refrigeration engineering sketches or drawings at design studios, drawing office or work sites.	
4. Level	2	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of drawing air-conditioning and refrigeration engineering drawings</p> <ul style="list-style-type: none"> ◆ Understand of the development drawings of air ducts ◆ Understand of the electrical control circuit wiring diagrams of air-conditioning and refrigeration equipment ◆ Understand of the layout and line drawing of central air-conditioning air system and water systems ◆ Understand the assembly drawings of facilities ◆ Understand the definitions of tolerance, limits and fits ◆ Understand of the layout of refrigerant systems <p>6.2 Draw simple air-conditioning and refrigeration engineering drawings</p> <ul style="list-style-type: none"> ◆ Draw the development drawings of different types of air ducts, including: <ul style="list-style-type: none"> • Cylindrical and rectangular air ducts including straight duct \ bend \ offset \ reducer and rectangular-round transformation • Cross-sectional drawings of air ducts and their accessories ◆ Draw the electrical control circuit wiring diagrams of air-conditioning and refrigeration equipment, including: <ul style="list-style-type: none"> • Power supply wiring diagrams • Electrical control circuit wiring diagrams of single-phase and three-phase electric motors • Electrical control circuit diagrams of window-type and split-type air-conditioners, refrigerators, freezers and chiller plant ◆ Draw the layout of central air-conditioning air system ◆ Draw the layout of central air-conditioning water systems ◆ Draw assembly drawings of simple mechanical parts <p>6.3 Professionalism in drawing air-conditioning and refrigeration engineering drawings</p> <ul style="list-style-type: none"> ◆ Draw air-conditioning and refrigeration engineering drawings independently according to drawing standards required by EMSD ◆ Understand the code of practice of EMSD on air-conditioning and refrigeration in order to perform the task of drawing basic air-conditioning and refrigeration engineering drawings 	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: (i) Capable to complete the task of drawing simple air-conditioning and refrigeration engineering drawings systematically and efficiently.
8. Remarks	(i) This unit of competency is applicable to practitioners engaged in general design, installation, testing, commissioning, operation, repair, maintenance and sales of air-conditioning and refrigeration equipment; and (ii) The credit value of this unit of competency is set on the presumption that the person already possesses elementary knowledge of engineering drawing.

1. Title	Apply basic knowledge of central air-conditioning systems
2. Code	EMACDE202A
3. Range	Apply basic knowledge of central air-conditioning systems in the air-conditioning systems air-conditioning systems of the design, installation, testing, commissioning, operation, repair, maintenance and project management of central air-conditioning systems at design studios or central air-conditioning system work sites.
4. Level	2
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Basic knowledge of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Understand the types and characteristics of central air-conditioning systems, including: <ul style="list-style-type: none"> • Types and characteristics of central air-conditioning systems • Construction and working principles of fan coil units • Difference between constant air volume system and variable air volume system ◆ Understand the equipment layout of central air-conditioning water systems, air systems and refrigeration systems, including: <ul style="list-style-type: none"> • Equipment of water systems for central air-conditioning system and its layout plans • Equipment of air system for central air-conditioning system and its layout plans • Equipment of refrigeration system for central air-conditioning system and its layout plans ◆ Understand the working principles of central air-conditioning electrical control systems, including: <ul style="list-style-type: none"> • Purpose of central air-conditioning electrical control systems • Meanings of symbols of typical electrical control components • Principles of self-lock, interlock and sequential control of different control devices in the electrical control wiring diagrams for central air-conditioning system ◆ Understand the functions and working principles of safety protection devices and control devices for central air-conditioning system, including: <ul style="list-style-type: none"> • Protection devices for central air-conditioning system (including high pressure switch, low pressure switch, oil pressure switch, oil heater, overload protector, water flow switch and air flow switch) • Control devices for central air-conditioning systems (including solenoid valve, thermal expansion valve, evaporating pressure regulating valve, condensing pressure regulating valve and thermostats)

	<p>6.2 Application of knowledge of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Identify various types of equipment for central air-conditioning system ◆ Read the layout plans of equipment for central air-conditioning system ◆ Select various types of devices for central air-conditioning system
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to apply basic knowledge of central air-conditioning systems in general design, installation, testing, commissioning, operation, repair, maintenance and project management work; and</p> <p>(ii) Capable to explain to clients the basic knowledge of central air-conditioning systems.</p>
8. Remarks	<p>This unit of competency is applicable to practitioners engaged in general design, installation, testing, commissioning, operation, repair, maintenance and project management of central air-conditioning systems.</p>

1. Title	Apply basic knowledge of automatic control for air-conditioning and refrigeration systems
2. Code	EMACDE203A
3. Range	Apply basic knowledge of automatic control for air-conditioning and refrigeration systems at design studios, air-conditioning and refrigeration system work sites or machine rooms to perform tasks of designing, installing, testing, commissioning, operating, repairing and maintaining air-conditioning and refrigeration systems.
4. Level	2
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Basic knowledge of automatic control for air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Understand the functions and application range of automatic control in air-conditioning and refrigeration systems ◆ Understand the meanings of typical terms used in automatic control, including control object, control variables, set points, deviation, interference, sensor, controller and actuator ◆ Understand the principles of open-loop and closed-loop control systems, including: <ul style="list-style-type: none"> • Using block diagram to illustrate the composition of an automatic control system • Using block diagram with examples to illustrate the open-loop control system • Using block diagram with examples to illustrate the closed-loop control system ◆ Understand the functions and structural principles of typical controllers, including thermal switch, solenoid valve, expansion valve, pressure regulation valve and servo-motor ◆ Understand the functions and structural principles of typical actuators, including electric regulating valve and electric regulating air valve ◆ Understand the basic control principles of refrigeration system and temperature control of refrigerator ◆ Understand the principles of temperature control of air-conditioning system and fan coil unit ◆ Understand the working principles of measuring instrument of air-conditioning system, including: <ul style="list-style-type: none"> • Different types of thermometers • Different types of pressure gauges • Different types of psychrometers • Different types of level gauges • Different types of anemometers

	<p>6.2 Application of knowledge of automatic control for air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Identify various types of automatic air-conditioning and refrigeration control system equipment ◆ Read the layout plan of automatic air-conditioning and refrigeration control system equipment ◆ Select various types of automatic air-conditioning and refrigeration control system equipment and devices
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> (i) Capable to apply basic knowledge of automatic control for air-conditioning and refrigeration systems in general design, installation, testing, commissioning, operation, repair and maintenance; and (ii) Capable to explain to clients the basic knowledge of automatic control for air-conditioning and refrigeration systems.
8. Remarks	<p>This unit of competency is applicable to practitioners engaged in general design, installation, testing, commissioning, operation, repair and maintenance of air-conditioning and refrigeration system.</p>

1. Title	Apply knowledge of safety, health and environmental protection for air-conditioning and refrigeration engineering branch
2. Code	EMACSH201A
3. Range	Apply knowledge of safety, health and environmental protection for air-conditioning and refrigeration engineering branch at work sites, design studios or all kinds of working environment to reduce hazards in work sites and to coordinate the safety, health and environmental protection management work.
4. Level	2
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of safety, health and environmental protection for air-conditioning and refrigeration engineering branch</p> <ul style="list-style-type: none"> ◆ Understand the responsibilities of staff at all levels regarding safety and health, including being able to : <ul style="list-style-type: none"> • State clearly the responsibilities of employers, premise occupants and persons in charge regarding safety and health required by the Factories and Industrial Undertakings Ordinance (Sections 6A) • State clearly the general safety rules to be followed by employees in work required by the Factories and Industrial Undertakings Ordinance (Sections 6B) ◆ Understand basic industrial safety knowledge, including being able to : <ul style="list-style-type: none"> • Explain what is a safe working environment • Explain safe attire for work • Select proper personal protective equipment • Explain general safety measures to prevent fall of person • Explain proper procedures for manual lifting • Explain general ways of machine protection ◆ Understand the types of accidents in the air-conditioning and refrigeration processes and their preventions, including being able to: <ul style="list-style-type: none"> • List the safety precautions for general air-conditioning and refrigeration processes • List the safety precautions for working in cold storages • List the safety precautions when installing and repairing window-type and split-type air-conditioners ◆ Understand the types of general electrical appliance accidents and their preventions, including being able to: <ul style="list-style-type: none"> • State the safety requirements of general use of electricity • State accidents happened during the repair of general electrical appliances and their preventions

	<ul style="list-style-type: none"> • State accidents commonly seen at work sites and their preventions ◆ Understand general fire preventive measures, including being able to: <ul style="list-style-type: none"> • List measures to prevent fire • List the specifications of fire escape • List fire handling ways ◆ Understand the code of safety on general manual arc welding and oxygen-acetylene gas welding, including being able to: <ul style="list-style-type: none"> • List the code of safety for operating manual arc welding • List the code of safety for operating oxygen-acetylene gas welding ◆ Understand the code of safety for typical refrigerants, including being able to: <ul style="list-style-type: none"> • List the hazards of refrigerants • List the code of safety for transporting and storing refrigerants ◆ Understand the impact of refrigerants on environment, including being able to: <ul style="list-style-type: none"> • State the impact of global warming on human being • Explain how refrigerants cause global warming and ways to improve the situation • State the impact of the depletion of ozone layer on human being • Explain how refrigerants deplete the ozone layer and ways to improve the situation • list refrigerants that cause global warming and deplete the ozone layer ◆ Understand the impact of legionnaires' disease on human health and its prevention, including being able to: <ul style="list-style-type: none"> • Explain the symptoms and causes of the disease • Explain the disease spreads and its impact on human health • State ways to prevent the disease <p>6.2 Application of knowledge of safety, health and environmental protection for air-conditioning and refrigeration engineering branch</p> <ul style="list-style-type: none"> ◆ Apply knowledge of safety, health and environmental protection for air-conditioning and refrigeration engineering branch to design safe, healthy and environmental friendly air-conditioning and refrigeration systems; protect the safety, health and environment when carrying out air-conditioning and refrigeration works; and promote to others the awareness of safety, health and environmental protection
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7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: (i) Capable to Apply knowledge of safety, health and environmental protection for air-conditioning and refrigeration engineering branch to solve the problems involved in air-conditioning and refrigeration works; and communicate with the sector and clients.
8. Remarks	This unit of competency is applicable to practitioners of the air-conditioning and refrigeration branch.

1. Title	Perform refrigeration copper tubing work
2. Code	EMACIN201A
3. Range	Use refrigeration copper tubing work tools and oxy-acetylene brazing tools to install and service refrigeration copper tubing at installation or servicing sites under a degree of instruction.
4. Level	2
5. Credit	4
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Properties of refrigeration copper tubing and method of using tubing tools</p> <ul style="list-style-type: none"> ◆ Understand the properties of refrigeration copper tubing, including: <ul style="list-style-type: none"> • Method of showing the dimensions of refrigeration copper tubing • Types of refrigeration copper tubing • Method of storing refrigeration copper tubing ◆ Understand the uses of refrigeration copper tubing tools, including: <ul style="list-style-type: none"> • Tube cutter, tube bender, flaring tool, swaging tool and locking pliers ◆ Understand the oxy-acetylene brazing method, including: <ul style="list-style-type: none"> • Proper way of using oxy-acetylene brazing equipment • Way of preparing copper tube brazing joints • Adjustment of brazing flame • Operation procedures of oxy-acetylene brazing and salient points <p>6.2 Methods and procedures of copper refrigeration tube machining</p> <ul style="list-style-type: none"> ◆ Cut, bend, flare and seal the 15.88mm refrigeration copper tubing according to drawings and conduct pressure test successfully using 1,000kPa nitrogen ◆ Conduct oxy-acetylene silver-brazing to the 15.88mm refrigeration copper tubing according to drawings and conduct pressure test successfully using 1,000kPa nitrogen <p>6.3 Professionalism in copper refrigeration tube machining</p> <ul style="list-style-type: none"> ◆ Operate oxy-acetylene silver-brazing equipment and accessories correctly and safely ◆ Wear proper personal protective equipment correctly ◆ Follow the legal requirements and guidelines on oxy-acetylene brazing in Hong Kong
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to fabricate the 15.88mm refrigeration copper tubing according to drawings and conduct pressure test successfully using 1,000kPa nitrogen ; and</p> <p>(ii) Capable to conduct oxy-acetylene silver-brazing to the 15.88mm refrigeration copper tubing and conduct pressure test successfully using 1,000kPa nitrogen</p>
8. Remarks	This unit of competency is applicable to air-conditioning and refrigeration engineering practitioners in general.

1. Title	Wire up electrical control circuit of a fan coil unit
2. Code	EMACIN202A
3. Range	Wire up electrical control circuit of a fan coil unit at installation sites.
4. Level	2
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of typical simple electrical control circuits for air-conditioning and refrigeration</p> <ul style="list-style-type: none"> ◆ Understand the code of safety on electrical work, including: <ul style="list-style-type: none"> • Causes for accidents commonly seen in electrical work • Points to note for electrical work • Ways to prevent electric shock ◆ Calculate simple parallel and series DC circuits ◆ Understand the working principles of simple electrical control circuits of typical air-conditioning and refrigeration equipment ◆ Read simple electrical control circuits wiring diagrams for typical air-conditioning and refrigeration equipment <p>6.2 Methods and procedures for wiring up electrical control circuit of a fan coil unit</p> <ul style="list-style-type: none"> ◆ Use typical electrical measuring meters, including being able to: <ul style="list-style-type: none"> • Use multimeters to measure electric resistance and voltage of circuits • Use clamp type ammeter to measure current of circuits • Use insulation meter to measure insulation resistance of circuits ◆ Perform simple wiring and conduit installation, including being able to: <ul style="list-style-type: none"> • Follow the code of practice under the Electricity (Wiring) Regulations to select cables and flexible wires for the electrical installations • Follow the code of practice under the Electricity (Wiring) Regulations to select conduits, trunking and electrical devices commonly used for electrical installations • Follow the Electricity (Wiring) Regulations to perform simple wiring and conduit work • Wire up the electrical control circuits of the fan coil unit ◆ Use multimeters to check whether the electrical control circuit of the fan coil unit functions properly <p>6.3 Professionalism in wiring up electrical control circuit of a fan coil unit</p> <ul style="list-style-type: none"> ◆ Follow the code of practice under the Electricity (Wiring) Regulations to wire up electrical control circuit of a fan coil unit safely

7. Assessment Criteria	The integrated outcome requirements of this unit of competency are: (i) Capable to wire up the electrical control circuit of a fan coil unit according to drawings; and (ii) Capable to follow relevant code of practice when performing electrical works.
8. Remarks	This unit of competency is applicable to practitioners engaged in wiring up of air-conditioning and refrigeration control circuits.

1. Title	Perform basic installation of condensate drain pipes for air-conditioning and refrigeration systems
2. Code	EMACIN208A
3. Range	Install condensate drain pipes for air-conditioning and refrigeration systems at installation or servicing stations under a certain degree of instruction.
4. Level	2
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Functions, installation requirements, properties and applications of condensate drain pipes for air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Understand the functions of condensate drain pipes for air-conditioning and refrigeration systems ◆ Understand the installation requirements of condensate drain pipes for air-conditioning and refrigeration systems ◆ Understand the properties of typical condensate drain pipes for air-conditioning and refrigeration systems ◆ Understand the application range of typical condensate drain pipes for air-conditioning and refrigeration systems <p>6.2 Fabrication and installation methods and procedures of galvanized steel and PVC condensate drain pipes</p> <ul style="list-style-type: none"> ◆ Fabricate galvanized steel pipes, including cutting and screw threading with electric threader, according to the drawing ◆ Install galvanized steel pipes to the condensate water system of the air-conditioning and refrigeration system according to the drawing ◆ Fabricate, including cutting, bending and joining, PVC pipes according to the drawing ◆ Install PVC pipes to the condensate water system of the air-conditioning and refrigeration system according to the drawing <p>6.3 Professionalism in installing condensate drain pipes for air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Follow the code of practice to install condensate drain pipes for air-conditioning and refrigeration systems
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to fabricate and install galvanized steel pipes and PVC pipes to the condensate water system of the air-conditioning and refrigeration systems according to the drawing.</p>
8. Remarks	This unit of competency is applicable to practitioners engaged in general installation and repair of air-conditioning and refrigeration systems.

1. Title	Perform basic wiring up of electrical control circuit of air-handling units									
2. Code	EMACIN209A									
3. Range	Perform basic wiring up of electrical control circuit of air-handling units at installation or servicing stations under a certain degree of instruction.									
4. Level	2									
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;">Functions, construction and working principles of electrical control circuit of air-handling units</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ◆ Understand the functions and construction of electrical control circuit of air-handling units ◆ Understand the principles of wiring diagramme of electrical control circuit of air-handling units ◆ Understand the methods of wiring up the components in the wiring diagramme of electrical control circuit of air-handling units </td> </tr> <tr> <td style="vertical-align: top;">6.2</td> <td style="vertical-align: top;">Methods and procedures of wiring up basic electrical control circuit of air-handling units</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ◆ Wire up electrical control circuit of air-handling units according to the drawing ◆ Conduct functional test on electrical control circuit of air-handling units </td> </tr> <tr> <td style="vertical-align: top;">6.3</td> <td style="vertical-align: top;">Professionalism in wiring up basic electrical control circuit of air-handling units</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ◆ Follow the code of practice under the Electricity (Wiring) Regulations to wire up electrical control circuit of air-handling units safely </td> </tr> </table>	6.1	Functions, construction and working principles of electrical control circuit of air-handling units	<ul style="list-style-type: none"> ◆ Understand the functions and construction of electrical control circuit of air-handling units ◆ Understand the principles of wiring diagramme of electrical control circuit of air-handling units ◆ Understand the methods of wiring up the components in the wiring diagramme of electrical control circuit of air-handling units 	6.2	Methods and procedures of wiring up basic electrical control circuit of air-handling units	<ul style="list-style-type: none"> ◆ Wire up electrical control circuit of air-handling units according to the drawing ◆ Conduct functional test on electrical control circuit of air-handling units 	6.3	Professionalism in wiring up basic electrical control circuit of air-handling units	<ul style="list-style-type: none"> ◆ Follow the code of practice under the Electricity (Wiring) Regulations to wire up electrical control circuit of air-handling units safely
6.1	Functions, construction and working principles of electrical control circuit of air-handling units	<ul style="list-style-type: none"> ◆ Understand the functions and construction of electrical control circuit of air-handling units ◆ Understand the principles of wiring diagramme of electrical control circuit of air-handling units ◆ Understand the methods of wiring up the components in the wiring diagramme of electrical control circuit of air-handling units 								
6.2	Methods and procedures of wiring up basic electrical control circuit of air-handling units	<ul style="list-style-type: none"> ◆ Wire up electrical control circuit of air-handling units according to the drawing ◆ Conduct functional test on electrical control circuit of air-handling units 								
6.3	Professionalism in wiring up basic electrical control circuit of air-handling units	<ul style="list-style-type: none"> ◆ Follow the code of practice under the Electricity (Wiring) Regulations to wire up electrical control circuit of air-handling units safely 								
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to wire up basic electrical control circuit of air-handling units according to the drawing; and</p> <p>(ii) Capable to follow relevant code of practice when wiring up basic electrical control circuit of air-handling units.</p>									
8. Remarks	This unit of competency is applicable to practitioners engaged in general air-conditioning and refrigeration control circuit installation.									

1. Title	Perform basic wiring of electric motor starting circuits for air-conditioning and refrigeration
2. Code	EMACIN210A
3. Range	Perform basic wiring of electric motor starting circuits for air-conditioning and refrigeration at installation or servicing stations under a certain degree of instruction.
4. Level	2
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Functions and working principles of typical motor starting circuits for air-conditioning and refrigeration</p> <ul style="list-style-type: none"> ◆ Understand the functions of motor starting circuits ◆ Understand the working principles of the direct-on-line motor starting circuit ◆ Understand the working principles of the star-delta motor starting circuit ◆ Understand the working principles of the part-winding motor starting circuit <p>6.2 Methods and procedures of wiring up typical motor starting circuits for air-conditioning and refrigeration</p> <ul style="list-style-type: none"> ◆ Wire up the direct-on-line motor starting circuit according to the drawing ◆ Wire up the star-delta motor starting circuit according to the drawing ◆ Wire up the part-winding motor starting circuit according to the drawing <p>6.3 Professionalism in wiring up typical motor starting circuits for air-conditioning and refrigeration</p> <ul style="list-style-type: none"> ◆ Follow the code of practice under the Electricity (Wiring) Regulations to wire up motor starting circuits safely
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to wire up direct-on-line, star-delta and part-winding motor starting circuits; and</p> <p>(ii) Capable to follow relevant code of practice when performing electrical wiring work.</p>
8. Remarks	This unit of competency is applicable to practitioners engaged in typical installation and repair work of electrical control system for air-conditioning and refrigeration

1. Title	Wire up pressure control and pump down control circuits of refrigeration system
2. Code	EMACIN211A
3. Range	Wire up pressure control and pump down control circuits of refrigeration system at installation or servicing stations under a certain degree of instruction.
4. Level	2
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of pressure control and pump down control circuits of refrigeration system</p> <ul style="list-style-type: none"> ◆ Understand the functions and working principles of low-pressure control switches, high pressure control switches and dual pressure control switches ◆ Understand the functions and working principles of oil pressure safety control switches ◆ Understand the working principles of pressure control circuit of refrigeration system ◆ Understand the working principles of pump down control circuit of refrigeration system <p>6.2 Methods and procedures of wiring up pressure control and pump down control circuits of refrigeration system</p> <ul style="list-style-type: none"> ◆ Wire up the low pressure control switch and high pressure control switch to the refrigeration system ◆ Wire up the oil pressure safety control switch to the refrigeration system ◆ Wiring up the pump down control circuit of refrigeration system ◆ Conduct functional test of the low pressure control switch, high pressure control switch, and the oil pressure safety control switch ◆ Conduct functional test of the pump down control circuits of refrigeration system <p>6.3 Professionalism in wiring up pressure control and pump down control circuits of refrigeration system</p> <ul style="list-style-type: none"> ◆ Follow the code of practice under the Electricity (Wiring) Regulations to wire up pressure control and pump down control circuits of refrigeration system safely
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to wire up pressure control and pump down control circuits of refrigeration system; and</p> <p>(ii) Capable to follow relevant code of practice when performing electrical wiring work.</p>
8. Remarks	This unit of competency is applicable to practitioners engaged in typical installation and repair work of electrical control system for air-conditioning and refrigeration.

1. Title	Perform basic testing of electrical wiring for air-conditioning and refrigeration
2. Code	EMACIT201A
3. Range	Perform basic testing of electrical wiring for air-conditioning and refrigeration and install circuit protectors at installation or servicing stations under a certain degree of instruction.
4. Level	2
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Causes of circuit faults, construction of circuit protectors and methods of using electrical measuring instruments</p> <ul style="list-style-type: none"> ◆ Understand the definition, causes and damage of open-circuit, short-circuit and earthed-circuit faults, and insulation resistance ◆ Understand the functions of circuit protector ◆ Understand the construction and application range of fuse, mini circuit breaker (MCB) and molded case circuit breaker (MCCB) ◆ Understand the functions and using method of multimeter and megaohmmeter <p>6.2 Methods and procedures of measuring circuit faults for air-conditioning and refrigeration equipment and installing circuit protectors</p> <ul style="list-style-type: none"> ◆ Install a fuse in an air-conditioning and refrigeration circuit ◆ Install an MCB in an air-conditioning and refrigeration circuit ◆ Measure open-circuit, short-circuit and earthed-circuit faults of an air-conditioning and refrigeration circuit ◆ Measure the insulation resistance of an air-conditioning and refrigeration circuit <p>6.3 Professionalism in testing electrical wiring for air-conditioning and refrigeration</p> <ul style="list-style-type: none"> ◆ Follow the code of practice under the Electricity (Wiring) Regulations to test and measure electrical wiring for air-conditioning and refrigeration safely
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to perform basic testing of electrical wiring for air-conditioning and refrigeration and install circuit protectors systematically and efficiently; and</p> <p>(ii) Capable to follow relevant code of practice when performing testing of electrical wiring.</p>
8. Remarks	This unit of competency is applicable to practitioners engaged in general installation and repair of electrical wiring for air-conditioning and refrigeration.

1. Title	Perform basic testing and measuring of air-conditioning and refrigeration systems	
2. Code	EMACIT202A	
3. Range	Perform basic testing and measuring of air-conditioning and refrigeration systems at installation or servicing stations under a certain degree of instruction	
4. Level	2	
5. Credit	5	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Methods of using typical testing and measuring instruments for air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Understand the definition of units of measurement of temperature, relative humidity, pressure and air velocity ◆ Understand the using methods and applications of various types of thermometer ◆ Understand the using methods and applications of various types of relative humidity measuremet instruments ◆ Understand the using methods and applications of various types of pressure measuremet instruments ◆ Understand the using methods and applications of various types of air velocity measuremet instruments ◆ Understand the using methods and applications of various types of sound level measuremet instruments <p>6.2 Basic methods and procedures of testing and measuring air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Use typical thermometers to measure the temperature of the measuring points of an air-conditioning and refrigeration system ◆ Use typical psychrometers to measure indoor relative humidity ◆ Use gauge manifold to measure the high side pressure and low side pressure of a refrigeration system ◆ Use vane-type air velocity meter to measure supply air velocity of an air-conditioning system ◆ Use sound level meter to measure the sound level of air-conditioning system equipment <p>6.3 Professionalism in basic testing and measuring of air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Follow the user manual instructions to use air-conditioning and refrigeration system testing and measuring instruments ◆ Follow the code of practice to test and measure air-conditioning and refrigeration systems 	

7. Assessment Criteria	The integrated outcome requirements of this unit of competency are: (i) Capable to measure the temperature, relative humidity, pressure and air velocity of an air-conditioning and refrigeration system ; and (ii) Capable to follow the code of practice to test and measure air-conditioning and refrigeration systems.
8. Remarks	This unit of competency is applicable to practitioners engaged in general installation, repair and commissioning of air-conditioning and refrigeration systems.

1. Title	Wire up and repair electrical control components and starting circuits for air-conditioning and refrigeration
2. Code	EMACOR203A
3. Range	Wire up and repair electrical control components and starting circuits for air-conditioning and refrigeration at installation or servicing stations under a certain degree of instruction.
4. Level	2
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Types, functions, construction and working principles of typical electrical control components for air-conditioning and refrigeration</p> <ul style="list-style-type: none"> ◆ Use Ohm's Law to calculate simple DC and AC circuits ◆ Understand the methods of wiring up single-phase and three-phase power systems ◆ Understand the types, functions, construction and working principles of overload protector, electro-magnetic contactor and timer relay <p>6.2 Methods and procedures of wiring up and repairing typical electrical control components and starting circuits for air-conditioning and refrigeration</p> <ul style="list-style-type: none"> ◆ Wire up and repair overload protector, electro-magnetic contactor and timer relay ◆ Wire up and repair self-holding electrical circuit, interlocking electrical circuit and sequential control strating circuit <p>6.3 Professionalism in wiring up and repairing typical electrical control components and starting circuits for air-conditioning and refrigeration</p> <ul style="list-style-type: none"> ◆ Follow the code of practice under the Electricity (Wiring) Regulations to wire upand repair typical electrical control components and starting circuits for air-conditioning and refrigeration safely
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to wire up and repair typical electrical control components and starting circuits for air-conditioning and refrigeration according to drawings; and</p> <p>(ii) Capable to follow relevant code of practice when carrying out electrical work.</p>
8. Remarks	This unit of competency is applicable to practitioners engaged in general installation and repair of air-conditioning and refrigeration electrical control systems.

1. Title	Perform basic installation of thermal insulation materials for air-conditioning and refrigeration system
2. Code	EMACIN203A
3. Range	Perform basic installation of thermal insulation materials for air-conditioning and refrigeration system at installation sites under a certain degree of instruction.
4. Level	2
5. Credit	5
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Functions and installation practice of thermal insulation materials for air-conditioning and refrigeration system</p> <ul style="list-style-type: none"> ◆ Understand the functions of thermal insulation materials for air-conditioning and refrigeration chilled water pipe and air duct systems ◆ Understand the functions of damp proof layer ◆ Understand the installation practice of thermal insulation materials <p>6.2 Basic methods and procedures of installing thermal insulation materials for air-conditioning and refrigeration system</p> <ul style="list-style-type: none"> ◆ Identify various typical thermal insulation materials ◆ Install and dismantle platforms for work at height ◆ Install phenolic foam thermal insulation materials tight and neat on to the straight chilled water pipe ◆ Install elastomeric thermal insulation materials tight and neat on to the straight chilled water pipe ◆ Perform seal treatment to thermal insulation material connection points on pipes ◆ Install fibreglass thermal insulation materials tight and neat on to the straight air ducts ◆ Perform seal treatment to thermal insulation material connection points on air ducts <p>6.3 Professionalism in basic installation of thermal insulation materials for air-conditioning and refrigeration system</p> <ul style="list-style-type: none"> ◆ Understand the safety guidelines as required by the law and the code of practice and perform basic installation of thermal insulation materials for air-conditioning and refrigeration system
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to complete systematically and efficiently the basic installation of thermal insulation materials for air-conditioning and refrigeration system.</p>
8. Remarks	This unit of competency is applicable to practitioners engaged in installation of thermal insulation materials for air-conditioning and refrigeration system.

1. Title	Perform basic installation of window-type and split-type air-conditioners
2. Code	EMACIN204A
3. Range	Perform basic installation of window-type and split-type air-conditioners at installation sites under a certain degree of instruction.
4. Level	2
5. Credit	5
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Types, construction and features of window-type and split-type air-conditioners</p> <ul style="list-style-type: none"> ◆ Understand the code of safety on installation of window-type and split-type air-conditioners ◆ Understand the code of practice on installation of window-type and split-type air-conditioners ◆ Understand the classification of different kinds of window-type and split-type air-conditioners , including: <ul style="list-style-type: none"> • Classification by functions • Classification by construction • Classification by compressor type <p>6.2 Basic installation methods and procedures for window-type and split-type air-conditioners</p> <ul style="list-style-type: none"> ◆ Prepare ancillary materials for installation of window-type air-conditioners ◆ Install window-type air-conditioners on to aluminium windows according to general installation specifications and instructions of superiors ◆ Connect and install condensate drain pipes ◆ Prepare ancillary materials for installation of split-type air-conditioners ◆ Install the indoor units and outdoor units of split-type air-conditioners according to general installation specifications and instructions of superiors <p>6.3 Professionalism in basic installation of window-type and split-type air-conditioners</p> <ul style="list-style-type: none"> ◆ Follow the code of practice to perform installation of window-type and split-type air-conditioners
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to complete basic installation of typical window-type and split-type air-conditioners systematically and efficiently; and</p> <p>(ii) Capable to follow the code of practice to perform basic installation of window-type and split-type air-conditioners.</p>
8. Remarks	This unit of competency is applicable to practitioners engaged in typical installation of window-type and split-type air-conditioners.

1. Title	Perform basic installation of water systems for air-conditioning and refrigeration system
2. Code	EMACIN205A
3. Range	Perform basic installation of water systems for air-conditioning and refrigeration system at air-conditioning and refrigeration machine rooms or equipment installation sites under a certain degree of instruction.
4. Level	2
5. Credit	5
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Functions and layout plan for typical equipment of water systems for air-conditioning and refrigeration system</p> <ul style="list-style-type: none"> ◆ Identify fan coil unit, air handling unit, water pump, various types of pipe fittings and valves ◆ Understand the functions of the above-mentioned equipment ◆ Read equipment simple layout plans for water systems for air-conditioning and refrigeration system <p>6.2 Basic installation methods and procedures of water systems for air-conditioning and refrigeration system</p> <ul style="list-style-type: none"> ◆ Identify locations at work site for installing equipment according to the layout plan of the water systems for air-conditioning and refrigeration system ◆ Prepare ancillary materials for installation of water systems equipment for air-conditioning and refrigeration system ◆ Install water pumps, air handling units, expansion tanks, cooling towers, condensers, fan coil units, water pipes, valves and other water systems equipment and accessories according to instructions of superiors <p>6.3 Professionalism in basic installation of air-conditioning and refrigeration water systems</p> <ul style="list-style-type: none"> ◆ Follow the instructions of drawings and specifications to perform basic installation of water systems equipment for air-conditioning and refrigeration system ◆ Understand the safety guidelines as required by the law and the code of practice to perform basic installation of water systems for air-conditioning and refrigeration system
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to complete basic installation of water systems for air-conditioning and refrigeration system systematically and efficiently; and</p> <p>(ii) Capable to follow the code of practice to perform basic installation of water systems for air-conditioning and refrigeration system.</p>
8. Remarks	This unit of competency is applicable to practitioners engaged in general installation of air-conditioning and refrigeration water systems.

1. Title	Perform basic installation of air duct systems
2. Code	EMACIN206A
3. Range	Perform basic installation of air duct systems at industrial plants and installation sites.
4. Level	2
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of air duct system materials and common terminology</p> <ul style="list-style-type: none"> ◆ Possess knowledge of air duct system materials, including: <ul style="list-style-type: none"> • Properties and applications of typical metallic materials • Properties, specifications and applications of typical sheet metals • Properties, specifications and applications of typical air duct joints • Properties, specifications and applications of typical non-metallic materials • Features and applications of typical flexible air ducts ◆ Understand common terminology and symbols used in drawings of fabricating metallic air ducts. <p>6.2 Methods and procedures of making and installing simple air ducts and accessories</p> <ul style="list-style-type: none"> ◆ Install and dismantle platforms for work at height ◆ Use lifting devices such as chain block, slings, shackles and hooks ◆ Draw developing drawings of air ducts on metal sheets according to the drawing requirements ◆ Fabricate air ducts, including straight rectangular air duct, bend, reducer, offset, round-rectangular transformation according to the relevant DW series requirements of HVCA ◆ Install and join air ducts according to the relevant DW series requirements of HVCA ◆ Fabricate and install hanging frames and accessories for air ducts and relevant equipment, including volume control damper, fire damper, fusible link, non-return damper, handle · vibration reduction joints and air diffusers <p>6.3 Professionalism in installing simple air ducts and accessories</p> <ul style="list-style-type: none"> ◆ Install simple air ducts and accessories according to the relevant DW series requirements of HVCA
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to follow the code of practice to install simple air ducts and accessories systematically and efficiently.</p>
8. Remarks	This unit of competency is applicable to practitioners engaged in general production and installation of air duct systems.

1. Title	Perform basic installation of electrical wiring for air-conditioning and refrigeration									
2. Code	EMACIN207A									
3. Range	Perform basic installation of electrical wiring for air-conditioning and refrigeration at installation or servicing stations in clearly defined contexts under a degree of instruction.									
4. Level	2									
5. Credit	12									
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;">Knowledge of using typical electrical wiring installation tools</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ◆ Understand the functions of typical electrical wiring installation tools ◆ Understand the uses of typical electrical wiring installation tools </td> </tr> <tr> <td style="vertical-align: top;">6.2</td> <td style="vertical-align: top;">Methods and procedures of basic installation of electrical wiring for air-conditioning and refrigeration</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ◆ Use typical electrical wiring installation tools effectively ◆ Install, according to drawings, basic electrical wiring for air-conditioning and refrigeration, including steel conduit, plastic conduit, steel trunking, socket circuit, plug, junction box and distribution box and wiring </td> </tr> <tr> <td style="vertical-align: top;">6.3</td> <td style="vertical-align: top;">Professionalism in installation of electrical wiring for air-conditioning and refrigeration</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ◆ Follow the code of practice under the Electricity (Wiring) Regulations to install electrical wiring for air-conditioning and refrigeration safely </td> </tr> </table>	6.1	Knowledge of using typical electrical wiring installation tools	<ul style="list-style-type: none"> ◆ Understand the functions of typical electrical wiring installation tools ◆ Understand the uses of typical electrical wiring installation tools 	6.2	Methods and procedures of basic installation of electrical wiring for air-conditioning and refrigeration	<ul style="list-style-type: none"> ◆ Use typical electrical wiring installation tools effectively ◆ Install, according to drawings, basic electrical wiring for air-conditioning and refrigeration, including steel conduit, plastic conduit, steel trunking, socket circuit, plug, junction box and distribution box and wiring 	6.3	Professionalism in installation of electrical wiring for air-conditioning and refrigeration	<ul style="list-style-type: none"> ◆ Follow the code of practice under the Electricity (Wiring) Regulations to install electrical wiring for air-conditioning and refrigeration safely
6.1	Knowledge of using typical electrical wiring installation tools	<ul style="list-style-type: none"> ◆ Understand the functions of typical electrical wiring installation tools ◆ Understand the uses of typical electrical wiring installation tools 								
6.2	Methods and procedures of basic installation of electrical wiring for air-conditioning and refrigeration	<ul style="list-style-type: none"> ◆ Use typical electrical wiring installation tools effectively ◆ Install, according to drawings, basic electrical wiring for air-conditioning and refrigeration, including steel conduit, plastic conduit, steel trunking, socket circuit, plug, junction box and distribution box and wiring 								
6.3	Professionalism in installation of electrical wiring for air-conditioning and refrigeration	<ul style="list-style-type: none"> ◆ Follow the code of practice under the Electricity (Wiring) Regulations to install electrical wiring for air-conditioning and refrigeration safely 								
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to install basic electrical wiring for air-conditioning and refrigeration according to drawings; and</p> <p>(ii) Capable to follow relevant code of practice when carrying out electrical work.</p>									
8. Remarks	This unit of competency is applicable to practitioners of general electrical wiring installation for air-conditioning and refrigeration.									

1. Title	Perform basic installation of packaged air-conditioning systems									
2. Code	EMACIN212A									
3. Range	Perform basic installation of packaged air-conditioning systems at installation sites under a certain degree of instruction.									
4. Level	2									
5. Credit	7									
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;">Functions of water-cooled and air-cooled packaged air-conditioning system equipment</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ◆ Understand the names of various water-cooled and air-cooled packaged air-conditioning system equipment ◆ Understand the functions of various water-cooled and air-cooled packaged air-conditioning system equipment </td> </tr> <tr> <td style="vertical-align: top;">6.2</td> <td style="vertical-align: top;">Basic installation methods and procedures of packaged air-conditioning systems</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ◆ Use electric arc welding method to make simple supporting frames for water pumps, cooling towers and other packaged air-conditioning systems according to drawings ◆ Follow the instructions to perform basic installation of water-cooled packaged air-conditioning system equipment including water pumps, cooling towers and indoor units ◆ Follow the instructions to perform basic installation of air-cooled packaged air-conditioning system equipment including indoor and outdoor units </td> </tr> <tr> <td style="vertical-align: top;">6.3</td> <td style="vertical-align: top;">Professionalism in Basic installation of packaged air-conditioning systems</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ◆ Follow the instructions to perform basic installation of packaged air-conditioning system equipment ◆ Understand the safety guidelines as required by the law and the code of practice and perform packaged air-conditioning system installation </td> </tr> </table>	6.1	Functions of water-cooled and air-cooled packaged air-conditioning system equipment	<ul style="list-style-type: none"> ◆ Understand the names of various water-cooled and air-cooled packaged air-conditioning system equipment ◆ Understand the functions of various water-cooled and air-cooled packaged air-conditioning system equipment 	6.2	Basic installation methods and procedures of packaged air-conditioning systems	<ul style="list-style-type: none"> ◆ Use electric arc welding method to make simple supporting frames for water pumps, cooling towers and other packaged air-conditioning systems according to drawings ◆ Follow the instructions to perform basic installation of water-cooled packaged air-conditioning system equipment including water pumps, cooling towers and indoor units ◆ Follow the instructions to perform basic installation of air-cooled packaged air-conditioning system equipment including indoor and outdoor units 	6.3	Professionalism in Basic installation of packaged air-conditioning systems	<ul style="list-style-type: none"> ◆ Follow the instructions to perform basic installation of packaged air-conditioning system equipment ◆ Understand the safety guidelines as required by the law and the code of practice and perform packaged air-conditioning system installation
6.1	Functions of water-cooled and air-cooled packaged air-conditioning system equipment	<ul style="list-style-type: none"> ◆ Understand the names of various water-cooled and air-cooled packaged air-conditioning system equipment ◆ Understand the functions of various water-cooled and air-cooled packaged air-conditioning system equipment 								
6.2	Basic installation methods and procedures of packaged air-conditioning systems	<ul style="list-style-type: none"> ◆ Use electric arc welding method to make simple supporting frames for water pumps, cooling towers and other packaged air-conditioning systems according to drawings ◆ Follow the instructions to perform basic installation of water-cooled packaged air-conditioning system equipment including water pumps, cooling towers and indoor units ◆ Follow the instructions to perform basic installation of air-cooled packaged air-conditioning system equipment including indoor and outdoor units 								
6.3	Professionalism in Basic installation of packaged air-conditioning systems	<ul style="list-style-type: none"> ◆ Follow the instructions to perform basic installation of packaged air-conditioning system equipment ◆ Understand the safety guidelines as required by the law and the code of practice and perform packaged air-conditioning system installation 								
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to make simple supporting frames for packaged air-conditioning system equipment; and</p> <p>(ii) Capable to complete the basic installation of packaged air-conditioning system equipment.</p>									
8. Remarks	This unit of competency is applicable to practitioners engaged in general installation of packaged air-conditioning systems.									

1. Title	Perform basic service work of air-conditioning and refrigeration systems									
2. Code	EMACOR201A									
3. Range	Perform basic service work of air-conditioning and refrigeration systems at installation, maintenance and servicing stations under a certain degree of instruction.									
4. Level	2									
5. Credit	5									
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;">Functions, construction and working principles of major air-conditioning and refrigeration system equipment</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ◆ Understand the principles of refrigeration cycle ◆ Understand the functions, construction and working principles of major refrigeration system equipment </td> </tr> <tr> <td style="vertical-align: top;">6.2</td> <td style="vertical-align: top;">Basic servicing methods and procedures of air-conditioning and refrigeration systems</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ◆ Clean and wash the air filter, evaporator and condenser ◆ Perform pressure leak check and vacuuming of refrigeration system ◆ Charge the small refrigeration system (cooling capacity below 11kW) with correct amount of refrigerant ◆ Check and ensure that the running current is normal </td> </tr> <tr> <td style="vertical-align: top;">6.3</td> <td style="vertical-align: top;">Professionalism in basic servicing of air-conditioning and refrigeration systems</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ◆ Follow the instructions to perform basic servicing of air-conditioning and refrigeration systems ◆ Understand the safety guidelines as required by the law and the code of practice to undertake the servicing of air-conditioning and refrigeration systems </td> </tr> </table>	6.1	Functions, construction and working principles of major air-conditioning and refrigeration system equipment	<ul style="list-style-type: none"> ◆ Understand the principles of refrigeration cycle ◆ Understand the functions, construction and working principles of major refrigeration system equipment 	6.2	Basic servicing methods and procedures of air-conditioning and refrigeration systems	<ul style="list-style-type: none"> ◆ Clean and wash the air filter, evaporator and condenser ◆ Perform pressure leak check and vacuuming of refrigeration system ◆ Charge the small refrigeration system (cooling capacity below 11kW) with correct amount of refrigerant ◆ Check and ensure that the running current is normal 	6.3	Professionalism in basic servicing of air-conditioning and refrigeration systems	<ul style="list-style-type: none"> ◆ Follow the instructions to perform basic servicing of air-conditioning and refrigeration systems ◆ Understand the safety guidelines as required by the law and the code of practice to undertake the servicing of air-conditioning and refrigeration systems
6.1	Functions, construction and working principles of major air-conditioning and refrigeration system equipment	<ul style="list-style-type: none"> ◆ Understand the principles of refrigeration cycle ◆ Understand the functions, construction and working principles of major refrigeration system equipment 								
6.2	Basic servicing methods and procedures of air-conditioning and refrigeration systems	<ul style="list-style-type: none"> ◆ Clean and wash the air filter, evaporator and condenser ◆ Perform pressure leak check and vacuuming of refrigeration system ◆ Charge the small refrigeration system (cooling capacity below 11kW) with correct amount of refrigerant ◆ Check and ensure that the running current is normal 								
6.3	Professionalism in basic servicing of air-conditioning and refrigeration systems	<ul style="list-style-type: none"> ◆ Follow the instructions to perform basic servicing of air-conditioning and refrigeration systems ◆ Understand the safety guidelines as required by the law and the code of practice to undertake the servicing of air-conditioning and refrigeration systems 								
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to perform pressure leak check, vacuuming of refrigeration system and charging of refrigerant; and</p> <p>(ii) Capable to follow the code of practice safely to undertake the servicing of air-conditioning and refrigeration systems.</p>									
8. Remarks	This unit of competency is applicable to practitioners engaged in general installation, maintenance and repair of air-conditioning and refrigeration systems.									

1. Title	Clean and wash window-type and split-type air-conditioners
2. Code	EMACOR202A
3. Range	Clean and wash window-type and split-type air-conditioners at servicing stations or external sites.
4. Level	2
5. Credit	5
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Types and safe working practices of window-type and split-type air-conditioners</p> <ul style="list-style-type: none"> ◆ Understand the types of air-conditioners ◆ Understand the correct way of using air-conditioners ◆ Understand the functions of various components of air-conditioners, including: <ul style="list-style-type: none"> • Refrigeration system • Air distribution system • Electrical control system ◆ Understand the reasons for washing window-type and split-type air-conditioners ◆ Understand the safe working practices for repairing window-type and split-type air-conditioners ◆ Understand the code of practice for repairing window-type and split-type air-conditioners <p>6.2 Methods and procedures of cleaning and washing window-type and split-type air-conditioners</p> <ul style="list-style-type: none"> ◆ Clean and wash the filters of window-type and split-type air-conditioners ◆ Clean and wash the evaporators and condensers of window-type and split-type air-conditioners ◆ Repair simple faults in window-type and split-type air-conditioners <p>6.3 Professionalism in cleaning and washing window-type and split-type air-conditioners</p> <ul style="list-style-type: none"> ◆ Follow the code of practice to clean and wash window-type and split-type air-conditioners
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to complete the cleaning and washing of window-type and split-type air-conditioners systematically and efficiently; and</p> <p>(ii) Capable to follow the code of practice to clean and wash window-type and split-type air-conditioners.</p>
8. Remarks	This unit of competency is applicable to practitioners engaged in general repair and maintenance of window-type and split-type air-conditioners.

1. Title	Perform basic repair of electric motors for air-conditioning and refrigeration										
2. Code	EMACOR204A										
3. Range	Inspect, test and repair typical faults of electric motors for air-conditioning and refrigeration at servicing stations under a certain degree of instruction.										
4. Level	2										
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;">Construction and working principles of typical air-conditioning and refrigeration motors</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ◆ Understand the working principles of typical electric motors for air-conditioning and refrigeration ◆ Understand the construction and applications of typical electric motors for air-conditioning and refrigeration ◆ Understand the working principles of starter relays of typical electric motors for air-conditioning and refrigeration </td> </tr> <tr> <td style="vertical-align: top;">6.2</td> <td style="vertical-align: top;">Methods and procedures of inspecting, testing and repairing simple faults of typical electric motors for air-conditioning and refrigeration</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ◆ Wire up starter relay circuits for single-phase motors ◆ Wire up typical single-phase electric motors for air-conditioning and refrigeration to the power supply ◆ Use typical instruments to inspect, test and repair typical faults of electric motors for air-conditioning and refrigeration ◆ Perform routine maintenance and repair for typical electric motors for air-conditioning and refrigeration </td> </tr> <tr> <td style="vertical-align: top;">6.3</td> <td style="vertical-align: top;">Professionalism in basic repair of electric motors for air-conditioning and refrigeration</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ◆ Follow the code of practice under the Electricity (Wiring) Regulations to inspect, test and repair electric motors for air-conditioning and refrigeration safely </td> </tr> </table>		6.1	Construction and working principles of typical air-conditioning and refrigeration motors	<ul style="list-style-type: none"> ◆ Understand the working principles of typical electric motors for air-conditioning and refrigeration ◆ Understand the construction and applications of typical electric motors for air-conditioning and refrigeration ◆ Understand the working principles of starter relays of typical electric motors for air-conditioning and refrigeration 	6.2	Methods and procedures of inspecting, testing and repairing simple faults of typical electric motors for air-conditioning and refrigeration	<ul style="list-style-type: none"> ◆ Wire up starter relay circuits for single-phase motors ◆ Wire up typical single-phase electric motors for air-conditioning and refrigeration to the power supply ◆ Use typical instruments to inspect, test and repair typical faults of electric motors for air-conditioning and refrigeration ◆ Perform routine maintenance and repair for typical electric motors for air-conditioning and refrigeration 	6.3	Professionalism in basic repair of electric motors for air-conditioning and refrigeration	<ul style="list-style-type: none"> ◆ Follow the code of practice under the Electricity (Wiring) Regulations to inspect, test and repair electric motors for air-conditioning and refrigeration safely
6.1	Construction and working principles of typical air-conditioning and refrigeration motors	<ul style="list-style-type: none"> ◆ Understand the working principles of typical electric motors for air-conditioning and refrigeration ◆ Understand the construction and applications of typical electric motors for air-conditioning and refrigeration ◆ Understand the working principles of starter relays of typical electric motors for air-conditioning and refrigeration 									
6.2	Methods and procedures of inspecting, testing and repairing simple faults of typical electric motors for air-conditioning and refrigeration	<ul style="list-style-type: none"> ◆ Wire up starter relay circuits for single-phase motors ◆ Wire up typical single-phase electric motors for air-conditioning and refrigeration to the power supply ◆ Use typical instruments to inspect, test and repair typical faults of electric motors for air-conditioning and refrigeration ◆ Perform routine maintenance and repair for typical electric motors for air-conditioning and refrigeration 									
6.3	Professionalism in basic repair of electric motors for air-conditioning and refrigeration	<ul style="list-style-type: none"> ◆ Follow the code of practice under the Electricity (Wiring) Regulations to inspect, test and repair electric motors for air-conditioning and refrigeration safely 									
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to inspect, test and repair simple faults of electric motors for air-conditioning and refrigeration; and</p> <p>(ii) Capable to follow relevant code of practice when inspecting, testing and repairing electric motors for air-conditioning and refrigeration.</p>										
8. Remarks	This unit of competency is applicable to practitioners engaged in general installation and repair of electrical control systems for air-conditioning and refrigeration.										

1. Title	Perform basic repair and maintenance of refrigerators, freezers and display coolers
2. Code	EMACOR205A
3. Range	Perform basic repair and maintenance of refrigerators, freezers and display coolers with spare parts at servicing stations or work sites.
4. Level	2
5. Credit	5
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Functions, uses and construction of refrigerators, freezers and display coolers</p> <ul style="list-style-type: none"> ◆ Understand the functions of refrigerators, freezers and display coolers ◆ Understand the uses of refrigerators, freezers and display coolers ◆ Understand the construction of refrigerators, freezers and display coolers <p>6.2 Basic methods and procedures of repairing and maintaining refrigerators, freezers and display coolers</p> <ul style="list-style-type: none"> ◆ Clean and wash the condensers and evaporators of refrigerators, freezers and display coolers ◆ Use nitrogen to perform pressure leak check for the refrigeration system ◆ Vacuum the refrigeration system ◆ Charge the refrigeration system with correct amount of refrigerant ◆ Perform refrigerant leak test ◆ Disassemble and replace the compressors, evaporators, capillary tubes, drying filters, condensers and other accessories of refrigerators, freezers and display coolers <p>6.3 Professionalism in basic repair and maintenance of refrigerators, freezers and display coolers</p> <ul style="list-style-type: none"> ◆ Follow the manual instructions to perform basic repair and maintenance of refrigerators, freezers and display coolers ◆ Understand the safety guidelines as required by the law and the code of practice to undertake basic repair and maintenance of refrigerators, freezers and display coolers
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to disassemble and replace the compressors, evaporators and other accessories of refrigerators, freezers and display coolers; and</p> <p>(ii) Capable to follow the code of practice to undertake basic repair and maintenance of refrigerators, freezers and display coolers.</p>
8. Remarks	This unit of competency is applicable to practitioners engaged in general repair and maintenance of refrigerators, freezers and display coolers.

1. Title	Perform basic repair and maintenance of ice makers, beverage coolers and dehumidifiers
2. Code	EMACOR206A
3. Range	Perform basic repair and maintenance of ice makers, beverage coolers and dehumidifiers with spare parts at servicing stations or work sites.
4. Level	2
5. Credit	7
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Functions, uses and construction of ice makers, beverage coolers and dehumidifiers</p> <ul style="list-style-type: none"> ◆ Understand the functions of ice makers, beverage coolers and dehumidifiers ◆ Understand the uses of ice makers, beverage coolers and dehumidifiers ◆ Understand the structure of ice makers, beverage coolers and dehumidifiers <p>6.2 Basic methods and procedures of repairing and maintaining ice makers, beverage coolers and dehumidifiers</p> <ul style="list-style-type: none"> ◆ Clean and wash the condensers and evaporators of ice makers, beverage coolers and dehumidifiers ◆ Use nitrogen to perform pressure leak check for the refrigeration system ◆ Vacuum the refrigeration system ◆ Charge the refrigeration system with correct amount of refrigerant ◆ Perform refrigerant leak test ◆ Disassemble and replace the compressors, evaporators, capillary tubes, drying filters, condensers and other accessories of ice makers, beverage coolers and dehumidifiers <p>6.3 Professionalism in basic repair and maintenance of ice makers, beverage coolers and dehumidifiers</p> <ul style="list-style-type: none"> ◆ Follow the manual instructions to perform basic repair and maintenance of ice makers, beverage coolers and dehumidifiers ◆ Understand the safety guidelines as required by the law and the code of practice to undertake basic repair and maintenance of ice makers, beverage coolers and dehumidifiers
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to disassemble and replace the compressors, evaporators and other accessories of ice makers, beverage coolers and dehumidifiers; and</p> <p>(ii) Capable to follow the code of practice to undertake basic repair and maintenance of ice makers, beverage coolers and dehumidifiers.</p>
8. Remarks	This unit of competency is applicable to practitioners engaged in general repair and maintenance of ice makers, beverage coolers and dehumidifiers.

1. Title	Perform basic repair and maintenance of packaged air-conditioning systems	
2. Code	EMACOR207A	
3. Range	Perform basic repair and maintenance of packaged air-conditioning system equipment at servicing stations under a certain degree of instruction.	
4. Level	2	
5. Credit	7	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Construction, characteristics and operating process of water-cooled and air-cooled packaged air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Understand the construction, characteristics and operating process of air-cooled packaged air-conditioning systems ◆ Draw the component layout plans for air-cooled packaged air-conditioning systems ◆ Understand the construction, characteristics and operating process of water-cooled packaged air-conditioning systems ◆ Draw the component layout plans for water-cooled packaged air-conditioning systems ◆ Understand the relationship between the legionnaires' disease and cooling tower ◆ Understand the importance of repairing and maintaining packaged air-conditioning systems <p>6.2 Methods and procedures of basic repair and maintenance of packaged air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Clean and wash the air filters, evaporators and scale of water-cooled packaged systems ◆ Clean and wash the air filters, evaporators and condensers of air-cooled packaged systems ◆ Check and adjust the fan belt pulley ◆ Clean and wash the refuse and sullage in the cooling tower ◆ Follow the instructions to perform basic repair and maintenance of water-cooled and air-cooled packaged air-conditioning system equipment <p>6.3 Professionalism in basic repair and maintenance of packaged air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Follow the instructions to perform basic repair and maintenance of water-cooled and air-cooled packaged air-conditioning system equipment ◆ Understand the safety guidelines as required by the law and the code of practice to undertake the repair and maintenance of packaged air-conditioning systems 	

7. Assessment Criteria	The integrated outcome requirements of this unit of competency are: <ul style="list-style-type: none">(i) Capable to lean and wash the packaged air-conditioning system equipment; and(ii) Capable to follow the code of practice to undertake the repair and maintenance of packaged air-conditioning systems.
8. Remarks	This unit of competency is applicable to practitioners engaged in general repair and maintenance of packaged air-conditioning systems.

1. Title	Perform basic operation of central air-conditioning systems
2. Code	EMACOR208A
3. Range	Perform basic operation of central air-conditioning systems at central air-conditioning system machine rooms or air-conditioned areas under a certain degree of instruction.
4. Level	2
5. Credit	5
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Functions and working principles of major equipment of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Understand the functions of major equipment of central air-conditioning systems ◆ Understand the working principles of the major equipment of central air-conditioning systems <p>6.2 Basic methods and procedures of operating central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Perform pre-starting inspection for the central air-conditioning system ◆ Measure and adjust the operation parameters of the central air-conditioning system ◆ Carry out pre-starting preparations for the central air-conditioning system ◆ Start all central air-conditioning system equipment ◆ Shut down all central air-conditioning system equipment <p>6.3 Professionalism in basic operation of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Follow the operational manual instructions to perform basic operation of the central air-conditioning system equipment ◆ Understand the safety guidelines as required by the law and the code of practice to undertake basic operation of central air-conditioning systems
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to start, operate and shut down the central air-conditioning systems; and</p> <p>(ii) Capable to follow the code of practice to undertake basic operation of central air-conditioning systems.</p>
8. Remarks	This unit of competency is applicable to practitioners engaged in general operation, maintenance and repair of central air-conditioning systems.

1. Title	Perform basic repair and maintenance of water systems of central air-conditioning systems
2. Code	EMACOR209A
3. Range	Perform basic repair and maintenance of water systems of central air-conditioning system at central air-conditioning system machine rooms or air-conditioned areas under a certain degree of instruction.
4. Level	2
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Functions and construction of chilled water system of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Understand the functions and importance of the water treatment equipment of chilled water system of central air-conditioning systems ◆ Understand the construction and principles of water treatment equipment of chilled water system of central air-conditioning systems ◆ Understand the methods of cleaning and washing chilled water system and condensing water system of central air-conditioning systems <p>6.2 Basic methods and procedures of repairing and maintaining water systems of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Clean, wash and clear the pipings of chilled water system and condensing water system of central air-conditioning systems ◆ Perform basic repair and maintenance of fan coils and water pumps <p>6.3 Professionalism in basic repair and maintenance of water systems of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Follow the instructions of the repair and maintenance manual to perform basic repair and maintenance of water systems of central air-conditioning systems ◆ Understand the safety guidelines as required by the law and the code of practice to undertake basic repair and maintenance of water systems of central air-conditioning systems
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to clean and wash simple water systems of central air-conditioning systems; and</p> <p>(ii) Capable to follow the code of practice to undertake basic repair and maintenance of water systems of central air-conditioning systems.</p>
8. Remarks	This unit of competency is applicable to practitioners engaged in general repair and maintenance of water systems of central air-conditioning systems.

1. Title	Perform basic repair and maintenance of air system of central air-conditioning systems
2. Code	EMACOR210A
3. Range	Perform basic repair and maintenance of air system of central air-conditioning system at central air-conditioning system machine rooms or air-conditioned areas under a certain degree of instruction.
4. Level	2
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Functions, construction and legal requirements for air system of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Understand the functions and construction of air system of central air-conditioning system equipment and accessories ◆ Understand legislations and regulations of government departments related to ventilation systems and air system of central air-conditioning systems <p>6.2 Basic methods and procedures of repairing and maintaining air system of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Clean the air filters, air duct systems, fan coil units, air handling units, ventilation fans and fans ◆ Change air filters ◆ Check if the air damper and fire damper function properly ◆ Perform basic repair and maintenance for all the equipment of air systems (including the air-conditioning control system) <p>6.3 Professionalism in basic repair and maintenance of air system of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Follow the instructions of the repair and maintenance manual to perform basic repair and maintenance of air system of central air-conditioning systems ◆ Understand the safety guidelines as required by the law and the code of practice to undertake basic repair and maintenance of the air system of central air-conditioning air systems
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to clean the air system equipment of central air-conditioning systems;</p> <p>(ii) Capable to check if the air system of central air-conditioning systems operates properly; and</p> <p>(iii) Capable to follow the code of practice to undertake basic repair and maintenance of the air system of central air-conditioning systems.</p>
8. Remarks	This unit of competency is applicable to practitioners engaged in general repair and maintenance of air system of central air-conditioning systems.

1. Title	Perform basic repair and maintenance of reciprocating chiller plants									
2. Code	EMACOR211A									
3. Range	Repair and maintain reciprocating chiller plants at servicing stations or machine rooms under a certain degree of instruction.									
4. Level	2									
5. Credit	6									
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;">Construction and working principles of reciprocating chiller plants</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ◆ Understand the construction, working principles and characteristics of reciprocating compressor ◆ Understand the construction, working principles and applications of reciprocating chiller plants </td> </tr> <tr> <td style="vertical-align: top;">6.2</td> <td style="vertical-align: top;">Basic methods and procedures of repairing and maintaining reciprocating chiller plants</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ◆ Check if the reciprocating chiller plant functions properly ◆ Clean the condenser and evaporator ◆ Disassemble the reciprocating compressor for maintenance and repair and replace afterwards ◆ Identify the simple faults of the reciprocating chiller plant and repair them according to its operating condition and operation parameters </td> </tr> <tr> <td style="vertical-align: top;">6.3</td> <td style="vertical-align: top;">Professionalism in basic repair and maintenance of reciprocating chiller plants</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ◆ Follow the instructions to perform basic repair and maintenance of reciprocating chiller plants ◆ Understand the safety guidelines as required by the law and the code of practice to undertake the basic repair and maintenance of reciprocating chiller plants </td> </tr> </table>	6.1	Construction and working principles of reciprocating chiller plants	<ul style="list-style-type: none"> ◆ Understand the construction, working principles and characteristics of reciprocating compressor ◆ Understand the construction, working principles and applications of reciprocating chiller plants 	6.2	Basic methods and procedures of repairing and maintaining reciprocating chiller plants	<ul style="list-style-type: none"> ◆ Check if the reciprocating chiller plant functions properly ◆ Clean the condenser and evaporator ◆ Disassemble the reciprocating compressor for maintenance and repair and replace afterwards ◆ Identify the simple faults of the reciprocating chiller plant and repair them according to its operating condition and operation parameters 	6.3	Professionalism in basic repair and maintenance of reciprocating chiller plants	<ul style="list-style-type: none"> ◆ Follow the instructions to perform basic repair and maintenance of reciprocating chiller plants ◆ Understand the safety guidelines as required by the law and the code of practice to undertake the basic repair and maintenance of reciprocating chiller plants
6.1	Construction and working principles of reciprocating chiller plants	<ul style="list-style-type: none"> ◆ Understand the construction, working principles and characteristics of reciprocating compressor ◆ Understand the construction, working principles and applications of reciprocating chiller plants 								
6.2	Basic methods and procedures of repairing and maintaining reciprocating chiller plants	<ul style="list-style-type: none"> ◆ Check if the reciprocating chiller plant functions properly ◆ Clean the condenser and evaporator ◆ Disassemble the reciprocating compressor for maintenance and repair and replace afterwards ◆ Identify the simple faults of the reciprocating chiller plant and repair them according to its operating condition and operation parameters 								
6.3	Professionalism in basic repair and maintenance of reciprocating chiller plants	<ul style="list-style-type: none"> ◆ Follow the instructions to perform basic repair and maintenance of reciprocating chiller plants ◆ Understand the safety guidelines as required by the law and the code of practice to undertake the basic repair and maintenance of reciprocating chiller plants 								
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to handle and fix simple faults of reciprocating chiller plants; and</p> <p>(ii) Capable to follow the code of practice to undertake the basic repair and maintenance of reciprocating chiller plants.</p>									
8. Remarks	This unit of competency is applicable to practitioners engaged in general repair and maintenance of reciprocating chiller plants.									

1. Title	Perform basic operation of central control and monitoring system (CCMS) of air-conditioning and refrigeration systems
2. Code	EMACOR212A
3. Range	Perform central control and monitoring work for air-conditioning and refrigeration systems at air-conditioning and refrigeration system control rooms under a certain degree of instruction.
4. Level	2
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Functions and typical terms for CCMS of air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Understand the functions of CCMS of air-conditioning and refrigeration systems ◆ Understand the components of CCMS of air-conditioning and refrigeration systems ◆ Understand the meaning of typical terms for CCMS of air-conditioning and refrigeration systems ◆ Understand the functions of typical building automation system software ◆ Understand the functions and construction of direct digital controller ◆ Understand the starting procedures and maintenance procedures of CCMS <p>6.2 Methods and procedures of basic operation of CCMS of air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Carry out pre-starting preparations for the CCMS of air-conditioning and refrigeration systems ◆ Start the CCMS of air-conditioning and refrigeration systems ◆ Obtain the operational data of the air-conditioning and refrigeration system from CCMS to identify the operational status of the system <p>6.3 Professionalism in basic operation of CCMS of air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Follow the operation manual instructions for the CCMS of air-conditioning and refrigeration systems to perform basic operation ◆ Follow the code of practice to undertake basic operation of CCMS of air-conditioning and refrigeration systems
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to start the CCMS of air-conditioning and refrigeration systems ; and</p> <p>(ii) Capable to follow the code of practice to undertake basic operation of CCMS of air-conditioning and refrigeration systems.</p>
8. Remarks	This unit of competency is applicable to practitioners engaged in general operation of air-conditioning and refrigeration system.

1. Title	Perform basic repair and maintenance of heat-pump type air-conditioners
2. Code	EMACOR213A
3. Range	Perform basic repair and maintenance for heat-pump type air-conditioners at servicing stations or external sites with spare parts under a certain degree of instruction.
4. Level	2
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Functions, uses and construction of heat-pump type air-conditioners</p> <ul style="list-style-type: none"> ◆ Understand the functions of heat-pump type air-conditioners ◆ Understand the uses of heat-pump type air-conditioners ◆ Understand the construction of heat-pump type air-conditioners ◆ Understand the functions and construction of four-way solenoid valves <p>6.2 Methods and procedures of repairing and maintaining heat-pump type air-conditioners</p> <ul style="list-style-type: none"> ◆ Replace four-way solenoid valves ◆ Locate and repair simple faults in heat-pump type air-conditioners ◆ Perform basic maintenance for heat-pump type air-conditioners <p>6.3 Professionalism in repairing and maintaining heat-pump type air-conditioners</p> <ul style="list-style-type: none"> ◆ Follow the manual instructions to perform basic repair and maintenance for heat-pump type air-conditioners ◆ Understand the safety guidelines as required by the law and the code of practice to undertake basic repair and maintenance of heat-pump type air-conditioners
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to replace components of heat-pump type air-conditioners; and</p> <p>(ii) Capable to follow the code of practice to undertake basic repair and maintenance of heat-pump type air-conditioners.</p>
8. Remarks	This unit of competency is applicable to practitioners engaged in general repair and maintenance of heat-pump type air-conditioners. The credit value of this unit of competency is set on the presumption that the person already possesses the competency of basic repair and maintenance of window-type air-conditioners.

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"> ◆ Understand basic risk assessment methods, including <ul style="list-style-type: none"> • Manual handling operation • Works in confined spaces • Work site hazards • Simple mechanism for risk grading • Risk assessment guidelines • Operating hazards analysis <p>6.2 Conduct basic risk assessment</p> <ul style="list-style-type: none"> ◆ 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.
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"> ◆ Understand general knowledge of occupational health and safety and its application ◆ Understand the basic requirements on occupational health and safety for general work sites <p>6.2 Application of basic occupational health and safety management</p> <ul style="list-style-type: none"> ◆ 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. <p>Management items include:</p> <ul style="list-style-type: none"> • Work site safety inspection • Follow-up of protective measures • Basic risk assessment • Follow-up investigation of accident • Assisting in safety promotion events • Assisting in the implementation of safety policy and management targets for the company or clients • Assisting in organizing group meetings
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"> ◆ Understand types and causes of general industrial accidents, including: electric shock, fall of person, fire, burn, gas poisoning, explosion, contusion, etc. ◆ 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. <p>6.2 Handle general industrial accidents</p> <ul style="list-style-type: none"> ◆ Capable to handle general industrial accidents on site, including adopting simple contingencies, according to the code of practice for accidents <p>6.3 Professionalism in handling industrial accidents</p> <ul style="list-style-type: none"> ◆ Handle general industrial accidents properly according to the requirements of the code of practice for industrial accidents ◆ Timely report to the supervisor
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"> ◆ 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 <ul style="list-style-type: none"> • 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 <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"> ◆ Use percentage and graphs to compile relevant statistics based on the data and information of occupational safety and health and environmental protection ◆ Obtain data and information of occupational safety and health and environmental protection to compile relevant statistics, and come up with simple conclusions <ul style="list-style-type: none"> • Obtain data required from all kinds of engineering information including accident investigation report, risk assessment report, operational hazards analysis report, etc.
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"> ◆ Understand ways for occupational safety and health, and hazards that may occur, and to prevent accidents ◆ 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"> • Work at height • Chemicals • Noisy environment • Biohazard • High humidity and temperature • Remote areas <p>6.2 Preventive measures on occupational safety and health</p> <ul style="list-style-type: none"> ◆ 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"> • Eye protector • Ear protector • Safety belt • Chemical handling procedures • Environmental hygiene, etc.
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.

Competency Level 3

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"> ◆ Understand the techniques and methods of using computer to draw complicated mechanical engineering drawings <p>6.2 Application of computer in drawing electrical and mechanical drawings</p> <ul style="list-style-type: none"> ◆ Use the computer to draw complicated mechanical engineering drawings according to design <ul style="list-style-type: none"> • Draw 3D drawings for mechanical parts <ul style="list-style-type: none"> ▸ Full 3D drawings ▸ Sectional 3D drawings ▸ Perspective 3D drawings • Draw different shapes of air ducts <ul style="list-style-type: none"> ▸ Cylindrical pipe ▸ Conical pipe ▸ Irregular surface pipe ▸ Air duct unit • Draw mechanical equipment assembly drawings <ul style="list-style-type: none"> ▸ Weld joints of pipes with different diameters ▸ Assembly of mechanical parts
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 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"> ◆ Understand the techniques and methods of using computer to draw combined services drawings of building services, including: <ul style="list-style-type: none"> • Setting layer rules for combined services drawings of building services • Difference between drawing the equipment on layout plan directly and drawing on external reference drawings • Management and application of external reference drawings • Setting of configuration and drawing specifications <p>6.2 Application of computer in engineering drawing</p> <ul style="list-style-type: none"> ◆ Use the computer to draw combined services drawings of building services, including: <ul style="list-style-type: none"> • 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 • Compile the drawing layer of electrical and mechanical facilities with reference to external sources • Use information saved in files or databank to improve the efficiency of drawing ◆ Retrieve, manage and apply external reference drawings efficiently
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 typical electrical and mechanical materials</p> <ul style="list-style-type: none"> ◆ Understand the functions, properties and range of application of typical metallic and non-metallic materials, including: <ul style="list-style-type: none"> • Physical properties and chemical properties such as electric induction, thermal induction, expansion and contraction, anti-corrosion, solubility, etc. • Mechanical properties such as strength, hardness, resilience, fatigue limit, high-temperature strength, etc. • Processing properties such as casting, extension, welding, machining, heat treatment, etc. • Understand the functions and range of application of typical 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. <p>6.2 Choose electrical and mechanical materials needed</p> <ul style="list-style-type: none"> ◆ 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 ◆ Capable to choose and check the materials to ensure that they comply with the safety specifications
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	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"> ◆ Understand the classification and working principles of air-conditioning systems and equipment <ul style="list-style-type: none"> • Classification of air-conditioning systems according to the following: <ul style="list-style-type: none"> ▸ Application of air-conditioning ▸ Degree of centralization of air handling equipment ▸ Fluid media used in the thermal distribution system Method of adjusting air volume ▸ Type of return air system ▸ Air velocity in air ducts • Understand the advantages and disadvantages of typical air-conditioning systems • Understand the applicability of typical air-conditioning systems • Understand the working principles of the component units of central air-conditioning system, including: <ul style="list-style-type: none"> ▸ Illustrating with diagrams the component units of a typical central air-conditioning system and its mode of operation ▸ Construction and working principles of chiller plant ▸ Construction and working principles of air handling equipment ▸ Construction and working principles of air delivery system ▸ Structure and working principles of chilled water system ▸ Construction and working principles of automatic control equipment • Working principles of unitary air-conditioning system, including: <ul style="list-style-type: none"> ▸ Construction and working principles of window type air-conditioner

	<ul style="list-style-type: none"> ▶ Construction and working principles of split type air-conditioner ▶ Construction Structure and working principles of packaged type air-conditioner <p>6.2 Design air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Calculate parameters for comfort air-conditioning design according to design criteria ◆ Calculate parameters for different types of industrial air-conditioning designs according to design criteria
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	Apply the knowledge of air and water systems of central air-conditioning system
2. Code	EMACDE301A
3. Range	Apply the knowledge of air and water systems of central air-conditioning system to perform tasks of design, installation, commissioning, testing, operation, maintenance, repair, project management and sales of central air-conditioning systems at design studios, or air-conditioning and refrigeration system work sites or sales outlets.
4. Level	3
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of air and water systems of central air-conditioning system</p> <ul style="list-style-type: none"> ◆ Understand the classification of air-conditioning systems, including: <ul style="list-style-type: none"> • Classifying the construction of air-conditioning systems according to the cooling medium in the air-conditioned space (such as all air systems, air-water systems and direct expansion systems) • Classifying the construction of air-conditioning systems according to the distribution of air-handling equipment (such as centralized systems, semi-centralized systems and distributed systems) ◆ Understand the nomenclatures and functions of different types of equipment of a central air-conditioning system, including: <ul style="list-style-type: none"> • Air-handling equipment for central air-conditioning • Refrigeration equipment for central air-conditioning • Air system equipment for central air-conditioning • Water system equipment for central air-conditioning • Control system equipment for central air-conditioning ◆ Understand the working principles of fan coil type air-conditioning systems, including: <ul style="list-style-type: none"> • Construction and working principles of fan coil type air-conditioning systems • Methods of fresh air delivery of fan coil type air-conditioning systems • Methods of water supply of fan coil type air-conditioning systems

	<ul style="list-style-type: none"> ◆ Understand the working principles of air system of central air-conditioning system, including: <ul style="list-style-type: none"> • Types and functions of air-handling equipment • Types and functions of air distribution equipment (including fans and air ducts) • Types and functions of air diffusion equipment (including supply air grilles, return air grilles, air diffusers and VAV boxes) ◆ Understand the working principles of chilled water system of central air-conditioning system, including: <ul style="list-style-type: none"> • Working principles of open-type and closed-type chilled water systems • Working principles and characteristics of direct-return and reverse-return chilled water systems • Working principles and application properties of constant flow and variable flow chilled water systems • Working principles and characteristics of primary pump and secondary pump chilled water systems ◆ Understand the working principles of cooling water systems of central air-conditioning system, including: <ul style="list-style-type: none"> • Working principles of open-type and closed-type cooling water systems • Functions and working principles of cooling water system of central air-conditioning system • Classification, working principles and characteristics of cooling towers ◆ Apply the knowledge of air and water systems of central air-conditioning system to solve the problems involved in the design, installation, commissioning, testing, operation, maintenance, repair, project management and sales of central air-conditioning works; communicate with the sector and clients <p>6.2 Application of the knowledge of air and water systems of central air-conditioning system</p>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply the knowledge of air and water systems of central air-conditioning system to solve the problems involved in central air-conditioning works; communicate with the sector and clients.</p>
8. Remarks	<p>This unit of competency is applicable to practitioners of general central air-conditioning works. The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of air-conditioning, refrigeration and ventilation systems.</p>

1. Title	Apply the knowledge of centrifugal water pumps and fans
2. Code	EMACDE302A
3. Range	Apply the knowledge of centrifugal water pumps and fans at design studios or air-conditioning and refrigeration system machine rooms in tasks of designing, installing, commissioning, operating, repairing and maintaining air-conditioning and refrigeration systems.
4. Level	3
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of centrifugal water pumps and fans</p> <ul style="list-style-type: none"> ◆ Understand the working principles and construction of centrifugal water pumps, including: <ul style="list-style-type: none"> • Working principles of centrifugal water pumps • Construction of single-stage horizontal centrifugal water pumps • Construction of multi-stages centrifugal water pumps ◆ Understand the working characteristics of centrifugal water pumps, including: <ul style="list-style-type: none"> • Definition of flow, lift, power, efficiency, rotational speed and allowable suction height • Select suitable centrifugal water pumps with reference to the performance curves of pumps • Determine the operating point and adjusted operating point of centrifugal water pumps with reference to the pump performance curves and piping performance curves • Calculate the installation height for centrifugal water pumps ◆ Understand the working principles and construction of centrifugal fans, including: <ul style="list-style-type: none"> • Working principles of centrifugal fans • Working construction of centrifugal fans ◆ Understand the working characteristics of centrifugal fans, including: <ul style="list-style-type: none"> • Air flow, pressure head, power and efficiency • Select suitable centrifugal fans with reference to the fan performance curves ◆ Understand the working principles and construction of axial flow centrifugal fans, including: <ul style="list-style-type: none"> • Working principles of axial flow fans • Construction of axial flow fans ◆ Understand the working characteristics of axial flow fans, including: <ul style="list-style-type: none"> • Select suitable axial flow fans with reference to the fan performance curves

	<p>6.2 Application of knowledge of centrifugal water pumps and fans</p> <ul style="list-style-type: none"> ◆ Apply the knowledge of centrifugal water pumps and fans, including: <ul style="list-style-type: none"> • Select required centrifugal fans according to the nature of liquid, working condition, discharge flow and lift • Select required centrifugal fans according to the working condition, air flow and pressure • Install, commission, operate, repair and maintain centrifugal water pumps • Install, commission, operate, repair and maintain centrifugal fans and axial flow fans
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply the knowledge of centrifugal water pumps and fans to solve problems involving in designing, installing, commissioning, operating, repairing and maintaining air-conditioning and refrigeration system; communicate with the sector and clients.</p>
8. Remarks	<p>This unit of competency is applicable to practitioners engaged in designing, installing, commissioning, operating, repairing and maintaining air-conditioning and refrigeration systems.</p>

1. Title	Apply the knowledge of refrigerants, secondary refrigerants and refrigerant oil
2. Code	EMACDE303A
3. Range	Apply the knowledge of refrigerants, secondary refrigerants and refrigerant oil to perform tasks of design, installation, commissioning, testing, operation, maintenance, repair and project management of air-conditioning and refrigeration systems at design studios or work sites with such systems.
4. Level	3
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of refrigerants, secondary refrigerants and refrigerant oil</p> <ul style="list-style-type: none"> ◆ Understand the functions, types, naming and coding of refrigerants, including: <ul style="list-style-type: none"> • Functions of refrigerants • Types of refrigerants • Naming and coding of refrigerants ◆ Understand the criteria for selection of refrigerants, including: <ul style="list-style-type: none"> • Thermal properties of refrigerants • Physical and chemical properties of refrigerants • Safety and environment protection requirements of refrigerants ◆ Understand the limitations of refrigerants, and their substitutes, including: <ul style="list-style-type: none"> • Describing the depletion of the ozone layer and the details of the Montreal Protocol and its amendments • Describing the greenhouse effect and the details of the Kyoto Protocol • Listing the substitute refrigerants for CFCs and HCFCs ◆ Understand the characteristics and applications of typical refrigerants, including: <ul style="list-style-type: none"> • Describing the characteristics and applications of halogenated hydrocarbon and the refrigerants made from such mixtures • Describing the characteristics and applications of hydrocarbon refrigerants • Describing the characteristics and applications of inorganic refrigerants ◆ Understand the functions and selection criteria of secondary refrigerants ◆ Understand the characteristics and applications of typical secondary refrigerants, including: <ul style="list-style-type: none"> • Characteristics and applications of saline solution • Characteristics and applications of organic solution

	<p>6.2 Application of refrigerants, secondary refrigerants and refrigerant oil</p> <ul style="list-style-type: none"> ◆ Understand the functions and characteristics of refrigerant oil and its selection criteria, including: <ul style="list-style-type: none"> • Functions of refrigerant oil • Characteristics of refrigerant oil in contact with a refrigerant • Criteria for selection of refrigerant oil ◆ Apply the knowledge of refrigerants, secondary refrigerants and refrigerant oil to solve the problems involved in the design, installation, commissioning, testing, operation, maintenance, repair and project management of air-conditioning and refrigeration works
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply the knowledge of refrigerants, secondary refrigerants and refrigerant oil to solve the problems involved in the design, installation, commissioning, testing, operation, maintenance, repair and project management of air-conditioning and refrigeration works.</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 air-conditioning and refrigeration systems.</p>

1. Title	Apply the knowledge of the building construction of cold storage
2. Code	EMACDE304A
3. Range	Apply the knowledge of the building construction of cold storage, at design studios or cold storage in the design, installation, commissioning, operation, repair and maintenance of cold storages.
4. Level	3
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of the building construction of cold storage</p> <ul style="list-style-type: none"> ◆ Understand the types and characteristics of cold storages ◆ Calculate the capacity of cold storages ◆ Understand the construction and knowledge of cold storage insulation and moisture prevention, including: <ul style="list-style-type: none"> • Construction of cold storage • Purpose of cold storage insulation and moisture prevention • Requirements on insulation materials of cold storage • Factors affecting the heat conductivity of insulation materials ◆ Possess the insulation and moisture prevention knowledge for the building enclosure of cold storage, including: <ul style="list-style-type: none"> • Purpose of insulation and moisture prevention for the building enclosure of cold storage • General insulation and moisture prevention measures for the building enclosure of cold storage • Typical insulation and moisture prevention materials for cold storage ◆ Understand the code of practice on the use of cold storage to preserve the quality of frozen food and enhance economic effectiveness <p>6.2 Application of knowledge of the building construction of cold storage</p> <ul style="list-style-type: none"> ◆ Apply the knowledge of the building construction of cold storage to solve problems involved in the design, installation, commissioning, operation, repair and maintenance of cold storage; communicate with the sector and clients
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply the knowledge of the building construction of cold storage to solve problems involved in the design, installation, commissioning, operation, repair and maintenance of cold storage; communicate with the sector and clients.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses elementary knowledge of air-conditioning and refrigeration.

1. Title	Apply the knowledge of refrigeration system of cold storage
2. Code	EMACDE305A
3. Range	Apply the knowledge of refrigeration system of cold storage, at design studios or cold storage in the design, installation, commissioning, operation, repair and maintenance of cold storages.
4. Level	3
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of refrigeration system of cold storage</p> <ul style="list-style-type: none"> ◆ Understand the functions, types, characteristics and working principles of different types of refrigerant supply systems, including being able to illustrate: <ul style="list-style-type: none"> • Characteristics and working principles of direct-expansion refrigerant supply system • Characteristics and working principles of gravity type refrigerant supply system • Characteristics and working principles of liquid-pump refrigerant supply system ◆ Understand the functions and working principles of different types of compression refrigeration system and installation requirements on major components, including: <ul style="list-style-type: none"> • Freon system • Ammonia system • Cascaded system ◆ Understand the function, construction and working principles of various types of condensing system of refrigeration systems, including: <ul style="list-style-type: none"> • Condensing system of Freon system • Condensing system of ammonia system • Condensing system of Cascaded system ◆ Understand the function, construction, working principles and characteristics of various types of special freezing equipment for cold storage ◆ Understand the advantages and disadvantages of centralized refrigeration system and distributed refrigeration system ◆ Understand the concept, advantages and working principles of air-cooled cold storage

	<ul style="list-style-type: none"> ◆ Understand the construction of major components of air-cooled cold storage ◆ Understand the working principles of different ice making methods ◆ Understand the functions and construction of typical ice making equipment ◆ Understand the installation and insulation requirements on refrigeration equipment and pipings for cold storages ◆ Understand the procedures of flushing, vacuuming, refrigerant charging and leak checking for the refrigeration system of cold storage , including: <ul style="list-style-type: none"> • Freon system • Ammonia system <p>6.2 Application of knowledge of refrigeration system of cold storage</p> <ul style="list-style-type: none"> ◆ Apply the knowledge of the refrigeration system of cold storage to solve problems involved in the design, installation, commissioning, operation, repair and maintenance of cold storage; communicate with the sector and clients
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply the knowledge of the refrigeration system of cold storage to solve problems involved in the design, installation, commissioning, operation, repair and maintenance of cold storage; communicate with the sector and clients °</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses elementary knowledge of air-conditioning and refrigeration.</p>

1. Title	Apply the knowledge of ventilation systems
2. Code	EMACDE306A
3. Range	Apply the knowledge of ventilation systems, at design studios or ventilation system work sites in the design, installation, commissioning, operation, testing, repair, maintenance and project management of ventilation systems.
4. Level	3
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of ventilation systems</p> <ul style="list-style-type: none"> ◆ Understand the functions of ventilation systems, including: <ul style="list-style-type: none"> • Functions of ventilation systems • Impact of harmful substances in the air on environment and human body • Impact of meteorological condition on human body • Hygienic standard on harmful substances in the air • Ventilation method of preventing harmful substances in the air ◆ Understand the working principles of various types of ventilation systems , including: <ul style="list-style-type: none"> • Working principles of total ventilation • Working principles of spot ventilation ◆ Understand the principles of various types of air purifiers, including: <ul style="list-style-type: none"> • Performance of typical air purifiers • Construction and working principles of typical dust extractors • Construction and working principles of typical air purifiers <p>6.2 Application of knowledge of ventilation systems</p> <ul style="list-style-type: none"> ◆ Apply the knowledge of ventilation systems to solve problems involved in the design, installation, commissioning, operation, testing, repair, maintenance and project management of ventilation systems; communicate with the sector and clients
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply the knowledge of ventilation systems to solve problems involved in the design, installation, commissioning, operation, testing, repair, maintenance and project management of ventilation systems; communicate with the sector and clients °</p>
8. Remarks	This unit of competency is applicable to ventilation system engineering practitioners.

1. Title	Apply the knowledge of refrigeration compressors and major refrigeration equipment
2. Code	EMACDE307A
3. Range	Apply the knowledge of refrigeration compressors and major refrigeration equipment to perform tasks of designing, installing, commissioning, operating, repairing and maintaining refrigeration systems at design studios or air-conditioning and refrigeration system rooms.
4. Level	3
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of refrigeration compressors and major refrigeration equipment</p> <ul style="list-style-type: none"> ◆ Understand the functions, types, construction, working principles and characteristics of refrigeration compressors, including: <ul style="list-style-type: none"> • Describing the functions and types of refrigeration compressors • Describing the construction , working principles and characteristics of reciprocating compressors • Describing the construction, working principles and characteristics of screw compressors • Describing the construction, working principles and characteristics of centrifugal compressors • Describing the construction, working principles and characteristics of rotary compressors • Describing the construction, working principles and characteristics of scroll compressors ◆ Understand the functions, types, construction, working principles and characteristics of condensers, including: <ul style="list-style-type: none"> • Describing the functions and types of condensers • Describing the construction, working principles and characteristics of water-cooled condensers • Describing the construction, working principles and characteristics of air-cooled condensers • Describing the construction, working principles and characteristics of evaporative condensers (cooling towers) ◆ Understand the functions, types, construction, working principles and characteristics of evaporators, including: <ul style="list-style-type: none"> • Describing the functions and types of evaporators • Describing the construction, working principles and characteristics of flooded-type evaporators • Describing the construction, working principles and characteristics of different types of dry type evaporators

	<ul style="list-style-type: none"> ◆ Understand the functions, types, construction, working principles and characteristics of refrigerant metering devices, including: <ul style="list-style-type: none"> • Describing the functions and types of metering devices • Describing the construction, working principles and characteristics of manual metering valves • Describing the construction, working principles and characteristics of capillary tubes • Describing the construction, working principles and characteristics of float valves • Describing the construction, working principles and characteristics of thermal expansion valves • Describing the construction, working principles and characteristics of electronic expansion valves ◆ Understand the functions, types, construction and working principles of liquid receivers and oil separators, including: <ul style="list-style-type: none"> • Describing the functions, construction and working principles of liquid receivers • Describing the functions, construction and working principles of oil separators <p>6.2 Application of knowledge of refrigeration compressors and major refrigeration equipment</p> <ul style="list-style-type: none"> ◆ Apply the knowledge of refrigeration compressors and major refrigeration equipment to solve the problems involved in designing, installing, commissioning, operating, repairing and maintaining air-conditioning and refrigeration systems
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply the knowledge of refrigeration compressors and major refrigeration equipment to solve the problems involved in designing, installing, commissioning, operating, repairing and maintaining air-conditioning and refrigeration systems.</p>
8. Remarks	<p>This unit of competency is applicable to practitioners of general air-conditioning and refrigeration works.</p>

1. Title	Apply the knowledge of installation and related legislations of ventilation systems
2. Code	EMACIN302A
3. Range	Apply the knowledge of installation and related legislations of ventilation systems, at design studios or ventilation system work sites, in the design, installation, commissioning, testing, operation, repair and maintenance of ventilation systems.
4. Level	3
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of installation and related legislations of ventilation systems</p> <ul style="list-style-type: none"> ◆ Understand the working principles of various types of ventilation systems , including: <ul style="list-style-type: none"> • Functions and applications of air-conditioning system • Negative pressure ventilation, positive pressure ventilation and balanced pressure ventilation ◆ Calculate the fresh air requirement of a ventilation system ◆ Possess knowledge of installing, maintaining and repairing air duct system equipment, including: <ul style="list-style-type: none"> • Performance, working principles and installation method of different types of ventilation fans and fans • Uses and properties of different types of air duct materials • Uses, working principles and installation method of air dampers, fire dampers and smoke dampers • Uses, performance, working principles, installation method and maintenance of air filters and dust collectors ◆ Understand legal requirements in Hong Kong on ventilation systems, including: <ul style="list-style-type: none"> • Legal requirements of Buildings Department on the installation and maintenance of ventilation systems • Legal requirements of Fire Services Department on the installation and maintenance of ventilation systems(including thermal insulation materials) • Legal requirements of Food and Environmental Hygiene Department on the installation and maintenance of ventilation systems ◆ Understand the relationship between air-conditioning and ventilation systems and fire control systems, including: <ul style="list-style-type: none"> • Working principles of ventilation / air-conditioning control (VAC control) systems • Working principles of control linkage between automatic fire alarm system and ventilation / air-conditioning control (VAC control) systems

	<p>6.2 Application of knowledge of installation and related legislations of ventilation systems</p> <p>◆ Apply the knowledge of installation and related legislations of ventilation systems to solve problems involved in the design, installation, commissioning, testing, operation, repair and maintenance of ventilation systems; communicate with the sector and clients</p>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply the knowledge of ventilation systems installation and related legislations of ventilation systems to solve problems involved in the design, installation, commissioning, testing, operation, repair and maintenance of ventilation systems; communicate with the sector and clients.</p>
8. Remarks	<p>This unit of competency is applicable to ventilation system engineering practitioners.</p>

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"> ◆ Understand the uses of various types of engineering drawings of electrical works ◆ Identify different versions of engineering drawings of electrical works ◆ Capable to apply electrical symbols, scaling calculations and relevant engineering drawings of electrical works <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"> ◆ Obtain suitable electrical engineering drawings according to project requirements ◆ Capable to obtain relevant information of the main circuit, including: <ul style="list-style-type: none"> • Connection of the main circuit • Details of power distribution • Power switch interlock ◆ Capable to obtain relevant information of electrical equipment and control circuits, including: <ul style="list-style-type: none"> • Principles of control • Control circuits • Control components, including circuit breakers, relays, push-buttons and their contacts • Electronic control circuits ◆ Capable to obtain information of control circuit and wiring drawings, including: <ul style="list-style-type: none"> • Selection of cables • Classification of cables • Laying of cables • Wiring conduits • Wiring trunkings • Identification and marking of cables • Connection of cables

	<ul style="list-style-type: none"> ◆ 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"> • Principles of control circuit interlock • Conduits and trunkings required • Laying of cables • Connection of cables • Identification and marking of cables
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	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"> ◆ Understand techniques and principles of ultrasonic testing and examination for internal damages of metallic equipment ◆ Understand the advantages and limitations of ultrasonic testing, especially with reference to those of liquid penetrant testing, magnetic particle testing and x-ray testing <p>6.2 Methods and procedures of analyzing and examining damages on metal equipment</p> <ul style="list-style-type: none"> ◆ Understand the influence of the metallic internal structure on damage examination and analysis ◆ Use ultrasonic testing instruments effectively to analyze and examine internal damages or structure defects such as voids and pores on the metal equipment ◆ Use ultrasonic instruments to measure and calculate crack positions and size ◆ Mark the position with cracks effectively ◆ 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 ◆ Keep record of testing effectively <p>6.3 Professionalism in inspecting and examining damages on metal equipment</p> <ul style="list-style-type: none"> ◆ Have adequate hands-on practice in ultrasonic testing for internal damages according to professional qualification requirements, and record and analyze damages ◆ Inspect and analyze damages on metal equipment or structure defects safely according to guidelines on the use of materials and code of practice ◆ Understand international standards or in-house guidelines, and report the positions and size of damages or structure defects identified according to requirements 	

7. Assessment Criteria	The integrated outcome requirements of this unit of competency are: (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 (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
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	Analysis of non-destructive test (NDT) - magnetic particle testing	
2. Code	EMCUMA313A	
3. Range	Use magnetic particle testing method, at servicing centres or locations with operating equipment, to analyze and examine surface or sub-surface cracks and weld defects on metal equipment or materials.	
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 inspecting metal equipment or materials for cracks</p> <ul style="list-style-type: none"> ◆ Understand the principles of magnetic particle testing used to inspect metal equipment or materials for surface or sub-surface cracks ◆ Understand the relationship between current and magnetic field ◆ Know about magnetic conductivity for various types of ferromagnetic metals ◆ Understand the merits and limitations of magnetic particle testing, especially with reference to those of liquid penetrant testing, ultrasonic testing and x-ray testing <p>6.2 Methods and procedures of analyzing and examining cracks on metal equipment or materials</p> <ul style="list-style-type: none"> ◆ Use magnetic particle testing effectively to examine and analyze surface or sub-surface cracks on metal equipment ◆ Choose suitable amount of current for magnetic particle testing according to different magnetic conductivity for various types of metals ◆ Base on the pros and cons of various types of NDTs to recommend on and conduct magnetic particle testing so as to confirm the positions and degree of work piece damages or structure defects ◆ Mark the positions with cracks effectively <p>6.3 Professionalism in inspecting and examining metal equipment and materials for cracks</p> <ul style="list-style-type: none"> ◆ Have adequate hands-on practice in crack inspection according to professional qualification requirements, and record and analyze cracks ◆ Inspect and analyze surface or sub-surface cracks on metal equipment or materials safely according to guidelines on the use of materials and code of practice ◆ Understand international standards or in-house guidelines, and report the positions and size of surface or sub-surface cracks identified according to requirements 	

7. Assessment Criteria	The integrated outcome requirements of this unit of competency are: (i) Capable to use magnetic particle testing to examine and analyze surface or sub-surface cracks on metal equipment; and (ii) Capable to point out the pros and cons of magnetic particle testing with reference to liquid penetrant testing, ultrasonic testing and x-ray testing.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses the competency of EMCUMA201A “Non-destructive test (NDT) - magnetic particle testing”.

1. Title	Wire up electrical control circuits for air-conditioning and refrigeration	
2. Code	EMACIN301A	
3. Range	Install and wire up various types of electrical control circuits for air-conditioning and refrigeration at installation sites.	
4. Level	3	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of electrical control circuits for air-conditioning and refrigeration</p> <ul style="list-style-type: none"> ◆ Understand the working principles of various types of electrical control circuits for air-conditioning and refrigeration ◆ Understand the drawings of electrical control works for air-conditioning and refrigeration, including being able to: <ul style="list-style-type: none"> • Read the drawings of electrical control circuits for air-conditioning and refrigeration • Read the layout plans of air-conditioning and refrigeration equipment • Estimate the quantity of materials for the installation of electric control equipment according to engineering drawings and installation requirements <p>6.2 Methods and procedures of wiring up electrical control circuits for air-conditioning and refrigeration</p> <ul style="list-style-type: none"> ◆ Install and wire up electrical control and fire control circuits for air-conditioning and refrigeration and ventilation system equipment, including being able to: <ul style="list-style-type: none"> • Follow the code of practice under the Electricity (Wiring) Regulations to install electric control, electrical interlock and sequential control circuits for various types of air-conditioning and refrigeration and ventilation system equipment • Follow the code of practice under the Electricity (Wiring) Regulations and the Fire Services Ordinance to install fire control circuits for air-conditioning and ventilation systems • Use multimeters and insulation testers to test whether the circuit is suitable to use • Test whether the circuit functions properly ◆ Install and wire up various types of electrical control components for air-conditioning and refrigeration, including being able to: <ul style="list-style-type: none"> • Install and wire up various types of electrical control components for air-conditioning and refrigeration, including thermostat, fan switch, flow switch, pressure control switch, oil pressure safety switch, relay, contactor and timer • Test whether the electric control components function properly 	

	<ul style="list-style-type: none"> ◆ Install electric motors and wire up starting circuits, including being able to: <ul style="list-style-type: none"> • Install single-phase and three-phase motors • Follow the code of practice under the Electricity (Wiring) Regulations to install starting circuits of various types of electric motors ◆ Test whether the electric motor functions properly <p>6.3 Professionalism in wiring up electrical control circuits for air-conditioning and refrigeration</p> <ul style="list-style-type: none"> ◆ Follow the code of practice under the Electricity (Wiring) Regulations to wire up various types of electrical control circuits for air-conditioning and refrigeration safely
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> (i) Capable to wire up various types of electrical control circuits for air-conditioning and refrigeration according to drawings; and (ii) Capable to follow relevant code of practice when carrying out electrical work.
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses elementary knowledge and skills of wiring up electrical control circuits for air-conditioning and refrigeration</p>

1. Title	Assemble pipings for air-conditioning and refrigeration engineering
2. Code	EMACIN308A
3. Range	Assemble piping for air-conditioning and refrigeration engineering at air-conditioning and refrigeration equipment installation, repair and maintenance sites.
4. Level	3
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Properties and applications of piping materials for air-conditioning and refrigeration engineering</p> <ul style="list-style-type: none"> ◆ Understand the properties of typical piping materials for air-conditioning and refrigeration engineering ◆ Understand the applications of different types of pipes ◆ Understand the functions of typical galvanized steel pipe fittings, including socket, elbow, reducer, tee, bushing, nipple and pipe plug ◆ Identify typical galvanized steel pipe fittings <p>6.2 Methods and procedures of assembling piping for air-conditioning and refrigeration engineering</p> <ul style="list-style-type: none"> ◆ Cut galvanized steel pipes with a diameter of 50mm ◆ Use electric threader to make screw threads for 50mm galvanized steel pipes ◆ Connect 50mm galvanized steel pipes by thread joint and conduct 1,000Pa water pressure leak test ◆ Cut and bend copper pipes with a diameter of 15.88mm ◆ Use silvering-brazing method to join 35mm hard copper pipes and conduct 1,000Pa water pressure leak test ◆ Cut and bend PVC pipes with a diameter of 25mm ◆ Join the PVC pipes with glue <p>6.3 Professionalism in assembling piping for air-conditioning and refrigeration engineering</p> <ul style="list-style-type: none"> ◆ Understand the safety guidelines as required by the law and the code of practice to undertake assembling and brazing of piping for air-conditioning and refrigeration engineering
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to assemble, join and braze various types of piping for air-conditioning and refrigeration engineering, and conform to the pressure test requirements; and</p> <p>(ii) Capable to follow the code of practice to assemble, join and braze piping for air-conditioning and refrigeration engineering.</p>
8. Remarks	This unit of competency is applicable to practitioners engaged in general practitioners engaged in the installation, maintenance and repair of air-conditioning and refrigeration equipments.

1. Title	Apply knowledge of environmental impact of refrigerants and foamers
2. Code	EMACSH302A
3. Range	Apply knowledge of the environmental impact of refrigerants and foamers, at design studios, air-conditioning and refrigeration system work sites or machine rooms, in tasks of installation, operation, repair, maintenance, safety, health and environmental protection for air-conditioning and refrigeration services.
4. Level	3
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Apply knowledge of environmental impact of refrigerants and foamers</p> <ul style="list-style-type: none"> ◆ Understand the impact of refrigerants and foamers, including: <ul style="list-style-type: none"> • Composition and properties of chlorofluorocarbon (CFC) and hydro chlorofluorocarbon (HCFC) as refrigerants • Functions of ozone layer and causes of its depletion • International actions for the ozone layer protection and the progress made ◆ Understand the impact of refrigerants on greenhouse effect, including: <ul style="list-style-type: none"> • Implications of greenhouse gases and greenhouse effect • 3 ways to evaluate the impact of gases on greenhouse effect: global warming potential (GWP), total equivalent warming impact (TEWI) and life cycle climate performance (LCCP) • GWP of commonly used refrigerants • International actions taken to control the emission of greenhouse gases and the progress made ◆ Understand the properties of substitute refrigerants, including: <ul style="list-style-type: none"> • Major considerations for choosing substitutes for CFCHCFC refrigerants • Properties of various types of substitute refrigerants • International evaluation of substitute refrigerants ◆ Understand the recovery and disposal of refrigerants, including: <ul style="list-style-type: none"> • Working principles and applications of various types of refrigerant recovering machinery • Impurities need to be separated from the recovered refrigerants • Ways to dispose exhausted refrigerants

	<ul style="list-style-type: none"> ◆ Understand the applications of substitute foamers in foam-thermal insulation, including: <ul style="list-style-type: none"> • Foaming methods for various types of CFC substitutes • Properties of various types of substitute foamers • Comparison of the properties of various types of substitute foamers • Comparison of the substitutability of various types of substitute foamers for foam-thermal insulation ◆ Apply knowledge of the environmental impact of refrigerants and foamers in the design, installation, operation, repair and maintenance of air-conditioning and refrigeration equipment to minimize the damage of refrigerants and foamers to the environment <p>6.2 Application of knowledge of environmental impact of refrigerants and foamers</p>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply knowledge of the environmental impact of refrigerants and foamers in the design, installation, operation, repair and maintenance of air-conditioning and refrigeration equipment to minimize the damage of refrigerants and foamers to the environment.</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 refrigerants.</p>

1. Title	Install window type and split type air-conditioners	
2. Code	EMACIN303A	
3. Range	Perform installation of window type and split type air-conditioners at installation sites.	
4. Level	3	
5. Credit	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of installing window type and split type air-conditioners</p> <ul style="list-style-type: none"> ◆ Estimate the required indoor refrigeration output, including: <ul style="list-style-type: none"> • Describing the definition of typical units of refrigeration output • Describing the factors affecting the indoor refrigeration output • Estimating the required indoor refrigeration output according to various factors ◆ Select suitable air-conditioners, including: <ul style="list-style-type: none"> • Determining the specifications of air-conditioners according to the required indoor refrigeration output and environmental limitations • Explaining the information inscribed on the nameplate of an air-conditioner ◆ Understand the features of window type and split type air-conditioners, including: <ul style="list-style-type: none"> • Selecting suitable indoor temperature • Describing the environmental conditions for use of air-conditioners • Operating a window type air-conditioner and its remote control • Operating a split type air-conditioner and its remote control <p>6.2 Methods and procedures of installing window type and split type air-conditioners</p> <ul style="list-style-type: none"> ◆ Install window type air-conditioners, including: <ul style="list-style-type: none"> • Selecting the correct installation position for window type air-conditioners • Installing window type air-conditioners on aluminium windows and steel windows according to general installation requirements • Performing operation tests for the installed window type air-conditioner 	

	<ul style="list-style-type: none"> ◆ Install split type air-conditioners, including: <ul style="list-style-type: none"> • Selecting the correct installation position for split type air-conditioners • Installing the indoor unit and outdoor unit of a split type air-conditioner according to general installation requirements • Making, installing and joining refrigerant (copper) pipings • Performing vacuum and pressure tests for the refrigeration system and adding the refrigerant • Performing (copper) pipings evacuation and leakage detection and releasing the refrigerant from the outdoor unit to the whole refrigeration system • Wiring up and installing the electrical circuits of the indoor and outdoor units • Performing running tests for the installed split type air-conditioner <p>6.3 Professionalism in installing window type and split type air-conditioners</p> <ul style="list-style-type: none"> ◆ Install window type and split type air-conditioners independently or instruct others to perform such tasks ◆ Understand the safety guidelines as required by the law and codes of practice and undertake tasks of installing window type and split type air-conditioners
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> (i) Capable to complete tasks of installing window type and split type air-conditioners systematically and efficiently; and (ii) Capable to undertake tasks of installing window type and split type air-conditioners safely according to codes of practice.
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge and skills of installing window type and split type air-conditioners.</p>

1. Title	Install chilled water system equipment for air-conditioning and refrigeration	
2. Code	EMACIN304A	
3. Range	Perform installation of chilled water systems for air-conditioning and refrigeration at air-conditioning and refrigeration system rooms or installation sites.	
4. Level	3	
5. Credit	12	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of installing chilled water systems for air-conditioning and refrigeration</p> <ul style="list-style-type: none"> ◆ Understand the engineering drawings of the chilled water system equipment for air-conditioning and refrigeration, including: <ul style="list-style-type: none"> • Reading the installation plans of the chilled water system equipment for air-conditioning and refrigeration (including air-handling unit, fan coil unit, expansion tank, cooling tower, pump, condenser and chiller plant) • Considering relevant requirements and limitations and identifying, at the work site, the installation position for the chilled water system equipment according to the layouts of the system equipment for air-conditioning and refrigeration and for other purposes ◆ Understand the construction and working principles of the typical equipment of the chilled water system for air-conditioning and refrigeration, including: <ul style="list-style-type: none"> • Describing the construction of air-handling units, fan coil units, expansion tanks, cooling towers, pumps, condensers, chiller plant and different types of valves and water system accessories • Describing the working principles of air-handling units, fan coil units, expansion tanks, cooling towers, pumps, condensers, chiller plant and different types of valves and water system accessories <p>6.2 Methods and procedures of installing chilled water systems for air-conditioning and refrigeration</p> <ul style="list-style-type: none"> ◆ Install the chilled water system equipment for air-conditioning and refrigeration, including: <ul style="list-style-type: none"> • Installing air-handling units, fan coil units, expansion tanks, cooling towers, pumps, condensers, chiller plant and different types of valves and water system accessories according to installation plans and general installation requirements • Installing different types of water system pipes, pipe support and accessories with the use of electric welding 	

	<ul style="list-style-type: none"> ◆ Perform hydraulic pressure tests and pipeline wash for the chilled water system for air-conditioning and refrigeration, including: <ul style="list-style-type: none"> • Performing hydraulic pressure tests for the water system pipeline • Performing wash for the water system pipeline <p>6.3 Professionalism in installing chilled water systems for air-conditioning and refrigeration</p> <ul style="list-style-type: none"> ◆ Perform installation of chilled water system equipment for air-conditioning and refrigeration according to installation plans and specifications ◆ Understand the safety guidelines as required by the law and codes of practice and undertake tasks of installing chilled water system equipment for air-conditioning and refrigeration
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to complete tasks of installing chilled water system equipment for air-conditioning and refrigeration systematically and efficiently; and</p> <p>(ii) Capable to undertake tasks of installing chilled water system equipment for air-conditioning and refrigeration safely according to codes of practice.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge and skills of installing chilled water systems for air-conditioning and refrigeration.</p>

1. Title	Install air duct systems	
2. Code	EMACIN305A	
3. Range	Perform installation of air duct systems at plants or installation sites.	
4. Level	3	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of making and installing air duct systems</p> <ul style="list-style-type: none"> ◆ Understand the requirements for making and installing galvanized sheet steel air ducts and accessories as laid down in the DW series requirements of HVCA ◆ Understand the requirements for making and installing PVC air ducts and accessories as laid down in the DW series requirements of HVCA ◆ Understand the requirements for making and installing pre-insulated duct board systems as laid down by HVCA ◆ Understand the working principles of air filters, precipitators, air duct silencers, fan hoods and different types of fans <p>6.2 Methods and procedures of making and installing air duct systems</p> <ul style="list-style-type: none"> ◆ Make and install metal air ducts and components, including: <ul style="list-style-type: none"> • Making different types of galvanized sheet steel air ducts and accessories according to the DW codes as laid down by HVCA • Installing and joining different types of galvanized sheet steel air ducts and accessories according to the DW series requirements of HVCA • Installing air nozzles, splitter, vibration reduction joints • Installing volume control dampers, fire dampers and fusible-link smoke dampers ◆ Make and install non-metal air ducts and components, including: <ul style="list-style-type: none"> • Making, installing and joining different types of PVC air ducts and accessories according to the DW series requirements of HVCA • Making, installing and joining pre-insulated air ducts according to the installation guidelines of manufacturers • Installing and joining flexible air ducts according to the installation guidelines of manufacturers 	

	<ul style="list-style-type: none"> ◆ Install typical air duct system equipment, including: <ul style="list-style-type: none"> • Installing air filters, precipitators and other air-cleaning equipment • Installing air duct silencers • Installing fan hoods ◆ Install ventilation fans, including: <ul style="list-style-type: none"> • Installing different types of exhaust fans • Installing supply air fans and return air fans for different types of air duct systems <p>6.3 Professionalism in installing air duct systems</p> <ul style="list-style-type: none"> ◆ Perform tasks of making and installing air duct systems according to the DW series requirements of HVCA or the codes of manufacturers
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to undertake tasks of installing air duct systems systematically, efficiently and safely according to codes of practice.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge and skills of installing air duct systems.</p>

1. Title	Install thermal insulation materials for air-conditioning and refrigeration systems
2. Code	EMACIN306A
3. Range	Perform the installation of various types of thermal insulation materials for air-conditioning and refrigeration systems at installation sites.
4. Level	3
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of installing thermal insulation materials for air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Understand the performance of typical thermal insulation materials ◆ Understand the selection criteria for different thermal insulation materials <p>6.2 Methods and procedures of installing thermal insulation materials for air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Install heat preservation materials for cold water pipe systems of air-conditioning and refrigeration systems air-conditioning and refrigeration, including being able to: <ul style="list-style-type: none"> • Install phenolic foam and fibre glass thermal insulation materials tight and neat on to all cold water pipes and equipment • Install elastomeric thermal insulation materials tight and neat on to all cold water pipes and equipment • Install elastomeric thermal insulation materials tight and neat on to all cold water pipes and equipment and reinforce with wire mesh and cement • Perform seal treatment to thermal insulation material connection points • Install damp proof layers on thermal insulation materials ◆ Install thermal insulation materials for air duct systems, including being able to: <ul style="list-style-type: none"> • Install soft or hard fibre glass, phenolic foam and elastomeric thermal insulation materials tight and neat on to all cold air ducts and equipment

	<p>6.3 Professionalism in installing thermal insulation materials for air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> • Install elastomeric thermal insulation materials tight and neat on to all cold air ducts and equipment and reinforce with wire mesh and cement • Perform seal treatment to thermal insulation material connection points • Install damp proof layers on thermal insulation materials ◆ Understand the safety guidelines as required by the law and the code of practice to install various types of thermal insulation materials for air-conditioning and refrigeration systems
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to complete the installation of various types of thermal insulation materials for air-conditioning and refrigeration systems systematically and efficiently.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses elementary knowledge and skills of thermal insulation for air-conditioning and refrigeration systems.</p>

1. Title	Install packaged air-conditioning systems
2. Code	EMACIN307A
3. Range	Install various types of packaged air-conditioning systems and relevant equipment at installation sites.
4. Level	3
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of installing packaged air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Understand the construction, characteristics and operating process of packaged air-conditioning systems, including being able to: <ul style="list-style-type: none"> • Illustrate the construction, characteristics and operating process of air-cooled packaged air-conditioning systems • Illustrate the construction, characteristics and operating principles of water-cooled packaged air-conditioning systems ◆ Draw the component layouts for air-cooled packaged air-conditioning systems ◆ Draw the component layouts for water-cooled packaged air-conditioning systems ◆ Draw cooling water circulation diagram <p>6.2 Methods and procedures of installing packaged air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Install water-cooled packaged air-conditioning systems, including being able to: <ul style="list-style-type: none"> • Select suitable locations for the installation of water-cooled packaged air-conditioning systems • Install the water-cooled packaged air-conditioning systems tight and firm at suitable locations • Install suitable vibration reduction system properly ◆ Install cooling tower, including being able to: <ul style="list-style-type: none"> • Install cooling tower and its cooling water pipes and accessories • Install cooling water filling tank ◆ Install air-cooled packaged air-conditioning systems, including being able to: <ul style="list-style-type: none"> • Select suitable locations for the installation of air-cooled packaged air-conditioning systems • Install the air-cooled packaged air-conditioning systems tight and firm at suitable locations

	<p>6.3 Professionalism in installing packaged air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Install various types of packaged air-conditioning systems and relevant equipment according to drawings and installation specifications ◆ Understand the safety guidelines as required by the law and the code of practice to carry out installation of packaged air-conditioning systems
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to complete the installation of various types of packaged air-conditioning systems systematically and efficiently.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses elementary knowledge and skills of installing packaged air-conditioning systems.</p>

1. Title	Test and measure operating parameters of air-conditioning and refrigeration systems	
2. Code	EMACIT301A	
3. Range	Use measuring instruments to test and measure the operating parameters of air-conditioning and refrigeration systems, at air-conditioning and refrigeration system machine rooms or work sites, in order to carry out the inspection, commissioning and testing of the systems.	
4. Level	3	
5. Credit	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of testing and measuring operating parameters of air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Understand the types and functions of typical instruments for measuring air-conditioning and refrigeration systems, including being able to: <ul style="list-style-type: none"> • Illustrate temperature measuring methods and the construction and working principles of various types of temperature measuring instruments • Illustrate relative humidity measuring methods and the construction and working principles of various types of relative humidity measuring instruments • Illustrate pressure measuring methods and the construction and working principles of various types of pressure measuring instruments • Illustrate air velocity measuring methods and the construction and working principles of various types of air velocity measuring instruments <p>6.2 Methods and procedures of testing and measuring air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Measure the operating parameters of air-conditioning and refrigeration systems, including being able to: <ul style="list-style-type: none"> • Use typical thermometers to measure the temperature at all measuring points of air-conditioning and refrigeration systems • Use typical psychrometers to measure the relative humidity at all measuring points • Use typical pressure gauges to measure the pressure at all measuring points of air-conditioning and refrigeration systems • Use typical anemometers to measure the air velocity at all measuring points of air-conditioning systems ◆ Measure the dust concentration in the air, including being able to: <ul style="list-style-type: none"> • Measure the dust concentration in the air • Measure the efficiency of air filters at all levels in the air-conditioning systems 	

	<ul style="list-style-type: none"> ◆ Detect refrigerant leaks, including being able to: <ul style="list-style-type: none"> • Use soap solution to detect refrigerant leaks from refrigeration systems • Use halogen lamp to detect refrigerant leaks from refrigeration systems • Use electronic leak detector to detect refrigerant leaks from refrigeration systems • Use visual observation to detect refrigerant leaks from refrigeration systems <p>6.3 Professionalism in testing and measuring air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Understand the code of practice in order to undertake the tasks of testing and measuring the operating parameters of air-conditioning and refrigeration systems
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> (i) Capable to complete the testing and measurement of the operating parameters of various types of air-conditioning and refrigeration systems systematically and efficiently ; and (ii) Capable to follow the code of practice in order to undertake the tasks of testing and measuring the operating parameters of air-conditioning and refrigeration systems.
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses elementary knowledge of air-conditioning and refrigeration.</p>

1. Title	Measure noise and vibration of air-conditioning and refrigeration systems	
2. Code	EMACIT302A	
3. Range	Use measuring instruments to measure noise and vibration of air-conditioning and refrigeration systems, at air-conditioning and refrigeration system machine rooms or work sites, in order to carry out the inspection, commissioning and testing of the systems.	
4. Level	3	
5. Credit	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of measuring noise and vibration of air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Understand the causes and harm of noise, including being able to: <ul style="list-style-type: none"> • Illustrate the causes of noise generated by air-conditioning and refrigeration equipment • Illustrate the definition of sound pressure, sound pressure level, sound intensity, sound intensity level, sound power, sound power level, sound spectrum and sound level • Illustrate the harm of noise to human beings ◆ Understand the working principles of sound level meter ◆ List air-conditioning and refrigeration equipment that generally need to measure noise level ◆ Understand the causes and harm of vibration, including being able to: <ul style="list-style-type: none"> • Illustrate the causes of vibration generated by air-conditioning and refrigeration equipment • Illustrate the harm of vibration to air-conditioning and refrigeration equipment and human beings ◆ Understand the working principles of vibration sensor ◆ List air-conditioning and refrigeration equipment that generally need to measure vibration level <p>6.2 Methods and procedures of measuring noise and vibration of air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Use sound level meter to measure the noise level of air-conditioning and refrigeration equipment ◆ Use vibration sensor to measure the vibration level of air-conditioning and refrigeration equipment <p>6.3 Professionalism in measuring noise and vibration of air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Understand the legal requirements and code of practice in order to undertake the tasks of measuring the noise and vibration of air-conditioning and refrigeration systems 	

7. Assessment Criteria	The integrated outcome requirements of this unit of competency are: <ul style="list-style-type: none">(i) Capable to complete the measurement of the noise and vibration of various types of air-conditioning and refrigeration systems systematically and efficiently; and(ii) Capable to follow the code of practice in order to undertake the tasks of measuring noise and vibration of various types of air-conditioning and refrigeration systems.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses elementary knowledge of air-conditioning and refrigeration.

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"> ◆ Understand the construction and operating principles of air-conditioning and refrigeration systems, including the refrigerant piping, condenser, filter and evaporator, etc. <p>6.2 Method of repairing air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Clean and wash the air-conditioning and refrigeration systems, including: <ul style="list-style-type: none"> • Air filter • Using nitrogen to flush the refrigerant piping • Water-cooled condenser and defouling • air-cooled condenser • evaporator ◆ Pressure leak check and vacuuming of refrigeration system <ul style="list-style-type: none"> • Use nitrogen to perform pressure leak check for the refrigeration system • Vacuum the refrigeration system with the compressor • Vacuum the refrigeration system with the vacuum pump ◆ Charge the refrigeration system with refrigerant <ul style="list-style-type: none"> • Determine the correct amount of refrigerant to be charged • Understand the advantages and disadvantages of charging refrigerant • Charge a large refrigeration system with refrigerant at the charging valve • Charge liquid refrigerant at the discharge valve of compressor • Charge vapour refrigerant at the suction valve of compressor • Charge refrigerant to a hermetic compressor • Know the methods of liquid charging and vapour charging of refrigerant • Understand the safety precautions for charging liquid refrigerant

	<ul style="list-style-type: none"> ◆ Evacuate air and water from the refrigeration system <ul style="list-style-type: none"> • Understand the harm of air and water in the refrigeration system • Determine whether there is air and water in the refrigeration system • Evacuate the air from the refrigeration system • Evacuate the water from the refrigeration system ◆ Pump down and recover refrigerant from the refrigeration system <ul style="list-style-type: none"> • Understand the purpose of pumping down and recovering the refrigerant • Pump down the refrigerant from the refrigeration system to the liquid receiver or condenser • Use a refrigerant recovering machine to recover the refrigerant from the refrigeration system to the refrigerant recovery cylinder ◆ Add and remove refrigerant oil <ul style="list-style-type: none"> • Choose suitable refrigerant oil • Remove refrigerant oil from and add it to the hermetic reciprocating compressor • Remove refrigerant oil from and add it to the hermetic rotary compressor • Remove refrigerant oil from and add it to the open-type compressor <p>6.3 Professionalism in repairing air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Perform air-conditioning and refrigeration systems repairing according to safety regulations and code of practice as required by the law
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	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"> ◆ Understand the classification and techniques to retrieve fault information on the maintenance of the electrical and mechanical equipment <p>6.2 Apply fault finding techniques to find the root of fault</p> <ul style="list-style-type: none"> ◆ 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"> • Bathtub curve • The failure of similar equipment ◆ Apply the following fault finding techniques to enhance the effectiveness detecting the electrical and mechanical faults <ul style="list-style-type: none"> • Middle point tracing technique • Input signals injection technique for tracing fault origin • Use potential divider method to calculate the location of fault
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 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"> ◆ Understand the construction and working principles of air-conditioning system and control equipment; including: <ul style="list-style-type: none"> • Refrigeration system of unitary air-conditioner • Air distribution equipment such as damper • Electric control equipment and circuit of air-conditioning system <p>6.2 Typical faults in air-conditioning system and control equipment and their repairing methods</p> <ul style="list-style-type: none"> ◆ Troubleshoot and repair refrigeration system of a unitary air-conditioner, including the following components <ul style="list-style-type: none"> • compressor • evaporator • condenser • refrigeration pipe • valves and related equipment ◆ Troubleshoot and repair air distribution equipment, such as damper of an air-conditioner ◆ Troubleshoot and repair control equipment and circuit of an air-conditioning system ◆ Use typical repairing and testing instruments effectively
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	Apply knowledge of safety operation of air-conditioning and refrigeration system
2. Code	EMACSH301A
3. Range	Apply safety knowledge of air-conditioning and refrigeration system in performing tasks of operation, repair, maintenance, safety, and health and environmental protection for the system at air-conditioning and refrigeration system work sites or machine rooms.
4. Level	3
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of safety operation of air-conditioning and refrigeration system</p> <ul style="list-style-type: none"> ◆ Understand the principles and functions of refrigeration system safety devices, including: <ul style="list-style-type: none"> • Pressure safety devices (including pressure gauge, safety valve, safety diaphragm and fusible plug) • Liquid-level safety devices (including float valve and float type level controller) • Temperature safety control devices (including thermostat and overheat cut-out controller) ◆ Understand safety operation procedures of refrigeration equipment, including: <ul style="list-style-type: none"> • Safety operation procedures for valve • Safety operation procedures for reciprocating compressor • Safety operation procedures for screw compressor • Safety operation procedures for centrifugal compressor • Safety operation procedures for cooling tower ◆ Understand refrigeration system the safety operation procedures for auxiliary equipment, including: <ul style="list-style-type: none"> • Safety operation procedures for expansion valve • Safety operation procedures for refrigerant solenoid valve and filter • Safety operation procedures for water pump • Safety operation procedures for ventilation fan • Safety operation procedures for removing oil from the refrigeration system ◆ Possess the knowledge of lifting operation and of using lifting appliances and rigs, including: <ul style="list-style-type: none"> • Safety operation procedures for lifting operation • Use of hook, wire rope, chain sling, shackle and typical lifting appliances and rigs • Use of typical small lifting equipment

	<p>6.2 Application of knowledge of safety operation of air-conditioning and refrigeration system</p> <ul style="list-style-type: none"> ◆ Apply knowledge of safety operation of air-conditioning and refrigeration system to prevent air-conditioning and refrigeration practitioners from having accidents when installing, operating, repairing and maintaining air-conditioning and refrigeration equipment so as to protect the safety of human being and equipment
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply knowledge of safety operation of air-conditioning and refrigeration system to prevent air-conditioning and refrigeration practitioners from having accidents when installing, operating, repairing and maintaining air-conditioning and refrigeration equipment.</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 air-conditioning and refrigeration.</p>

1. Title	Operate central control and monitoring system (CCMS) of air-conditioning and refrigeration systems	
2. Code	EMACOR301A	
3. Range	Operate CCMS to perform tasks of commissioning, testing, operation, repair and maintenance for air-conditioning and refrigeration systems at air-conditioning and refrigeration system control rooms.	
4. Level	3	
5. Credit	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of CCMS operation</p> <ul style="list-style-type: none"> ◆ Understand the functions, structure and application structure of air-conditioning and refrigeration CCMS, including: <ul style="list-style-type: none"> • Functions of CCMS of air-conditioning and refrigeration systems • Functions of CCMS components of air-conditioning and refrigeration systems • Construction of CCMS of air-conditioning and refrigeration systems • Meanings of typical terms for CCMS of air-conditioning and refrigeration systems • Difference between direct digital controller (DDC) and analog controller ◆ Understand basic knowledge of typical building automation system software, including being able to list: <ul style="list-style-type: none"> • Brand names of typical building automation system operating software • Functions of typical building automation system operating software • Trade standards and protocols of typical building automation system ◆ Understand the functions and construction of various types of direct digital controllers and network components, including: <ul style="list-style-type: none"> • Functions and construction of direct digital controllers • Functions and construction of the extension accessories of direct digital controllers • Functions and construction of network components ◆ Understand the control procedures of central air-conditioning systems, including: <ul style="list-style-type: none"> • Automatic control procedures of variable air volume system • Automatic control procedures of fan coil • Automatic control procedures of fresh air supply system • Automatic control procedures of air-handling unit ◆ Understand the starting procedures and maintenance procedures of CCMS 	

	<p>6.2 Methods and procedures of CCMS operation</p> <ul style="list-style-type: none"> ◆ Operate CCMS to control and monitor the normal operation of central air-conditioning equipment ◆ Start CCMS ◆ Perform general maintenance for CCMS ◆ Shut down CCMS <p>6.3 Professionalism in operating CCMS of air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Follow the operation manual instructions to operate the CCMS of air-conditioning and refrigeration systems independently ◆ Understand the safety guidelines as required by the law and the code of practice when undertaking the operation of CCMS of air-conditioning and refrigeration systems
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to operate CCMS of air-conditioning and refrigeration systems systematically and efficiently; and</p> <p>(ii) Capable to follow the operation manual to perform the operation of CCMS of air-conditioning and refrigeration systems.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses elementary knowledge of air-conditioning and refrigeration automatic control.</p>

1. Title	Repair and maintain window type and split type air-conditioners	
2. Code	EMACOR302A	
3. Range	Perform repairs and maintenance of window type and split type air-conditioners, including performance tests and fault detection, independently 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 Knowledge of repairing and maintaining window type and split type air-conditioners</p> <ul style="list-style-type: none"> ◆ Understand the construction and working principles of window type and split type air-conditioners, including: <ul style="list-style-type: none"> • Refrigeration system • Air delivery system • Electrical control system ◆ Understand the structure and working principles of split type air-conditioners, including: <ul style="list-style-type: none"> • Refrigeration system • Air delivery system • Electrical control system ◆ Master the knowledge of repairing window type and split type air-conditioners ◆ Master the knowledge of maintaining window type and split type air-conditioners <p>6.2 Methods and procedures of repairing and maintaining window type and split type air-conditioners</p> <ul style="list-style-type: none"> ◆ Test the performance of air-conditioners, including: <ul style="list-style-type: none"> • Checking the condensate drain to assess whether the air-conditioner works properly • Checking the temperature difference of the supply air and return air of the indoor unit to assess whether the air-conditioner works properly • Checking the operating current to assess whether the air-conditioner works properly • Checking the high side pressure and low side pressure of the refrigeration system to assess whether the air-conditioner works properly ◆ Replenish and recover refrigerants, including: <ul style="list-style-type: none"> • Operating the suction valve to replenish the refrigerant • Determining the correct charge of the refrigerant • Recovering the refrigerant before removing the split type air-conditioner 	

	<ul style="list-style-type: none"> ◆ Check and repair typical faults of air-conditioners, including: <ul style="list-style-type: none"> • Using typical tools for repairing air-conditioner • Checking and repairing typical faults of refrigeration system • Checking and repairing typical faults of heat dissipation system • Checking and repairing typical faults of air delivery system • Checking and repairing typical faults of electrical control system <p>6.3 Professionalism in repairing and maintaining window type and split type air-conditioners</p> <ul style="list-style-type: none"> ◆ Undertake tasks of repairing and maintaining window type and split type air-conditioners according to codes of practice
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> (i) Capable to conduct tests to detect faults; to complete tasks of repairing and maintaining window type and split type air-conditioners independently and efficiently; and (ii) Capable to undertake tasks of repairing and maintaining window type and split type air-conditioners safely according to codes of practice.
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge and skills of repairing and maintaining window type and split type air-conditioners.</p>

1. Title	Repair and maintain packaged air-conditioning systems	
2. Code	EMACOR303A	
3. Range	Perform repair and maintenance, at external sites, with spare parts for typical packaged air-conditioning systems.	
4. Level	3	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of packaged air-conditioning system repair and maintenance</p> <ul style="list-style-type: none"> ◆ Understand the construction, characteristics and operating process of packaged air-conditioning systems, including being able to: <ul style="list-style-type: none"> • Illustrate the construction, characteristics and operating process of air-cooled packaged air-conditioning systems • Draw the component layouts for air-cooled packaged air-conditioning systems • Illustrate the construction, characteristics and operating process of water-cooled packaged air-conditioning systems • Draw the component layouts for air-cooled packaged air-conditioning systems ◆ Maintain water-cooled packaged air-conditioning systems, including being able to: <ul style="list-style-type: none"> • Perform routine check and maintenance procedures for water-cooled packaged air-conditioning systems • Perform routine check and maintenance procedures for cooling tower and water pump • Perform routine check and maintenance procedures for cooling water quality • Clean and wash the scale of cooling water system <p>6.2 Methods and procedures of packaged air-conditioning system repair and maintenance</p> <ul style="list-style-type: none"> ◆ Maintain water-cooled packaged air-conditioning systems, including being able to: <ul style="list-style-type: none"> • Perform routine check and maintenance procedures for water-cooled packaged air-conditioning systems • Perform routine check and maintenance procedures for cooling tower and water pump • Perform routine check and maintenance procedures for cooling water quality • Clean and wash the scale of cooling water system ◆ Maintain air-cooled packaged air-conditioning systems, including being able to: <ul style="list-style-type: none"> • Perform routine check and maintenance procedures for air-cooled packaged air-conditioning systems 	

	<ul style="list-style-type: none"> ◆ Repair packaged air-conditioning systems, including being able to: <ul style="list-style-type: none"> • Troubleshoot and repair typical faults in water-cooled packaged air-conditioning systems(including electrical control systems, refrigeration systems, air duct systems and cooling systems) • Troubleshoot and repair typical faults in air-cooled packaged air-conditioning systems (including electrical control systems, refrigeration systems, air duct systems and cooling systems) <p>6.3 Professionalism in packaged air-conditioning system repair and maintenance</p> <ul style="list-style-type: none"> ◆ Follow the repair manual instructions to independently, or lead subordinates to, carry out packaged air-conditioning system repair and maintenance
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> (i) Capable to identify and eliminate the faults systematically and efficiently in order to complete repair and maintenance of typical packaged air-conditioning systems; and (ii) Capable to explain clearly to clients the key points of equipment operation, repair and maintenance.
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses elementary knowledge and skills of air-conditioning and refrigeration.</p>

1. Title	Repair and maintain refrigerators, freezers and display coolers	
2. Code	EMACOR304A	
3. Range	Perform repair and maintenance of refrigerators, freezers and display coolers with spare parts 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 Working principles and repair and maintenance knowledge of refrigerators, freezers and display coolers</p> <ul style="list-style-type: none"> ◆ Understand the working principles of refrigerators, freezers and display coolers ◆ Understand the knowledge of repairing refrigerators, freezers and display coolers ◆ Understand the knowledge of maintaining refrigerators, freezers and display coolers <p>6.2 Methods and procedures of repairing and maintaining refrigerators, freezers and display coolers</p> <ul style="list-style-type: none"> ◆ Repair the faults of the compressors of refrigerators, freezers and display coolers ◆ Rectify leaks and obstruction in the evaporators, capillary tubes, drying filters and condensers of refrigerators, freezers and display coolers ◆ Repair the faults of the temperature controllers, compressor starting relays and overload protectors of refrigerators, freezers and display coolers ◆ Detect and repair the faults of the electrical control circuits of refrigerators, freezers and display coolers ◆ Identify and repair the typical faults of refrigerators, freezers and display coolers, including: <ul style="list-style-type: none"> • Conducting running tests • Repairing the faults caused by incorrect use • Identifying and repairing typical faults <p>6.3 Professionalism in repairing and maintaining refrigerators, freezers and display coolers</p> <ul style="list-style-type: none"> ◆ Perform repair and maintenance of refrigerators, freezers and display coolers independently according to the instructions of the manual ◆ Understand the safety guidelines as required by the law and codes of practice and undertake tasks of repairing and maintaining refrigerators, freezers and display coolers 	

7. Assessment Criteria	The integrated outcome requirements of this unit of competency are: (i) Capable to identify the problems systematically and efficiently; to handle and repair faults so as to complete tasks of repairing and maintaining refrigerators, freezers and display coolers; and (ii) Capable to explain clearly to the clients the key points of operating, repairing and maintaining refrigerators, freezers and display coolers.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge and skills of repairing and maintaining refrigerators, freezers and display coolers.

1. Title	Repair and maintain ice makers, beverage coolers and dehumidifiers	
2. Code	EMACOR305A	
3. Range	Perform repair and maintenance of ice makers, beverage coolers and dehumidifiers with spare parts 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 Working principles and repair and maintenance knowledge of ice makers, beverage coolers and dehumidifiers</p> <ul style="list-style-type: none"> ◆ Understand the working principles of ice makers, beverage coolers and dehumidifiers ◆ Understand the knowledge of repairing ice makers, beverage coolers and dehumidifiers ◆ Understand the knowledge of maintaining ice makers, beverage coolers and dehumidifiers <p>6.2 Methods and procedures of repairing and maintaining ice makers, beverage coolers and dehumidifiers</p> <ul style="list-style-type: none"> ◆ Repair the faults of the compressors of ice makers, beverage coolers and dehumidifiers ◆ Rectify leaks and obstruction in the evaporators, capillary tubes, drying filters and condensers of ice makers, beverage coolers and dehumidifiers ◆ Repair the faults of the temperature controllers, compressor starting relays and overload protectors of ice makers, beverage coolers and dehumidifiers ◆ Detect and repair the faults of the electrical control circuits of ice makers, beverage coolers and dehumidifiers ◆ Identify and repair the typical faults of ice makers, beverage coolers and dehumidifiers, including: <ul style="list-style-type: none"> • Conducting running tests • Repairing the faults caused by incorrect use • Identifying and repairing typical faults <p>6.3 Professionalism in repairing and maintaining ice makers, beverage coolers and dehumidifiers</p> <ul style="list-style-type: none"> ◆ Perform repair and maintenance of ice makers, beverage coolers and dehumidifiers independently according to the instructions of the manual ◆ Understand the safety guidelines as required by the law and codes of practice and undertake tasks of repairing and maintaining ice makers, beverage coolers and dehumidifiers 	

7. Assessment Criteria	The integrated outcome requirements of this unit of competency are: (i) Capable to identify the problems systematically and efficiently; to handle and repair faults so as to complete tasks of repairing and maintaining ice makers, beverage coolers and dehumidifiers; and (ii) Capable to explain clearly to the clients the key points of operating, repairing and maintaining ice makers, beverage coolers and dehumidifiers.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge and skills of repairing and maintaining ice makers, beverage coolers and dehumidifiers.

1. Title	Operate the refrigeration equipment of the cold storage	
2. Code	EMACOR306A	
3. Range	Perform operation of the refrigeration equipment of the cold storage at cold storage and machine rooms.	
4. Level	3	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of operating the refrigeration equipment of the cold storage</p> <ul style="list-style-type: none"> ◆ Understand the construction and working principles of typical refrigeration equipment of the cold storage, including: <ul style="list-style-type: none"> • Compressor • Oil-ammonia separator • Condenser • Liquid receiver • Intercooler • Air separator • Brine water evaporator <p>6.2 Methods and procedures of operating the refrigeration equipment of the cold storage</p> <ul style="list-style-type: none"> ◆ Perform test run for the refrigeration equipment of the cold storage, including: <ul style="list-style-type: none"> • Conducting inspection before test run the refrigeration equipment • Conducting test run for the refrigeration equipment • Calibrating the thermal expansion valve so that the cold storage can meet the needs of a wide range of cold stuffs ◆ Adjust the operating status of the refrigeration system of the cold storage, including: <ul style="list-style-type: none"> • Adjusting the cooling capacity of the cold storage • Adjusting the evaporation temperature • Adjusting the condensation temperature • Adjusting the suction gas temperature • Adjusting the discharge gas temperature ◆ Operate the refrigeration equipment of the cold storage, including: <ul style="list-style-type: none"> • Conducting inspection before restarting the refrigeration equipment • Starting the compressor • Defrosting the evaporator • Making necessary preparations before shutting down the refrigeration equipment for a long period of time 	

	<p>6.3 Professionalism in operating the refrigeration equipment of the cold storage</p> <ul style="list-style-type: none"> ◆ Follow the instructions of the operation manual to operate the refrigeration equipment of the cold storage independently ◆ Understand the safety guidelines as required by the law and the code of practice to undertake the operation of the refrigeration equipment of the cold storage
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> (i) Capable to operate the refrigeration equipment of the cold storage systematically and efficiently; and (ii) Capable to follow the instructions of the operation manual safely to undertake the operation of the refrigeration equipment of the cold storage.
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses elementary knowledge of the refrigeration equipment of the cold storage.</p>

1. Title	Repair and maintain the refrigeration equipment of the cold storage
2. Code	EMACOR307A
3. Range	Perform repair and maintenance of the refrigeration equipment of the cold storage at cold storage and machine rooms.
4. Level	3
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of repairing and maintaining the refrigeration equipment of the cold storage</p> <ul style="list-style-type: none"> ◆ Understand the construction and working principles of typical refrigeration equipment of the cold storage, including: <ul style="list-style-type: none"> • Compressor • Oil-ammonia separator • Condenser • Liquid receiver • Intercooler • Air separator • Brine water evaporator ◆ Understand the working principles of the refrigeration system of the cold storage ◆ Understand the typical faults of the refrigeration system of the cold storage and relevant solutions ◆ Understand the details of regular maintenance for the refrigeration system of the cold storage <p>6.2 Methods and procedures of repairing and maintaining the refrigeration system of the cold storage</p> <ul style="list-style-type: none"> ◆ Remove and add refrigerant oil, including: <ul style="list-style-type: none"> • Replacing refrigerant oil back into the compressor crankcase of an ammonia refrigeration system • Removing refrigerant oil from an ammonia refrigeration system • Adding refrigerant oil to the freon refrigeration system ◆ Remove air and water from the refrigeration system ◆ Conduct leakage test for the refrigeration system, and charge the refrigerant during system operation ◆ Repair compressors, including: <ul style="list-style-type: none"> • Identifying the faults of the compressor • Removing the compressor from the refrigeration system • Conducting a complete overhaul of the compressor • Reinstalling the compressor of the refrigeration system • Conducting a test run for the compressor

	<p>6.3 Professionalism in repairing and maintaining the refrigeration equipment of the cold storage</p> <ul style="list-style-type: none"> ◆ Perform repair and maintenance of the refrigeration equipment of the cold storage independently according to the instructions of the manual ◆ Understand the safety guidelines as required by the law and codes of practice and undertake tasks of repairing and maintaining the refrigeration equipment of the cold storage
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> (i) Capable to identify the problems systematically and efficiently; to handle and repair faults so as to complete tasks of repairing and maintaining the refrigeration equipment of the cold storage; and (ii) Capable to undertake tasks of repairing and maintaining the refrigeration equipment of the cold storage safely according to the manual.
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of the refrigeration equipment of the cold storage.</p>

1. Title	Operate central air-conditioning systems	
2. Code	EMACOR308A	
3. Range	Perform tasks of operating central air-conditioning systems at central air-conditioning system machine rooms or air-conditioned areas.	
4. Level	3	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of central air-conditioning system operation</p> <ul style="list-style-type: none"> ◆ Understand the construction and working principles of all central air-conditioning system equipment ◆ Understand the work flow of chilled water and condensing water systems ◆ Understand the work flow of air distribution system ◆ Understand the work flow of control system <p>6.2 Methods and procedures of central air-conditioning system operation</p> <ul style="list-style-type: none"> ◆ Perform pre-starting inspection for the central air-conditioning system ◆ Measure and adjust the operating parameters of the central air-conditioning system ◆ Start the central air-conditioning system, including: <ul style="list-style-type: none"> • Pre-starting preparations for the fan coil unit • Pre-starting preparations for the air-handling unit • Pre-starting preparations for the cooling tower • Pre-starting preparations for the chiller plant • Start all central air-conditioning system equipment ◆ Operate central air-conditioning systems, including: <ul style="list-style-type: none"> • Record the operating parameters of central air-conditioning systems • Check the operating condition of central air-conditioning systems • Adjust the operating parameters of central air-conditioning and refrigeration unit • Handle typical problems for central air-conditioning systems during operation ◆ Shut down the operation of central air-conditioning systems, including: <ul style="list-style-type: none"> • Normal shut down • Emergency shut down 	

	<p>6.3 Professionalism in central air-conditioning system operation</p> <ul style="list-style-type: none"> ◆ Follow the operational manual instructions to perform operation of the central air-conditioning systems independently ◆ Understand the safety guidelines as required by the law and the code of practice to undertake the operation of central air-conditioning systems
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> (i) Capable to operate central air-conditioning systems systematically and efficiently; and (ii) Capable to follow the operational manual safely to undertake the operation of central air-conditioning systems.
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses elementary knowledge of central air-conditioning systems.</p>

1. Title	Repair and maintain water systems of central air-conditioning systems	
2. Code	EMACOR309A	
3. Range	Perform repair and maintenance of water systems of central air-conditioning systems at central air-conditioning system machine rooms or air-conditioned areas.	
4. Level	3	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of repairing and maintaining water systems of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Understand the causes and handling methods of typical faults of water systems of central air-conditioning systems ◆ Understand details of maintenance of water systems of central air-conditioning systems ◆ Understand the working principles and installation of typical water systems equipment of central air-conditioning systems <p>6.2 Methods and procedures of repairing and maintaining water systems of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Perform water treatment for central air-conditioning systems, including: <ul style="list-style-type: none"> • Quality treatment for chilled water • Sediment control for condensing water • Metallic corrosion control for condensing water • Micro-organism control for condensing water ◆ Clean and wash water systems of central air-conditioning systems, including: <ul style="list-style-type: none"> • Using physical method to clean and wash the chilled water system and cooling water system • Using chemical method to clean and wash the chilled water system and condensing water system during shutdown mode • Using chemical method to clean and wash the chilled water system and condensing water system during non-shutdown mode ◆ Repair and maintain water systems equipment of central air-conditioning systems including cooling tower and water pump <p>6.3 Professionalism in repairing and maintaining water systems of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Follow the instructions of repair and maintenance manual to repair and maintain water systems of central air-conditioning systems ◆ Understand the safety guidelines required by the law to repair and maintain water systems of central air-conditioning systems 	

7. Assessment Criteria	The integrated outcome requirements of this unit of competency are: <ul style="list-style-type: none">(i) Capable to handle and eliminate the faults systematically and efficiently in order to complete the repair and maintenance of water systems of central air-conditioning systems; and(ii) Capable to follow the repair and maintenance manual safely to undertake the tasks of repairing and maintaining water systems of central air-conditioning systems.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of water systems of central air-conditioning systems.

1. Title	Repair and maintain air system of central air-conditioning system	
2. Code	EMACOR310A	
3. Range	Perform repair and maintenance of air system of central air-conditioning systems at central air-conditioning system machine rooms or air-conditioned areas.	
4. Level	3	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of repairing and maintaining air system of central air-conditioning system</p> <ul style="list-style-type: none"> ◆ Understand the working principles and installation of typical air system of central air-conditioning system ◆ Understand the causes and handling methods of typical faults of air system of central air-conditioning system ◆ Understand details of general maintenance of air system of central air-conditioning system <p>6.2 Methods and procedures of repairing and maintaining air system of central air-conditioning system</p> <ul style="list-style-type: none"> ◆ Measure and adjust the operating parameters of the air system of central air-conditioning system, including: <ul style="list-style-type: none"> • Measure and check if the supply air velocity, return air velocity, temperature, humidity and fresh air amount of the air system of central air-conditioning system conform to design requirements • Check if the output power of the air-handling equipment conforms to design requirements • Check if the air handling equipment conforms to design requirements ◆ Operate air system equipment of central air-conditioning system , including: <ul style="list-style-type: none"> • Pre-starting preparations for the air system • Start the air system equipment • Check if the air system equipment operate properly • Adjust the air system equipment so that the operating parameters conforms to design requirements • Carry out shut-down operation of the air system ◆ Repair and maintain central air-conditioning air system equipment, including: <ul style="list-style-type: none"> • Repair and maintenance of ventilation fans • Repair and maintenance of fan coil units • Repair and maintenance of air-handling units • Repair and maintenance of air ducts, volume control dampers (V.C.D.) and valves 	

	<p>6.3 Professionalism in repairing and maintaining air system of central air-conditioning system</p> <ul style="list-style-type: none"> ◆ Follow the instructions of repair and maintenance manual to repair and maintain air system of central air-conditioning system ◆ Understand the safety guidelines required by the law to repair and maintain air system of central air-conditioning system
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> (i) Capable to handle and eliminate the faults systematically and efficiently in order to complete the repair and maintenance of air system of central air-conditioning system ; and (ii) Capable to follow the repair and maintenance manual safely to undertake the tasks of repairing and maintaining air system of central air-conditioning system.
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses elementary knowledge of air system of central air-conditioning system.</p>

1. Title	Repair and maintain electrical control system of central air-conditioning systems	
2. Code	EMACOR311A	
3. Range	Perform repair and maintenance of electrical control system of central air-conditioning systems at machine rooms or air-conditioned areas.	
4. Level	3	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of electrical control system of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Understand the working principles of various types of electrical control system of central air-conditioning systems ◆ Understand the wiring diagram of electrical control system of central air-conditioning systems <p>6.2 Methods and procedures of repairing and maintaining electrical control system of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Maintain electrical control system of central air-conditioning systems , including routine maintenance and preventive inspection ◆ Locate and repair faults in electrical control system of central air-conditioning systems, including: <ul style="list-style-type: none"> • Troubleshoot and repair faults in the start-up and protection control circuits of the compressor • Troubleshoot and repair the faults in the temperature control circuits of the chilled water unit • Troubleshoot and repair the faults in the protection circuits (including chilled water low temperature protection switch, high pressure protection switch, oil heater, oil pressure safety switch, etc.) of the chilling water unit • Troubleshoot and repair the faults in the control circuits of the air-handling unit • Troubleshoot and repair the faults in the control circuits of the fan coil unit <p>6.3 Professionalism in repairing and maintaining electrical control system of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Follow the code of practice under the Electricity (Wiring) Regulations to perform repair and maintenance independently for electrical control system of central air-conditioning systems 	

7. Assessment Criteria	The integrated outcome requirements of this unit of competency are: (i) Capable to identify, handle and eliminate the faults systematically and efficiently so as to complete all kinds of repair and maintenance of electrical control system of central air-conditioning systems ; and (ii) Capable to follow relevant code of practice when carrying out electrical work.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses elementary knowledge and skills of wiring up electrical control circuits for air-conditioning and refrigeration.

1. Title	Repair and maintain reciprocating chiller plants
2. Code	EMACOR312A
3. Range	Perform repair and maintenance of reciprocating chiller plants at chiller plant rooms.
4. Level	3
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of repairing and maintaining reciprocating chiller plants</p> <ul style="list-style-type: none"> ◆ Understand the construction and working principles of reciprocating chiller plants ◆ Understand the methods of eliminating typical faults in reciprocating chiller plants ◆ Understand the details of reciprocating chiller plant maintenance <p>6.2 Methods and procedures of repairing and maintaining reciprocating chiller plants</p> <ul style="list-style-type: none"> ◆ Perform routine maintenance for reciprocating chiller plants, including: <ul style="list-style-type: none"> • Checking and monitoring if the chiller plants operate properly • Removing and charging refrigerant oil for maintenance after the chiller plant shuts down • Performing leak check, recovery and charging of refrigerants ◆ Perform routine repair for reciprocating chiller plants, including: <ul style="list-style-type: none"> • Performing routine repair for the chiller plant compressor • Performing routine repair for the condenser and evaporator • Performing routine repair for the refrigerant pipes, water pipes and valves ◆ Troubleshoot and repair faults in reciprocating chiller plants, including: <ul style="list-style-type: none"> • Find out causes of faults in chiller plants according to the operating condition and operating parameters of the chiller plants • Repair the faults after finding out the causes <p>6.3 Professionalism in repairing and maintaining reciprocating chiller plants</p> <ul style="list-style-type: none"> ◆ Follow the instructions of the repair and maintenance manual to perform repair and maintenance for reciprocating chiller plants ◆ Understand the code of practice to undertake the tasks of repairing and maintaining reciprocating chiller plants
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to complete repair and maintenance of various types of reciprocating chiller plants systematically and efficiently; and</p> <p>(ii) Capable to follow the code of practice to undertake the tasks of repairing and maintaining reciprocating chiller plants.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses elementary knowledge of chilled water type air-conditioning and refrigeration systems.

1. Title	Repair and maintain screw-type chiller plants
2. Code	EMACOR313A
3. Range	Perform repair and maintenance of screw-type chiller plants at chiller plant rooms.
4. Level	3
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of repairing and maintaining screw-type chiller plants</p> <ul style="list-style-type: none"> ◆ Understand the construction and working principles of screw-type chiller plants ◆ Understand the methods of eliminating typical faults in screw-type chiller plants ◆ Understand the details of screw-type chiller plant maintenance <p>6.2 Methods and procedures of repairing and maintaining screw-type chiller plants</p> <ul style="list-style-type: none"> ◆ Perform routine maintenance for screw-type chiller plants, including: <ul style="list-style-type: none"> • Checking and monitoring if the chiller plants operate properly • Removing and charging refrigerant oil for maintenance after the chiller plant shuts down • Performing leak check, recovery and charging of refrigerants ◆ Perform routine repair for screw-type chiller plants, including: <ul style="list-style-type: none"> • Performing routine repair for the chiller plant compressor • Performing routine repair for the condenser and evaporator • Performing routine repair for the refrigerant pipes, water pipes and valves ◆ Troubleshoot and repair faults in screw-type chiller plants, including: <ul style="list-style-type: none"> • Find out causes of faults in chiller plants according to the operating condition and operating parameters of the chiller plants • Repair the faults after finding out the causes <p>6.3 Professionalism in repairing and maintaining screw-type chiller plants</p> <ul style="list-style-type: none"> ◆ Follow the instructions of the repair and maintenance manual to perform repair and maintenance for screw-type chiller plants ◆ Understand the code of practice to undertake the tasks of repairing and maintaining screw-type chiller plants
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to complete repair and maintenance of various types of screw-type chiller plants systematically and efficiently; and</p> <p>(ii) Capable to follow the code of practice to undertake the tasks of repairing and maintaining screw-type chiller plants.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses elementary knowledge of chilled water type air-conditioning and refrigeration systems.

1. Title	Repair and maintain centrifugal chiller plants
2. Code	EMACOR314A
3. Range	Perform repair and maintenance of centrifugal chiller plants at chiller plant rooms.
4. Level	3
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of repairing and maintaining centrifugal chiller plants</p> <ul style="list-style-type: none"> ◆ Understand the construction and working principles of centrifugal chiller plants ◆ Understand the methods of eliminating typical faults in centrifugal chiller plants ◆ Understand the details of centrifugal chiller plant maintenance <p>6.2 Methods and procedures of repairing and maintaining centrifugal chiller plants</p> <ul style="list-style-type: none"> ◆ Perform routine maintenance for centrifugal chiller plants, including: <ul style="list-style-type: none"> • Checking and monitoring if the chiller plants operate properly • Removing and charge refrigerant oil for maintenance after the chiller plant shuts down • Performing leak check, recovery and charging of refrigerants ◆ Perform routine repair for centrifugal chiller plants, including: <ul style="list-style-type: none"> • Performing routine repair for the chiller plant compressor • Performing routine repair for the condenser and evaporator • Performing routine repair for the refrigerant pipes, water pipes and valves ◆ Troubleshoot and repair faults in centrifugal chiller plants, including: <ul style="list-style-type: none"> • Find out causes of faults in chiller plants according to the operating condition and operating parameters of the chiller plants • Repair the faults after finding out the causes <p>6.3 Professionalism in repairing and maintaining centrifugal chiller plants</p> <ul style="list-style-type: none"> ◆ Follow the instructions of the repair and maintenance manual to perform repair and maintenance for centrifugal chiller plants ◆ Understand the code of practice to undertake the tasks of repairing and maintaining centrifugal chiller plants
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to complete repair and maintenance of various types of centrifugal chiller plants systematically and efficiently; and</p> <p>(ii) Capable to follow the code of practice to undertake the tasks of repairing and maintaining centrifugal chiller plants.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses elementary knowledge of chilled water type air-conditioning and refrigeration systems.

1. Title	Repair and maintain heat-pump type air-conditioners
2. Code	EMACOR315A
3. Range	Repair and maintain heat-pump type air-conditioners at servicing stations or external sites with spare parts.
4. Level	3
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Working principles of heat-pump type air-conditioners</p> <ul style="list-style-type: none"> ◆ Understand the working principles of heat-pump air-conditioners, including being able to: <ul style="list-style-type: none"> • Illustrate the definition of heat pump's C.O.P. • Use pressure-enthalpy (p-h) diagram to illustrate reverse cycle heat pump theory • Illustrate the controlling procedures for heating cycle and cooling cycle of heat-pump type air-conditioners ◆ Compare the constructional difference between heat-pump type air-conditioners and cooling type air-conditioners ◆ Compare the advantages and disadvantages of the heating methods used by heat-pump air-conditioners and electric heaters <p>6.2 Methods and procedures of repairing and maintaining heat-pump type air-conditioners</p> <ul style="list-style-type: none"> ◆ Perform maintenance for typical heat-pump type air-conditioners ◆ Charge and recover refrigerant ◆ Check and repair faults of four-way solenoid valves ◆ Check and repair typical faults of heat-pump type air-conditioners <p>6.3 Professionalism in repairing and maintaining heat-pump type air-conditioners</p> <ul style="list-style-type: none"> ◆ Follow the manual instructions to repair and maintain heat-pump type air-conditioners ◆ Understand the safety guidelines as required by the law and the code of practice to repair and maintain heat-pump type air-conditioners
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are</p> <p>(i) Capable to identify and eliminate the faults systematically and efficiently in order to complete repair and maintenance heat-pump type air-conditioners; and</p> <p>(ii) Capable to explain clearly to clients the key points of operation, repair and maintenance of heat-pump type air-conditioners.</p>
8. Remarks	This unit of competency is applicable to practitioners engaged in heat-pump type air-conditioner repair and maintenance. The credit value of this unit of competency is set on the presumption that the person already possesses the competency of general repair and maintenance of window-type air-conditioners.

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"> ◆ 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 <p>6.2 Handle industrial accidents</p> <ul style="list-style-type: none"> ◆ Investigate industrial accidents related to electrical and mechanical services <ul style="list-style-type: none"> • 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. • Use objective methods and techniques to investigate and collect information. The investigation work include on-the-spot investigation, interviewing the victims/witnesses in person or on the phone, using questionnaire, etc. ◆ Report the accident to relevant departments ◆ Assist relevant departments to investigate the accident ◆ Improvement plans <ul style="list-style-type: none"> • Make improvement plans to reduce similar industrial accidents • Understand the causes of industrial accidents and ways of prevention ◆ Write accident investigation reports <ul style="list-style-type: none"> • Understand the document format and wording required and write accident investigation reports
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"> ◆ Understand the concepts and techniques of safety management in order to perform safety supervision, including: <ul style="list-style-type: none"> • Work safety requirements of the electrical and mechanical engineering contract • Safety inspection • Accident investigation • Safety audit and check • Work site tidiness and hygiene • Safety promotion • Risk assessment • Safety committee • Knowledge of latest safety legislations and their recent amendments <p>6.2 Occupational safety and health supervision</p> <ul style="list-style-type: none"> ◆ 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
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	Handle and review customers' complaints about electrical and mechanical product or service quality
2. Code	EMCUQM302A
3. Range	With regard to electrical and mechanical service quality management, analyze, review and handle customers' complaints properly, in clearly-defined conditions, according to in-house instructions.
4. Level	3
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 In-house instructions on handling customers' complaints</p> <ul style="list-style-type: none"> ◆ Understand in-house instructions on handling customers' complaints about electrical and mechanical product or service quality <p>6.2 Analyze, handle and review customers' complaints about electrical and mechanical product quality</p> <ul style="list-style-type: none"> ◆ Analyze and handle customers' complaints about electrical and mechanical product or service quality properly according to in-house instructions, including: <ul style="list-style-type: none"> • Referring the complaints to departments concerned to follow up and review of causes of the issues • Analyzing causes of the complaints and solving the problems with departments concerned • Handling and responding to the customers' complaints about quality or service ◆ review customers' complaints about electrical and mechanical product quality or service <ul style="list-style-type: none"> • analyze customers' satisfaction on the handling of complaints based on information from survey questionnaire on complaints • review the way of handling complaints • review the performance of handling complaints
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to analyze and handle customers' complaints about electrical and mechanical product quality, and make reviews.</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	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"> ◆ Understand the engineering procedures for electrical and mechanical services ◆ Understand quality monitoring points of each engineering procedure, including the electrical and mechanical installation procedure, inspection procedure, debugging procedure, commissioning procedure and servicing procedure ◆ Understand the quality control system of the organization and ensure that the service quality meet the requirements, including: <ul style="list-style-type: none"> • Ensuring that the engineering procedures meet the quality requirements and performance indicators • Confirming and rectifying procedures not complying with regulations • Organize teams to formulate quality improvement plans <p>6.2 Implement quality control and quality assurance</p> <ul style="list-style-type: none"> ◆ Follow the quality management scheme, quality assurance procedures and verification specifications to implement quality assurance ◆ Strictly examine the major monitoring points of each engineering procedure to ensure the quality performance of procedures ◆ Record various engineering quality problems and report to the management through the communication mechanism
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	Formulate simple quality assurance plan and quality assurance reports
2. Code	EMCUQM304A
3. Range	With regard to electrical and mechanical engineering design, and in clearly-defined conditions, formulate simple quality assurance plan for all process for electrical and mechanical services and compile quality assurance reports on electrical and mechanical services.
4. Level	3
5. Credit	6
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Format, key points and relevant concerns of quality assurance reports</p> <ul style="list-style-type: none"> ◆ Understand the format, key points and relevant concerns of quality assurance reports on electrical and mechanical services <p>6.2 Compile quality assurance reports on electrical and mechanical services and formulate simple quality assurance plan</p> <ul style="list-style-type: none"> ◆ Compile quality assurance reports on electrical and mechanical services with correct format ◆ Formulate simple quality assurance plan, including: <ul style="list-style-type: none"> • Quality management standards and technical requirements • Quality management staff's responsibilities • Quality management resources arrangement • Quality management work instructions • Quality monitoring points of electrical and mechanical engineering process • Confirm the method and items of quality assurance and check • Measures to rectify quality deviations • Internal quality audit • File record management system
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to compile quality assurance reports on electrical and mechanical services and formulate simple quality assurance plan.</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"> ◆ Understand format, key points and record required of quality assurance report on electrical and mechanical services <p>6.2 Record all kinds of engineering quality issues and problems</p> <ul style="list-style-type: none"> ◆ 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"> • 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. ◆ Quantify issues and problems on quality management so as to provide sufficient data or information for the management to produce the quality assurance reports
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.

1. Title	Apply sales and marketing techniques
2. Code	EMCUMS301A
3. Range	Apply sales and marketing techniques, in workplaces where electrical sales and marketing is involved, to perform sales and marketing related to engineering projects.
4. Level	3
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Basic concepts of sales and marketing</p> <ul style="list-style-type: none"> ◆ Understand basic concepts of sales and marketing ◆ Understand the relationship between sales and marketing and different process of an engineering project: <ul style="list-style-type: none"> • Quotation • Preparations for the project • Design and procurement • Electrical and mechanical equipment installation • Requirement details of the inspection, debugging and commissioning of electrical and mechanical equipment • Requirement details of the operation, maintenance and servicing of electrical and mechanical equipment <p>6.2 Sales and marketing techniques</p> <ul style="list-style-type: none"> ◆ Know the application of all types of sales and marketing methods such as: <ul style="list-style-type: none"> • Sales and marketing techniques for general electrical and mechanical installation products and engineering services, e.g. general newspaper advertisement and leaflets by post • Sales and marketing techniques for specific electrical and mechanical installation products and engineering services, e.g. professional advertisement for engineering and business-to-business direct sale • Sales and marketing manpower organizational chart • Authority and responsibilities of sales and marketing staff at different levels • Concepts and limitations of local sales and marketing network • Sales and marketing flowchart • Sales and marketing review
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply sales and marketing techniques to perform sales and marketing related to engineering projects.</p>
8. Remarks	This unit of competency is applicable to electrical and mechanical practitioners in general.

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"> ◆ Understand the entire storage system for electrical and mechanical engineering documents, including the correlational series and classification of typical drawings , and document storage system <p>6.2 Processing of electrical and mechanical engineering documents</p> <ul style="list-style-type: none"> ◆ Arrange drawings and classification of information <ul style="list-style-type: none"> • With engineering senses, classify the correlational series of typical drawings and information effectively for easy management ◆ Formulate system for the issuance of drawings and information, including: <ul style="list-style-type: none"> • Record of drawings and information issued • Marking of versions and dates issued ◆ Formulate retrieval mechanism for old drawings and information <ul style="list-style-type: none"> • 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 • Establish effective communication channels with users of the drawings and information ◆ 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"> • Use information technology and techniques to formulate systems to enhance the efficiency of storing, issuing, tracing and updating drawings and information
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	Design central air-conditioning control systems
2. Code	EMACDE401A
3. Range	Apply specialized knowledge of central air-conditioning control systems to perform tasks of designing, installing, inspecting, commissioning, testing, operating, repairing and maintaining central air-conditioning systems at design studios, or work sites, machine rooms or control rooms with central air-conditioning systems.
4. Level	4
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of central air-conditioning control systems</p> <ul style="list-style-type: none"> ◆ Understand the principles of air and temperature control, including: <ul style="list-style-type: none"> • Principles of temperature control by mixing of fresh air and primary return air • Principles of temperature control by mixing of secondary return air and conditioned air • Principles of temperature control by electrical heaters • Principles of temperature control by water spraying to cool air ◆ Understand the principles of humidity control, including; <ul style="list-style-type: none"> • Principles of indirect control of relative humidity by fixing the dew point • Principles of direct control of relative humidity by not fixing the dew point ◆ Understand the principles of automatic control of variable air volume systems, including: <ul style="list-style-type: none"> • Principles of air delivery control in variable air volume systems • Principles of temperature and humidity control in an air-conditioned room with a variable air volume system • Principles of static pressure control in the air ducting of variable air volume systems • Principles of balanced control of the supply air fan and return air fan • Principles of air volume control of fans • Principles of control of a variable air volume system in multi-room environment

	<ul style="list-style-type: none"> ◆ Understand the principles of interlock control in air-conditioning systems, including: <ul style="list-style-type: none"> • Principles of interlock control of the supply air fan and return air fan in an air-conditioning system • Principles of fan speed control • Principles of fire safety control in air-conditioning systems ◆ Understand the principles of the automatic control system of fan coils <p>6.2 Design central air-conditioning control systems</p> <ul style="list-style-type: none"> ◆ Apply specialized knowledge of central air-conditioning control systems to solve the problems involved in designing, installing, inspecting, commissioning, testing, operating, repairing and maintaining central air-conditioning systems
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply specialized knowledge of central air-conditioning control systems to solve the problems involved in designing, installing, inspecting, commissioning, testing, operating, repairing and maintaining central air-conditioning systems.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of central air-conditioning systems.</p>

1. Title	Perform energy audits of air-conditioning systems	
2. Code	EMACDE402A	
3. Range	Apply specialized knowledge and techniques to perform energy audits for air-conditioning systems at sites with such systems so as to save energy.	
4. Level	4	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of performing energy audits of air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Understand the energy efficiency of different types of air-conditioning systems ◆ Understand the purpose of energy audits ◆ Understand the working principles of typical methods of heat recovery ◆ Understand the typical methods of reducing energy consumption in air-conditioning systems <p>6.2 Methods and procedures of performing energy audits of air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Assess the energy efficiency of air-conditioning systems, including: <ul style="list-style-type: none"> • Assessing the impact of building design on the energy consumption of air-conditioning systems • Assessing whether the air-conditioning system design is highly energy-efficient and propose improvements if necessary • Estimating the energy consumption of air-conditioning systems • Using recognized benchmarks for energy consumption (kwh/m²) to assess the performance of air-conditioning systems ◆ Perform energy audits of air-conditioning systems, including: <ul style="list-style-type: none"> • Performing energy audits of air-conditioning systems • Proposing ways to improve the energy efficiency of air-conditioning systems according to audit results ◆ Assess the heat recovery methods used in air-conditioning systems and the ways to reduce energy consumption; propose improvements in these two aspects <p>6.3 Professionalism in performing energy audits of air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Perform energy audits of air-conditioning systems according to legal requirements and codes of practice 	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: (i) Capable to apply specialized knowledge and techniques to complete energy audits of air-conditioning systems.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of air-conditioning and refrigeration.

1. Title	Design air-conditioning and ventilation systems for prevention of smoke and fire in buildings
2. Code	EMACDE403A
3. Range	Apply specialized knowledge of air-conditioning and ventilation systems, at design studios or relevant work sites, for prevention of smoke and fire in buildings and perform tasks of designing, installing, inspecting, commissioning, testing, operating, repairing and maintaining air-conditioning and ventilation systems.
4. Level	4
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of air-conditioning and ventilation systems for prevention of smoke and fire in buildings</p> <ul style="list-style-type: none"> ◆ Understand the relationship between air-conditioning and ventilation systems and the prevention of smoke and fire in buildings, including: <ul style="list-style-type: none"> • Hazards of fumes in buildings • Generation and flow of fumes and flames in buildings • Methods of controlling fumes and flames in buildings ◆ Understand the types and working principles of smoke extraction systems and relevant codes of practice, including: <ul style="list-style-type: none"> • Functions of smoke extraction systems • Working principles of static smoke extraction systems • Working principles of dynamic smoke extraction systems • Code of Practice for Minimum Fire Service Installations and Equipment and Code of Practice for Inspection, Testing of Installations and Equipment issued by the Fire Services Department and the impact of both documents on the requirements of smoke extraction systems ◆ Understand the working principles of staircase pressurization systems and relevant codes of practice, including: <ul style="list-style-type: none"> • Functions of staircase pressurization systems • Working principles of staircase pressurization systems • Code of Practice for Minimum Fire Service Installations and Equipment and Code of Practice for Inspection, Testing of Installations and Equipment issued by the Fire Services Department and the impact of both documents on the requirements of staircase pressurization systems • International standards on the requirements of staircase pressurization systems ◆ Understand various methods of VAC control approved by the Fire Services Department

	<p>6.2 Design air-conditioning and ventilation systems for prevention of smoke and fire in buildings</p> <ul style="list-style-type: none"> ◆ Perform tests on smoke extraction and staircase pressurization systems according to the Code of Practice for Minimum Fire Service Installations and Equipment and the Code of Practice for Inspection, Testing of Installations and Equipment issued by the Fire Services Department ◆ Apply the knowledge of air-conditioning and ventilation systems for prevention of smoke and fire in buildings to make analysis and judgement so as to solve the problems involved in designing, installing, inspecting, commissioning, testing, operating, repairing and maintaining air-conditioning and ventilation systems; communicate with the sector and clients
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to design air-conditioning and ventilation systems for prevention of smoke and fire in buildings and make analysis and judgement so as to solve the problems involved in designing, installing, inspecting, commissioning, testing, operating, repairing and maintaining air-conditioning and ventilation systems; to communicate with the sector and clients.</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 ventilation systems and relevant regulations.</p>

1. Title	Determine air-conditioning load
2. Code	EMACDE404A
3. Range	Apply specialized knowledge and techniques at design studios, analyze a wide range of information and determine the air-conditioning load for different types of buildings so as to design air-conditioning systems.
4. Level	4
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of air-conditioning load</p> <ul style="list-style-type: none"> ◆ Understand the impact of air-conditioning load on an air-conditioning system ◆ Understand the design parameters for indoor and outdoor air-conditioning systems in Hong Kong ◆ Understand the relationship between indoor cooling load and heat generation <p>6.2 Methods and procedures of determining air-conditioning load</p> <ul style="list-style-type: none"> ◆ Use the coefficient of cooling load to determine air-conditioning load, including: <ul style="list-style-type: none"> • Assessing and analyzing the environmental and structural information of the building • Calculating the heat generation due to conduction from peripheral structures of the building (including external and internal walls, roof and windows) • Calculating the heat generation due to penetration of sunlight through windows • Calculating the heat generation due to indoor heat sources (including equipment, lighting and human bodies) • Calculating the cooling load caused by infiltration and ventilation • Determining the total cooling load of the building's air-conditioning system ◆ Estimate and calculate the total cooling load of the building's air-conditioning system <p>6.3 Professionalism in determining air-conditioning load</p> <ul style="list-style-type: none"> ◆ Determine air-conditioning load according to legal requirements, codes of practice and design guidelines
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply specialized knowledge and techniques, analyze a wide range of information and determine the air-conditioning load for different types of buildings.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of air-conditioning and refrigeration.

1. Title	Test and commission water systems of central air-conditioning systems	
2. Code	EMACIT401A	
3. Range	Apply specialized knowledge and skills to test and commission water systems of central air-conditioning systems at locations with central air-conditioning or central air-conditioning machine rooms.	
4. Level	4	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of testing and commissioning water systems of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Understand the details and importance of testing and commissioning water systems of central air-conditioning systems ◆ Understand the regulations and code of practice on testing and commissioning water systems of central air-conditioning systems <p>6.2 Methods and procedures of testing and commissioning water systems of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Clean and wash chilling water systems, including: <ul style="list-style-type: none"> • Flush chilled water system pipes • Clean and wash chilled water system pipes with water pump by forced recirculation method • Clean and wash chilled water system pipes with chemicals ◆ Perform running test for chilled water system equipment, including: <ul style="list-style-type: none"> • Check for the defects of the water pumps, pipes and all equipment and accessories of the chilled water system • Perform running test for the water pumps, pipes and all equipment of the chilling water system ◆ Perform running test for chilled water system equipment, including: <ul style="list-style-type: none"> • Check for the defects of the water pumps, pipes, cooling towers and all equipment and accessories of the condensing water system • Perform running test for the water pumps, pipes, cooling towers and all equipment and accessories of the condensing water system ◆ Perform water balancing for the chilled water system, including: <ul style="list-style-type: none"> • Adjust the water flow of all water mains and branches of the chilled water system to meet the design requirements • Adjust the water flow of all chilled water system equipment to meet the design requirements • Adjust the water flow of pumps of the chilled water system to meet the design requirements 	

	<p>6.3 Professionalism in testing and commissioning water systems of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Perform testing and commissioning of water systems of central air-conditioning systems according to legal requirements and codes of practice
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply specialized knowledge and skills to complete the testing and commissioning of water systems of central air-conditioning systems.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of central air-conditioning systems.</p>

1. Title	Test and commission air system of central air-conditioning systems	
2. Code	EMACIT402A	
3. Range	Apply specialized knowledge and skills to test and commission air system of central air-conditioning systems at locations with central air-conditioning or central air-conditioning machine rooms.	
4. Level	4	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of testing and commissioning air system of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Understand the details and importance of testing and commissioning air system of central air-conditioning system ◆ Understand the regulations and code of practice on testing and commissioning air system of central air-conditioning systems <p>6.2 Methods and procedures of testing and commissioning air system of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Check that all air system equipment and accessories have no surface defect ◆ Test that the air system equipment function properly ◆ Perform air leak test for the air duct system, including: <ul style="list-style-type: none"> • Use visual observation method initially with smoke machine to check for air leaks from the air duct system • Use air duct leakage testing machine to conduct air leak test for the air duct system according to HVCA standard (DW series) ◆ Perform air balancing for the air system of central air-conditioning systems , including: <ul style="list-style-type: none"> • Adjust the air volume of all main air ducts and branch air ducts to meet the design requirements • Adjust the air volume of all supply air outlets and return air outlets to meet the design requirements • Adjust the air volume of ventilation fans and air-handling units to meet the design requirements <p>6.3 Professionalism in testing and commissioning air system of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Perform testing and commissioning of air system of central air-conditioning systems according to legal requirements and codes of practice 	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: (i) Capable to apply specialized knowledge and skills to complete the testing and commissioning of air system of central air-conditioning systems
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of central air-conditioning systems.

1. Title	Test and commission chiller plant	
2. Code	EMACIT403A	
3. Range	Apply specialized knowledge and skills to test and commission chiller plants at chiller plant machine rooms.	
4. Level	4	
5. Credit	12	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of testing and commissioning chiller plants</p> <ul style="list-style-type: none"> ◆ Understand the details and importance of testing and commissioning chiller plants ◆ Understand the regulations and code of practice on testing and commissioning chiller plants <p>6.2 Methods and procedures of testing and commissioning chiller plants</p> <ul style="list-style-type: none"> ◆ Test and commission reciprocating chiller plants, including: <ul style="list-style-type: none"> • Perform air tight test for compressors and refrigeration pipes of the reciprocating chiller plant • Perform vacuuming test for compressors and refrigeration pipes of the reciprocating chiller plant • Charge the reciprocating chiller plant with refrigerant • Check for the defects of all reciprocating chiller plant equipment and accessories • Test that all reciprocating chiller plant equipment run properly • Perform test run for the reciprocating chiller plant • Adjust the operating parameters of the reciprocating chiller plant to meet the design requirements ◆ Test and commission screw chiller plants, including: <ul style="list-style-type: none"> • Check for the defects of all screw chiller plant equipment and accessories • Perform running test for all screw chiller plant equipment • Perform test run for the screw chiller plant • Adjust the operating parameters of the screw chiller plant to meet the design requirements ◆ Test and commission centrifugal chiller plants, including: <ul style="list-style-type: none"> • Check for the defects of all centrifugal chiller plant equipment and accessories • Perform running test for all centrifugal chiller plant equipment • Perform test run for the centrifugal chiller plant • Adjust the operating parameters of the centrifugal chiller plant to meet the design requirements 	

	6.3 Professionalism in testing and commissioning chiller plants	◆ Perform testing and commissioning of chiller plants according to legal requirements and codes of practice
7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: (i) Capable to apply specialized knowledge and skills to complete the testing and commissioning of chiller plants.	
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of various types of chiller plants.	

1. Title	Test and commission automatic control system for air-conditioning and refrigeration	
2. Code	EMACIT404A	
3. Range	Apply specialized knowledge and skills to test and commission automatic control system for air-conditioning and refrigeration at places with air-conditioning and refrigeration systems, their control rooms or machine rooms.	
4. Level	4	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of testing and commissioning automatic control system for air-conditioning and refrigeration</p> <ul style="list-style-type: none"> ◆ Understand the details and importance of testing and commissioning air-conditioning and refrigeration automatic control system ◆ the regulations and code of practice on testing and commissioning air-conditioning and refrigeration automatic control system <p>6.2 Methods and procedures of testing and commissioning automatic control system for air-conditioning and refrigeration</p> <ul style="list-style-type: none"> ◆ Carry out preparations for testing and commissioning the automatic control system for air-conditioning and refrigeration , including: <ul style="list-style-type: none"> • Check the sensor, controller and controlling equipment of the automatic control system for surface defects • Perform running test for the sensor, controller and controlling equipment of the automatic control system • Check whether the wiring of the electrical control system meets the design requirements • Measure to assure that the electrical wiring, insulation resistance and earthing protection of the equipment and components meet the design requirements • Check whether the voltage of power supply meets the design requirements ◆ Test and commission individual control systems, including: <ul style="list-style-type: none"> • Test and commission the dew point control system • Test and commission the room temperature and relative humidity control system • Test and commission the compressor protection system 	

	<ul style="list-style-type: none"> ◆ Test and commission the overall automatic control system for air-conditioning and refrigeration, including: <ul style="list-style-type: none"> • Test and commission the equipment interlock protection system • Test and commission the overall automatic control system for air-conditioning and refrigeration • Set the operating parameters of controllers <p>6.3 Professionalism in testing and commissioning automatic control system for air-conditioning and refrigeration</p> <ul style="list-style-type: none"> ◆ Perform testing and commissioning of automatic control system for air-conditioning and refrigeration according to legal requirements and codes of practice
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply specialized knowledge and skills to complete the testing and commissioning of overall automatic control system for air-conditioning and refrigeration.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of overall automatic control system for air-conditioning and refrigeration.</p>

1. Title	Assess noise of air-conditioning and refrigeration system	
2. Code	EMACIT405A	
3. Range	Apply specialized knowledge and skills to assess noise of air-conditioning and refrigeration systems at places with or machine rooms of air-conditioning and refrigeration systems, and provide solutions to reduce the noise.	
4. Level	4	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of air-conditioning and refrigeration system noise assessment</p> <ul style="list-style-type: none"> ◆ Understand the details of air-conditioning and refrigeration system noise assessment ◆ Understand the definition and applications of noise spectrum and noise level A (dB) ◆ Understand the definition and applications of different noise assessment curves ◆ Understand the acceptable noise level of different types of air-conditioned areas and buildings ◆ Understand noise sources of different types of air-conditioning and refrigeration equipment ◆ Understand the relationship between room acoustic power and room acoustic pressure level ◆ Understand the types of silencers and their properties of acoustics and aerodynamics <p>6.2 Methods and procedures of assessing air-conditioning and refrigeration system noise</p> <ul style="list-style-type: none"> ◆ Measure the air-conditioning and refrigeration system noise during operation, including indoor noise spectrum and noise level A (dB) ◆ Measure the outlet velocity of the air-conditioning and refrigeration system during operation ◆ Use noise assessment tools to assess the noise level of the air-conditioning and refrigeration system, including: <ul style="list-style-type: none"> • Use the data obtained from the air-conditioning and refrigeration system measurement to plot the noise assessment curve NR • Use the noise assessment curve to assess whether the noise of the air-conditioning and refrigeration system exceeds the acceptable standard ◆ Reduce the air-conditioning and refrigeration system noise, including: <ul style="list-style-type: none"> • Find out why the air-conditioning and refrigeration system is so noisy • Propose ways to reduce noise of the air-conditioning and refrigeration system according to the actual situation • Select suitable air duct silencer 	

	<p>6.3 Professionalism in air-conditioning and refrigeration system noise assessment</p> <ul style="list-style-type: none"> ◆ Perform air-conditioning and refrigeration system assessment according to the legal requirements and code of practice
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> (i) Capable to apply specialized knowledge and skills, and analyze a wide range of information, in order to complete air-conditioning and refrigeration system noise assessment; and (ii) Capable to propose ways to reduce noise of air-conditioning and refrigeration systems according to actual situations.
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of air-conditioning and refrigeration systems and noise.</p>

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"> ◆ 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 <p>6.2 Supervise equipment maintenance work to ensure its quality</p> <ul style="list-style-type: none"> ◆ Support and coordinate the repair work <ul style="list-style-type: none"> • Support the repair work technically and in the aspect of resource allocation • Coordinate all items of repair and pay attention to the progress of crucial procedures ◆ Monitor the repair work <ul style="list-style-type: none"> • Check randomly the repair quality according to the importance of procedure • 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 ◆ Purchase suitable tools and equipment to enhance the repairing efficiency <ul style="list-style-type: none"> • Apply repairing procedures and techniques, and purchase adequate suitable repairing tools and equipment to enhance the repairing efficiency • Formulate and implement repairing tools and equipment maintenance plan ◆ Maintain good human resources management, time management and interpersonal relationship <ul style="list-style-type: none"> • Analyze and formulate manpower training plans • Implement good time management • Maintain good interpersonal relationship 	

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	Measure indoor air quality parameters
2. Code	EMACOR401A
3. Range	Apply specialized knowledge, skills and instruments to measure indoor air quality parameters at air-conditioned areas for indoor air quality assessment.
4. Level	4
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of indoor air quality</p> <ul style="list-style-type: none"> ◆ Understand the definition of indoor air pollution and indoor air ◆ Understand the various sources of indoor air pollution ◆ Understand the characteristics, health effect and prevention of various types of indoor air pollutants ◆ Understand the definition and measuring units of various indoor air quality parameters ◆ Understand the working principles of measuring instruments of indoor air quality parameters ◆ Understand the relationship between indoor air quality and sick building syndrome ◆ Understand the present situation of indoor air quality in Hong Kong <p>6.2 Methods and procedures of measuring indoor air quality</p> <ul style="list-style-type: none"> ◆ Measure indoor air quality parameters, including: <ul style="list-style-type: none"> • Select suitable sampling place for measuring indoor air quality • Use instruments to measure indoor air quality parameters (including indoor temperature, relative humidity, air flow speed, carbon dioxide, carbon monoxide, respirable suspended particulate, nitrogen dioxide, ozone, formaldehyde, total-volatile organic compounds, radon and bacteria in the air) so as to complete the measurement report and make recommendations on indoor air quality improvement <p>6.3 Professionalism in measuring indoor air quality</p> <ul style="list-style-type: none"> ◆ Follow the code of practice to measure indoor air quality parameters at air-conditioned areas
7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: (i) Capable to apply specialized knowledge, skills and instruments to complete measuring indoor air quality.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of air-conditioning systems.

1. Title	Supervise air-conditioning and refrigeration system operation, repair and maintenance	
2. Code	EMACOR402A	
3. Range	Apply specialized knowledge and skills to supervise air-conditioning and refrigeration system operation, repair and maintenance at locations with air-conditioning and refrigeration systems or their machine rooms.	
4. Level	4	
5. Credit	12	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of supervising air-conditioning and refrigeration system operation, repair and maintenance</p> <ul style="list-style-type: none"> ◆ Understand the details and requirements for managing air-conditioning and refrigeration equipment operation, repair and maintenance ◆ Understand the technical regulations and procedures for air-conditioning and refrigeration equipment operation, repair and maintenance <p>6.2 Methods and procedures of supervising air-conditioning and refrigeration system operation, repair and maintenance</p> <ul style="list-style-type: none"> ◆ Troubleshoot and repair unusual faults in air-conditioning and refrigeration systems, including: <ul style="list-style-type: none"> • Analyze the operating condition and operating parameter data of the air-conditioning and refrigeration system to find out the cause of the unusual fault in the air-conditioning and refrigeration system • Repair the fault after knowing the cause ◆ Supervise staff to carry out operation, repair and maintenance, including: <ul style="list-style-type: none"> • Arrange the staff to carry out operation, repair and maintenance according to operating requirements • Assess if the operation, repair and maintenance works done by the staff meet the specified requirements • Organize technical exchange for the staff ◆ Prepare documents for air-conditioning and refrigeration equipment operation, repair and maintenance, including: <ul style="list-style-type: none"> • Preparing record forms for air-conditioning and refrigeration equipment operation, repair and maintenance work • Preparing schedules for air-conditioning and refrigeration equipment repair and maintenance • Preparing lists of equipment, parts and materials required for repair and maintenance 	

	<p>6.3 Professionalism in supervising air-conditioning and refrigeration system operation, repair and maintenance</p> <p>◆ Supervise the operation, repair and maintenance of air-conditioning and refrigeration systems according to the legal requirements and code of practice</p>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply specialized knowledge and skills, and allocate and organize a wide range of resources, in order to complete the supervision of the operation, repair and maintenance of air-conditioning and refrigeration systems.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of air-conditioning and refrigeration system operation, repair and maintenance.</p>

1. Title	Plan the finance, accounts and insurance of engineering projects	
2. Code	EMCUPM401A	
3. Range	Make proper financial, accounting and insurance arrangements for the management of electrical and mechanical projects.	
4. Level	4	
5. Credit	6	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Cost accounting techniques and concepts of financial and insurance arrangements for electrical and mechanical projects</p> <ul style="list-style-type: none"> ◆ Understand the cost accounting techniques for electrical and mechanical projects in order to assess the funding needs. The accounting techniques include making use of the statement of assets and liabilities, calculation of interest rates, calculation of basic cash flow, calculation of present value, accounting items, etc. ◆ Understand the company's concepts of financial and insurance arrangements for the engineering project <p>6.2 Finance and engineering insurance</p> <ul style="list-style-type: none"> ◆ Know about the financial arrangements, including the arrangements of different kinds of loans, mortgage, lease, hedging, futures, etc. ◆ Know about all kinds of insurance arrangements, including third party insurance, accident insurance, labour insurance, etc. 	
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to plan the financial, accounting and insurance arrangements for the electrical and mechanical project properly to ensure the finance of the project is sound and cost-effective.</p>	
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of finance, accounting and insurance.	

1. Title	Supervise on-site air-conditioning and refrigeration works	
2. Code	EMACPM401A	
3. Range	Apply specialized knowledge and skills to supervise on-site air-conditioning and refrigeration works at air-conditioning and refrigeration work sites or machine rooms.	
4. Level	4	
5. Credit	15	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of air-conditioning and refrigeration work supervision</p> <ul style="list-style-type: none"> ◆ Understand the quality requirements on air-conditioning and refrigeration works, including: <ul style="list-style-type: none"> • Air system • Water system • Refrigeration system • Electrical control system ◆ Understand the principles of electrical and mechanical installation engineering personnel management <p>6.2 methods and procedures of air-conditioning and refrigeration work supervision</p> <ul style="list-style-type: none"> ◆ Evaluate the work performance of air-conditioning and refrigeration workers, including: <ul style="list-style-type: none"> • Explain to the workers the aims of the work performance evaluation • Evaluate the work performance of the workers to see if the works targets are achieved • Suggest to the workers ways to improve their work performance • Use management skills to improve the work performance of the workers ◆ Control the quality, progress and costs of the air-conditioning and refrigeration project, including: <ul style="list-style-type: none"> • Meeting the design requirements for the air-conditioning and refrigeration project • Meeting the quality requirements for the air-conditioning and refrigeration project • Meeting the design requirements on the progress of the air-conditioning and refrigeration project • Meeting the budget requirements for the air-conditioning and refrigeration project 	

	<p>6.3 Professionalism in air-conditioning and refrigeration work supervision</p> <ul style="list-style-type: none"> ◆ supervise on-site air-conditioning and refrigeration works according to the legal requirements and code of practice
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply specialized knowledge and skills, and through allocation and coordination of various types of resources, to complete the supervision of on-site air-conditioning and refrigeration works.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of air-conditioning and refrigeration installation.</p>

1. Title	Perform air-conditioning and refrigeration engineering contract administration
2. Code	EMACPM402A
3. Range	Apply specialized knowledge of air-conditioning and refrigeration engineering contract administration to manage air-conditioning and refrigeration projects at air-conditioning and refrigeration management project office or work sites.
4. Level	4
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of air-conditioning and refrigeration engineering contract administration</p> <ul style="list-style-type: none"> ◆ Understand the details and characteristics of engineering contract, including: <ul style="list-style-type: none"> • Background, characteristics and purposes of engineering contract • Characteristics of engineering contract systems commonly adopted internationally • Characteristics of building contracts in Hong Kong • Content that a comprehensive contract should include ◆ Understand the details of a engineering contract, including: <ul style="list-style-type: none"> • Definition of engineering contract administration • Importance and characteristics of engineering contract administration • Responsibilities of architect, owner, main contractor and sub-contractor • Work details of engineering contract administration ◆ Understand the details of sub-contracted administration, including: <ul style="list-style-type: none"> • Content of the air-conditioning and refrigeration sub-contract • Administration flow of the air-conditioning and refrigeration sub-contract <p>6.2 Perform air-conditioning and refrigeration engineering contract administration</p> <ul style="list-style-type: none"> ◆ Perform air-conditioning and refrigeration engineering contract administration to help solve the problems regarding the organization, contract, progress control, quality control and financial management of the air-conditioning and refrigeration project
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to perform specialized air-conditioning and refrigeration engineering contract administration to help solve the problems regarding the organization, contract, progress control, quality control and financial management of the air-conditioning and refrigeration project.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of air-conditioning and refrigeration system.

1. Title	Perform refrigeration system safety management	
2. Code	EMACSH401A	
3. Range	Apply specialized knowledge and skills to perform refrigeration system safety management at refrigeration system work sites or machine rooms.	
4. Level	4	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of refrigeration system safety management</p> <ul style="list-style-type: none"> ◆ Understand the types and causes of accidents for air-conditioning and refrigeration services ◆ Understand the safety requirements on refrigeration system, including: <ul style="list-style-type: none"> • Safety requirements on design • Safety requirements on installation • Safety requirements on human protection • Safety requirements on operation, repair and maintenance ◆ Understand the functions and working principles of various types of safety devices of refrigeration system <p>6.2 Methods and procedures of refrigeration system safety management</p> <ul style="list-style-type: none"> ◆ Manage the safety operation of refrigeration system, including: <ul style="list-style-type: none"> • Formulating the safety operation procedures for the refrigeration system • Formulating the safety procedures for the repair of refrigeration system ◆ Evaluate the safety arrangements for refrigeration equipment, including: <ul style="list-style-type: none"> • Evaluate whether the safety protection of the refrigeration system is adequate • Evaluate whether the automatic control of the refrigeration system is adequate • Evaluate whether the human protection measures are adequate ◆ Formulate accident handling measures, including: <ul style="list-style-type: none"> • Formulating accident handling plan • Evaluate whether the personal protective equipment is adequate • Evaluate whether the medications for emergency are adequate 	

	<p>6.3 Professionalism in refrigeration system safety management</p> <ul style="list-style-type: none"> ◆ Formulate a safety management plan according to the operation, repair and maintenance manuals of the refrigeration system ◆ Understand the safety guidelines as required by the law and the code of practice when performing tasks of refrigeration system safety management
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> (i) Capable to formulate a refrigeration system safety management plan; and (ii) Capable to apply specialized knowledge and skills to complete tasks of refrigeration system safety management.
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of refrigeration system.</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"> ◆ 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"> • Check points for different stages of the project • 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. <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"> ◆ Confirm and analyze items not conforming to the rules at different stages of the project, and formulate improvement plans with working teams concerned ◆ 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. ◆ 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"> • Division of procedure for the project • Check points of ‘planning-implementation-commissioning-rectification’ for quality management at different stages of the project • Performance indicators at different stages of the project • Ways to handle items not conforming to the rules • Quality management goals • Mechanism to communicate with relevant teams and formulation of timetables for improvement plans, etc.
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> <table border="0"> <tr> <td style="vertical-align: top;">6.1</td> <td style="vertical-align: top;">Knowledge of quality management</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ◆ Understand the concept of quality management ◆ Understand the goals of organizational quality management culture </td> </tr> <tr> <td style="vertical-align: top;">6.2</td> <td style="vertical-align: top;">Promote and foster basic level quality management culture</td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> ◆ Promote basic level quality management culture, including: <ul style="list-style-type: none"> • Implement on-the-job training on quality knowhow for frontline staff • Set up frontline staff quality monitoring group to foster quality management culture at working level • Organize quality management culture promotional activities, such as quiz competitions, quality circle, visits, seminars, etc. </td> </tr> </table>	6.1	Knowledge of quality management	<ul style="list-style-type: none"> ◆ Understand the concept of quality management ◆ Understand the goals of organizational quality management culture 	6.2	Promote and foster basic level quality management culture	<ul style="list-style-type: none"> ◆ Promote basic level quality management culture, including: <ul style="list-style-type: none"> • Implement on-the-job training on quality knowhow for frontline staff • Set up frontline staff quality monitoring group to foster quality management culture at working level • Organize quality management culture promotional activities, such as quiz competitions, quality circle, visits, seminars, etc.
6.1	Knowledge of quality management	<ul style="list-style-type: none"> ◆ Understand the concept of quality management ◆ Understand the goals of organizational quality management culture 					
6.2	Promote and foster basic level quality management culture	<ul style="list-style-type: none"> ◆ Promote basic level quality management culture, including: <ul style="list-style-type: none"> • Implement on-the-job training on quality knowhow for frontline staff • Set up frontline staff quality monitoring group to foster quality management culture at working level • Organize quality management culture promotional activities, such as quiz competitions, quality circle, visits, seminars, etc. 					
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.						

1. Title	Conduct site survey and quality control
2. Code	EMCUQM404A
3. Range	Investigate the characteristics and limitations of the work site and conduct quality control and monitoring of engineering projects.
4. Level	4
5. Credit	3
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Quality control and monitoring requirements on work site environment</p> <ul style="list-style-type: none"> ◆ Master the progress of design, installation, operation, maintenance and repair, inspection, commissioning and testing necessary for the engineering projects, and understand the quality control and monitoring requirements on work site environment <p>6.2 Conduct site survey and clear obstacles so as to implement quality control of electrical and mechanical installation project</p> <ul style="list-style-type: none"> ◆ Investigate and analyze the characteristics and limitations of the work site, and point out potential problems in and obstacles to the electrical and mechanical design, installation, operation, maintenance and repair, inspection, commissioning and testing of the projects there so as to ensure: <ul style="list-style-type: none"> • The effective implementation of all engineering projects • The effective implementation of quality control scheme • The effective operation of the flow chart of quality control procedures ◆ Suggest solutions to clear the obstacles so as to implement quality control of the electrical and mechanical installation projects
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to demonstrate how to conduct site survey and clear obstacles in order to assist in quality control of the electrical and mechanical installation projects.</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	Sell air-conditioning and refrigeration equipment	
2.Code	EMACMS401A	
3.Range	Apply specialized knowledge and skills to sell air-conditioning and refrigeration equipment at offices or sales outlets.	
4.Level	4	
5.Credit	12	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of selling air-conditioning and refrigeration equipment</p> <ul style="list-style-type: none"> ◆ Understand how to select air-conditioning and refrigeration equipment ◆ Understand the utilization, installation and repair of air-conditioning and refrigeration equipment ◆ Understand the psychology of consumers ◆ Understand how to communicate with customers <p>6.2 Methods and procedures of selling air-conditioning and refrigeration equipment</p> <ul style="list-style-type: none"> ◆ Visit customers, including: <ul style="list-style-type: none"> • Exploring potential customers through various channels • Making appointments to visit customers ◆ Introduce air-conditioning and refrigeration equipment, including: <ul style="list-style-type: none"> • Introduce company's scope of business to customers • Explain to customers the uses, quality, performance and after-sales service policy of air-conditioning and refrigeration equipment • Suggest suitable air-conditioning and refrigeration equipment to customers ◆ Negotiate and complete the transaction with the customer, including: <ul style="list-style-type: none"> • Understand the psychology of the customer • Seize the opportunity in the negotiation • Solve the differences of opinions with the customer • Complete the sales transaction of air-conditioning and refrigeration equipment ◆ Deliver air-conditioning and refrigeration equipment, including: <ul style="list-style-type: none"> • Calculating the payment for goods • Arranging the delivery of air-conditioning and refrigeration equipment 	

	<ul style="list-style-type: none"> ◆ Provide after-sales service to the customer, including: <ul style="list-style-type: none"> • Keep contact with the customer • Advise the customer on the utilization, installation and repair of the air-conditioning and refrigeration equipment • Handle the warranty claim from the customer for air-conditioning and refrigeration equipment <p>6.3 Professionalism in selling air-conditioning and refrigeration equipment</p> <ul style="list-style-type: none"> ◆ Understand the safety guidelines as required by the law and the code of practice for providing sales and after-sales services of air-conditioning and refrigeration equipment to customers
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> (i) Capable to apply specialized knowledge and skills to sell air-conditioning and refrigeration equipment to complete the task of selling air-conditioning and refrigeration equipment ; and (ii) Capable to provide satisfactory after-sales service to customers.
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses basic knowledge of air-conditioning and refrigeration equipment.</p>

Competency Level 5

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"> ◆ Understand the key points and purposes of all kinds of electrical and mechanical engineering reports, including: <ul style="list-style-type: none"> • Equipment fault report • Equipment inspection report • Accident investigation report • Operation management report <ul style="list-style-type: none"> ▸ Financial status of the company ▸ Balance of account ▸ Engineering budget • Engineering project management progress report <ul style="list-style-type: none"> ▸ Progress of crucial procedures ▸ Status of implementation of work plan, delay and causes, monitoring indicators and solutions ◆ Understand formats the above-mentioned electrical and mechanical engineering reports and typical technical terms of electrical and mechanical services <p>6.2 Write all kinds of electrical and mechanical engineering reports in Chinese</p> <ul style="list-style-type: none"> ◆ Use correct report format to write all kinds of the above-mentioned electrical and mechanical engineering reports in Chinese ◆ Use drawings to strengthen and enrich the contents of the reports, including bar chart, square chart, pie chart, circular chart and flow chart, etc ◆ Write in fluent Chinese
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"> ◆ Understand the key points and purposes of all kinds of electrical and mechanical engineering reports, including: <ul style="list-style-type: none"> • Equipment fault report • Equipment inspection report • Accident investigation report • Operation management report <ul style="list-style-type: none"> ▸ Financial status of the company ▸ Balance of account ▸ Engineering budget • Engineering project management progress report <ul style="list-style-type: none"> ▸ Progress of crucial procedures ▸ Status of implementation of work plan, delay and causes, monitoring indicators and solutions ◆ Understand formats the above-mentioned electrical and mechanical engineering reports and typical technical terms of electrical and mechanical services <p>6.2 Write all kinds of electrical and mechanical engineering reports in English</p> <ul style="list-style-type: none"> ◆ Use correct report format to write all kinds of the above-mentioned electrical and mechanical engineering reports in English ◆ Use drawings to strengthen and enrich the contents of the reports, including bar chart, square chart, pie chart, circular chart and flow chart, etc ◆ Write in fluent English
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 air system of central air-conditioning system	
2. Code	EMACDE501A	
3. Range	Use specialized techniques, data analysis and innovative skills, at design studios, to perform tasks of designing air system of central air-conditioning system.	
4. Level	5	
5. Credit	12	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of designing air system of central air-conditioning system</p> <ul style="list-style-type: none"> ◆ Understand the classification and working principles of air system of central air-conditioning system , including: <ul style="list-style-type: none"> • Classification of air system of central air-conditioning system • Working principles of all-fresh air systems • Working principles of fresh air and return air mixed systems • Working principles of constant air volume systems • Working principles of variable air volume systems • Working principles of fan coil unit with fresh air system ◆ Understand the classification, general specifications, selection criteria and layout principles of air ducts <p>6.2 Methods and procedures of designing air system of central air-conditioning system</p> <ul style="list-style-type: none"> ◆ Calculate the data from the air-handling process, including: <ul style="list-style-type: none"> • Calculating the volume of fresh air, temperature difference of supply air, summer and winter operating parameters with reference to a primary return air system • Calculating the summer operating parameters with reference to a secondary return air system • Selecting primary return or secondary return air systems • Calculating the conditioned air parameters of fan coil unit with fresh air system ◆ Design variable air volume systems, including: <ul style="list-style-type: none"> • Selecting different types of terminal devices for a variable air volume system • Calculating the operating parameters of a variable air volume system • Selecting single air duct system or dual air duct system according to actual situations 	

	<ul style="list-style-type: none"> ◆ Design air duct systems, including: <ul style="list-style-type: none"> • Calculating the resistance and operating parameters of air duct systems • Determining correct cross-sectional area of air ducts so as to balance the total resistance • Laying down the specifications of air duct system equipment ◆ Design air outlets and air flow pattern, including: <ul style="list-style-type: none"> • Determining the type of air distribution and the air flow pattern according to the characteristics and design requirements of the building • Selecting suitable supply air diffusers and return air diffusers • Calculating the operating parameters of side delivery of supply air • Calculating the operating parameters of supply air delivery by air diffusers <p>6.3 Professionalism in designing air system of central air-conditioning system</p> <ul style="list-style-type: none"> ◆ Lead a team to perform innovative tasks of designing air system of central air-conditioning system ◆ Perform tasks of designing air system of central air-conditioning system according to legal requirements and codes of practice
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to use specialized and innovative techniques to complete tasks of designing air system of central air-conditioning system ; and</p> <p>(ii) Capable to communicate with the sector and clients on issues relevant to the designing of air system of central air-conditioning system.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of central air-conditioning systems.</p>

1. Title	Design water systems of central air-conditioning system	
2. Code	EMACDE502A	
3. Range	Apply specialized knowledge of air-conditioning and refrigeration in analyzing, organizing and evaluating a wide of range of information, data analysis and innovative ideas, at design studios, to perform tasks of designing water systems of central air-conditioning system.	
4. Level	5	
5. Credit	12	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of designing water systems of central air-conditioning system</p> <ul style="list-style-type: none"> ◆ Understand the zoning of water systems of central air-conditioning system and its characteristics ◆ Understand the working principles of characteristics of different types of chilled water systems ◆ Understand the working principles of different types of cooling water systems <p>6.2 Methods and procedures of designing water systems of central air-conditioning system</p> <ul style="list-style-type: none"> ◆ Decide the zoning of the chilled water system of central air-conditioning system according to building environment and design requirements ◆ Design the central air-conditioning chilled water system , including: <ul style="list-style-type: none"> • Calculating the operating parameters of chilled water system • Deciding the dimensions of chilled water piping ◆ Design the condensing water system of central air-conditioning system, including: <ul style="list-style-type: none"> • Calculating the operating parameters of the condensing water system • Deciding the equipment specifications for the cooling tower and condensing water system ◆ Design a condensate water discharge system, including: <ul style="list-style-type: none"> • Calculating the condensate water volume of the air-handling equipment • Calculating the condensate drain pipe diameter ◆ Select water pumps and other water system equipment, including: <ul style="list-style-type: none"> • Calculating the resistance of the chilled water system • Designing the chilled water piping layout that has the least pressure loss • Deciding the chilled water pump specifications • Deciding the specifications of the expansion tank and other equipment 	

	6.3 Professionalism in designing water systems of central air-conditioning system	◆ Design water systems of central air-conditioning system according to legal requirements, codes of practice and the design guidelines
7. Assessment Criteria	The integrated outcome requirements of this unit of competency are: (i) Capable to apply specialized and innovative techniques to complete tasks of designing water systems of central air-conditioning system; and (ii) Capable to communicate with the sector and clients on issues relevant to the design of water systems of central air-conditioning system.	
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of water systems of central air-conditioning system.	

1. Title	Design chiller plant machine room
2. Code	EMACDE503A
3. Range	Apply highly specialized technical research and scholastic skills, and make complex information analysis, planning and judgement, so as to carry out tasks of designing chiller plant machine rooms at design studios.
4. Level	5
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 knowledge of chiller plant machine room design</p> <ul style="list-style-type: none"> ◆ Understand the principles and general requirements for chiller plant machine room design and layout <p>6.2 Methods and procedures of designing chiller plant machine room</p> <ul style="list-style-type: none"> ◆ Choose the location of chiller plant machine room, including: <ul style="list-style-type: none"> • Calculating the capacity of refrigeration equipment • Deciding the type of refrigerant • Deciding the type of refrigeration system (direct cooling type or indirect cooling type) • Deciding the number of chiller plants • Choose suitable location of the chiller plant machine room according to the limitation of the building environment, the operating requirements and the impact on environment ◆ Design the system layout for the chiller plant machine room according to the requirements on operation and repair, saving of pipeline and the impact on environment <p>6.3 Professionalism in designing chiller plant machine room</p> <ul style="list-style-type: none"> ◆ Perform tasks of designing chiller plant machine rooms according to legal requirements and codes of practice
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply highly specialized technical research and scholastic skills, and make complex information analysis, planning, design and judgement, so as to complete tasks of designing chiller plant machine rooms.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of air-conditioning and refrigeration systems.

1. Title	Prepare documents for air-conditioning and refrigeration system testing and commissioning	
2. Code	EMACIT501A	
3. Range	Command wide ranging, specialized technical, analytical and creative skills to prepare documents, at office, for air-conditioning and refrigeration system testing and commissioning.	
4. Level	5	
5. Credit	12	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of preparing documents for air-conditioning and refrigeration system testing and commissioning</p> <ul style="list-style-type: none"> ◆ Understand the details, procedures and importance of air-conditioning and refrigeration system testing and commissioning ◆ Understand the details and importance of the documents of air-conditioning and refrigeration system testing and commissioning ◆ Understand the typical standards and requirements for air-conditioning and refrigeration system testing and commissioning <p>6.2 Methods and procedures of preparing documents for air-conditioning and refrigeration system testing and commissioning</p> <ul style="list-style-type: none"> ◆ Compile the procedures of air-conditioning and refrigeration system testing and commissioning , including: <ul style="list-style-type: none"> • Overall situation of the air-conditioning and refrigeration system project • Procedures of air-conditioning and refrigeration system testing and commissioning • Methods and procedures for major testing and commissioning items ◆ Prepare schedule for air-conditioning and refrigeration system testing and commissioning, including: <ul style="list-style-type: none"> • Drawing a testing and commissioning flow chart for the air-conditioning and refrigeration system according to the testing and commissioning procedures • Preparing the schedule for air-conditioning and refrigeration system testing and commissioning ◆ Prepare an air-conditioning and refrigeration system testing and commissioning report, including: <ul style="list-style-type: none"> • Assessing whether the system functions normally according to the system testing data • Assessing whether the system meets the design requirements according to the system testing data • Preparing the air-conditioning and refrigeration system testing and commissioning report 	

	<p>6.3 Professionalism in preparing documents for air-conditioning and refrigeration system testing and commissioning</p> <ul style="list-style-type: none"> ◆ Lead a group of staff, and command wide ranging, specialized technical, analytical and creative skills, to prepare documents for air-conditioning and refrigeration system testing and commissioning ◆ Understand the legal requirements and code of practice to undertake tasks of preparing documents for air-conditioning and refrigeration system testing and commissioning
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to lead a group of staff to complete the preparation of documents for air-conditioning and refrigeration system testing and commissioning.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of air-conditioning and refrigeration system testing and commissioning.</p>

1. Title	Test overall performance of central air-conditioning systems	
2. Code	EMACIT502A	
3. Range	Apply a wide range of technical and specialized skills to test and analyze the overall performance of central air-conditioning systems at central air-conditioning systems operation sites or their machine rooms.	
4. Level	5	
5. Credit	12	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of testing overall performance of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Understand the details, procedures and importance of testing the overall performance of central air-conditioning systems ◆ Understand the typical standards for testing the overall performance of central air-conditioning and refrigeration systems <p>6.2 Methods and procedures of testing overall performance of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Make preparations for testing the overall performance of central air-conditioning systems, including: <ul style="list-style-type: none"> • Coordinating with other working units to compile the plans and programmes for testing the overall performance of central air-conditioning systems • Preparing appropriate testing instruments according to testing requirements • Choosing suitable points for testing ◆ Test the overall performance of central air-conditioning systems, including: <ul style="list-style-type: none"> • Checking whether all central air-conditioning system equipment run properly • Measuring the operating parameters of indoor air • Measuring the operating parameters of all central air-conditioning system equipment • Analyzing and adjusting all central air-conditioning system equipment so that the operating parameters vary within the allowable scope of variation ◆ Analyze the overall performance data of central air-conditioning systems, including: <ul style="list-style-type: none"> • Consolidate the data to compile engineering charts • Appraising the overall performance of the central air-conditioning systems according to the engineering charts to see if the performance meets the design requirements 	

	<p>6.3 Professionalism in testing overall performance of central air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Lead a team and command wide ranging, technical, specialized, analytical and creative skills to conduct testing on the overall performance of central air-conditioning systems ◆ Understand the legal requirements and code of practice so as to undertake the testing of overall performance of central air-conditioning systems
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <ul style="list-style-type: none"> (i) Capable to lead a team to complete the testing of overall performance of central air-conditioning systems; and (ii) Capable to analyze the overall performance data of central air-conditioning systems to see if the performance meets the design requirements.
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of central air-conditioning system operation.</p>

1. Title	Assess indoor air quality
2. Code	EMACOR501A
3. Range	Apply a wide range of technical and professional knowledge and skills, and make various information analyses, to perform indoor air quality assessment at air-conditioned areas.
4. Level	5
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of indoor air quality assessment</p> <ul style="list-style-type: none"> ◆ Understand the details of indoor air pollution hazard assessment, including: <ul style="list-style-type: none"> • Hazard evaluation • Dose-response relationship assessment • Exposure assessment • Dangerous symptom analysis ◆ Understand the procedures of formulating indoor air quality standards ◆ Understand the details and characteristics of indoor air standards <p>6.2 Methods and procedures of indoor air quality assessment</p> <ul style="list-style-type: none"> ◆ Assess indoor air quality , including: <ul style="list-style-type: none"> • Formulating work plan for indoor air quality assessment • Conducting quality control for the indoor air quality assessment • Monitoring the whole process of measuring indoor air quality parameters • Assessing indoor air quality parameters to see if they conform to the indoor air quality objectives ◆ Suggest ways to improve indoor air quality parameters that are below standard <p>6.3 Professionalism in indoor air quality assessment</p> <ul style="list-style-type: none"> ◆ Perform indoor air quality assessment according to legal requirements, code of practice and guidelines
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to apply a wide range of technical and professional knowledge and skills, and make various information analyses, to complete indoor air quality assessment and make recommendations on improvement; and</p> <p>(ii) Capable to explain the indoor air quality issues to the sector and clients.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of indoor air quality.

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"> ◆ Understand the principles and techniques of electrical and mechanical engineering project management, including the formulation of project procedures, schedule, contingency plan and review mechanism <p>6.2 Formulate procedures, schedule, contingency plans and review mechanism for electrical and mechanical projects</p> <ul style="list-style-type: none"> ◆ Draft project procedures <ul style="list-style-type: none"> • Confirm the project specifications, scope and targets according to the contract and related information • Analyze the work breakdown structure and organisational breakdown structure • 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 ◆ Formulate project schedule <ul style="list-style-type: none"> • 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"> ▸ Critical path and flow chart ▸ Arrangements of equipment, materials and parts ▸ Arrangements of human resources ◆ Formulate contingency mechanism and review mechanisms <ul style="list-style-type: none"> • Conduct risk assessment for the projects and formulate contingency mechanism ◆ Formulate review mechanism for the project to ensure that targets of the project be achieved
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	Check engineering drawings and documents of air-conditioning and ventilation systems for Fire Services Department's approval	
2. Code	EMACPM501A	
3. Range	Check engineering drawings and documents of air-conditioning and ventilation systems, at design studios or project management office, for Fire Services Department's approval.	
4. Level	5	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of Fire Services Department's and legal requirements on air-conditioning and ventilation</p> <ul style="list-style-type: none"> ◆ Understand the system of registered specialist contractor (ventilation works category), including: <ul style="list-style-type: none"> • Purpose of the registered specialist contractor system • Responsibilities of the appointed person • Responsibilities of the technical director ◆ Understand the legal requirements on air-conditioning and ventilation engineering, including: <ul style="list-style-type: none"> • Requirements on ventilation systems stipulated in chapter 123 of the Laws of Hong Kong • Requirements on ventilation systems stipulated in Buildings (Ventilation Systems) Regulations • Requirements on ventilation systems stipulated in relevant ordinances, codes of practice and circular memorandums of the Fire Services Department • Requirements of the Food and Environmental Hygiene Department and Home Affairs Department on ventilation systems stipulated in chapter 123 of the Laws of Hong Kong and relevant regulations <p>6.2 Methods and procedures of checking engineering drawings and documents of air-conditioning and ventilation systems for Fire Services Department's approval</p> <ul style="list-style-type: none"> ◆ Check the engineering drawings and documents of the air-conditioning and ventilation system to see if they are correct and meet the requirements of the Fire Services Department in order to submit for the Department's approval ◆ Inspect and test the air-conditioning and ventilation system, including : <ul style="list-style-type: none"> • Inspecting the air-conditioning and ventilation system according to the requirements of the Fire Services Department • Testing the air-conditioning and ventilation system according to the requirements of the Fire Services Department • Confirming that the air-conditioning and ventilation system meets the requirements of the Fire Services Department 	

	<p>6.3 Professionalism in checking engineering drawings and documents of air-conditioning and ventilation systems for Fire Services Department's approval</p> <p>◆ Understand the legal requirements and code of practice, analyze and evaluate a wide range of information, and check the engineering drawings and documents of air-conditioning and ventilation systems for Fire Services Department's approval</p>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to check systematically and efficiently the engineering drawings and documents of air-conditioning and ventilation systems to see if they meet the requirements of the Fire Services Department and to submit to the Department for approval.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of ventilation system and relevant legislations.</p>

1. Title	Perform management for air-conditioning and refrigeration project tender bids	
2. Code	EMACPM502A	
3. Range	Apply a wide range of technical and professional knowledge and skills, at air-conditioning and refrigeration project management office, in the management of air-conditioning and refrigeration project tender bids.	
4. Level	5	
5. Credit	15	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of managing air-conditioning and refrigeration project tender bids</p> <ul style="list-style-type: none"> ◆ Understand the details and characteristics of air-conditioning and refrigeration project tender invitations and bids, including: <ul style="list-style-type: none"> • Content of tender invitations and bids • Characteristics of tender invitations and bids • Procedures of general engineering tender invitations and bids <p>6.2 Methods and procedures of managing air-conditioning and refrigeration project tender bids</p> <ul style="list-style-type: none"> ◆ Carry out project planning in bidding air-conditioning and refrigeration project tenders, including: <ul style="list-style-type: none"> • Setting goals for tender planning • Formulating resources arrangement and organizational structure for air-conditioning and refrigeration project according to the goals for tender planning ◆ Conduct tender price evaluation, including: <ul style="list-style-type: none"> • Formulating the costing of the air-conditioning and refrigeration project according to contract conditions • Submitting counter-proposals to reduce the project price or raise the quality ◆ Determine the lump sum for a tender bid, including: <ul style="list-style-type: none"> • Conducting air-conditioning and refrigeration engineering market price analysis • Analyzing the accuracy of cost evaluation • Considering all factors to determine the lump sum for a tender bid <p>6.3 Professionalism in managing air-conditioning and refrigeration project tender bids</p> <ul style="list-style-type: none"> ◆ Perform management for air-conditioning and refrigeration project tender bids according to legal requirements and codes of practice 	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: (i) Capable to apply a wide range of technical and professional knowledge and skills and analyze all kinds of information so as to complete the management tasks for the air-conditioning and refrigeration project tender bid.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of air-conditioning and refrigeration system and engineering project management.

1. Title	Perform cost management for an air-conditioning and refrigeration project	
2. Code	EMACPM503A	
3. Range	Apply a wide range of technical and professional knowledge and skills so as to perform cost management for an air-conditioning and refrigeration project at project management office.	
4. Level	5	
5. Credit	15	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of cost management for air-conditioning and refrigeration project</p> <ul style="list-style-type: none"> ◆ Understand the details of project cost management, including: <ul style="list-style-type: none"> • Functions, principles and the details of project cost management • Importance of project cost management <p>6.2 Methods and procedures of cost management for air-conditioning and refrigeration project</p> <ul style="list-style-type: none"> ◆ Formulate resources plan for the air-conditioning and refrigeration project according to project documents and information ◆ Audit the costing of the air-conditioning and refrigeration project, including: <ul style="list-style-type: none"> • Accuracy of costing • Inclusion of any other additional costs in the costing due to other factors ◆ Control the costs of the air-conditioning and refrigeration project, including: <ul style="list-style-type: none"> • Implementing cost control at the decision-making stage of project investment • Implementing cost control at the stage of project design • Implementing cost control at the stage of calling for or bidding tender • Implementing cost control at the working stage • Implementing cost control at the stage of completion of project <p>6.3 Professionalism in managing air-conditioning and refrigeration project costs</p> <ul style="list-style-type: none"> ◆ Perform cost management for a air-conditioning and refrigeration project according to legal requirements and codes of practice 	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: (i) Capable to apply a wide range of technical and professional knowledge and skills and analyze all kinds of information so as to complete the cost management tasks for the air-conditioning and refrigeration project.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of air-conditioning and refrigeration system and engineering project management.

1. Title	Perform risk assessment for air-conditioning and refrigeration projects
2. Code	EMACPM504A
3. Range	Apply a wide range of technical and professional knowledge and skills, and analyze, reformat and evaluate all kinds of information so as to perform risk assessment for air-conditioning and refrigeration projects at project management office.
4. Level	5
5. Credit	12
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of risk assessment for air-conditioning and refrigeration project</p> <ul style="list-style-type: none"> ◆ Understand the concept of engineering project risk assessment, including: <ul style="list-style-type: none"> • Definition of risk • Factors of project risks • Causes of project risks • Characteristics of project risks ◆ Understand the classification of engineering project risks ◆ Understand the meaning of risk assessment ◆ Understand the details of risk assessment for air-conditioning and refrigeration project <p>6.2 Risk assessment methods and procedures for air-conditioning and refrigeration project</p> <ul style="list-style-type: none"> ◆ Identify air-conditioning and refrigeration project risks <ul style="list-style-type: none"> • Determining the source of air-conditioning and refrigeration project risks • Determining the conditions for air-conditioning and refrigeration project risks to occur • Determining the characteristics and impact of the air-conditioning and refrigeration project ◆ Apply risk assessment tools and methods in air-conditioning and refrigeration project risk assessment <p>6.3 Professionalism in risk assessment of air-conditioning and refrigeration project</p> <ul style="list-style-type: none"> ◆ Perform risk assessment for air-conditioning and refrigeration projects according to legal requirements and codes of practice
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply a wide range of technical and professional knowledge and skills, and analyze, reformat and evaluate all kinds of information so as to complete risk assessment tasks for air-conditioning and refrigeration projects.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of air-conditioning and refrigeration project management.

1. Title	Perform quality management for air-conditioning and refrigeration projects
2. Code	EMACPM505A
3. Range	Apply a wide range of technical and professional knowledge and skills, and carry out project planning, design and control at project management office or work sites, so as to perform quality management for air-conditioning and refrigeration projects.
4. Level	5
5. Credit	12
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of quality management for air-conditioning and refrigeration project</p> <ul style="list-style-type: none"> ◆ Understand the concept of project quality management, including: <ul style="list-style-type: none"> • Definition, process, purpose and details of project quality management • Relationship between quality management and project management ◆ Understand the purpose and details of project control ◆ Understand the purpose and details of project quality audit <p>6.2 Quality management methods and procedures for air-conditioning and refrigeration project</p> <ul style="list-style-type: none"> ◆ Formulate a quality scheme for the air-conditioning and refrigeration project, including: <ul style="list-style-type: none"> • Determining the quality target, scope and quality standards of the air-conditioning and refrigeration project • Using commonly used tools (e.g. costs—profits analysis, benchmarking or flow chart) to formulate a quality scheme for the air-conditioning and refrigeration project ◆ Implement quality assurance for the air-conditioning and refrigeration project, including: <ul style="list-style-type: none"> • Determining the quality standards of the air-conditioning and refrigeration project • Formulating the work flow of quality control • Evaluating the quality system of the air-conditioning and refrigeration project ◆ Implement air-conditioning and refrigeration project quality control, including: <ul style="list-style-type: none"> • Determining the factors affecting the air-conditioning and refrigeration • Using quality control methods to control the quality of the project

	<ul style="list-style-type: none"> ◆ Conduct quality audit for the air-conditioning and refrigeration project, including: <ul style="list-style-type: none"> • Carrying out preparations for air-conditioning and refrigeration project quality audit • Conducting the quality audit • Submitting the quality deviations report • Following up the implementation of remedial actions ◆ Perform quality management for air-conditioning and refrigeration projects according to legal requirements and codes of practice <p>6.3 Professionalism in quality management for air-conditioning and refrigeration project</p>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply a wide range of technical and professional knowledge and skills, and carry out project planning, design and control at project management office or work sites, so as to complete quality management tasks for air-conditioning and refrigeration projects.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of air-conditioning and refrigeration system and project management.</p>

1. Title	Conduct feasibility studies for air-conditioning and refrigeration projects
2. Code	EMACPM506A
3. Range	Apply a wide range of technical and professional knowledge and skills, and analyze, reformat and evaluate all kinds of information so as to conduct feasibility studies for air-conditioning and refrigeration projects at project management office.
4. Level	5
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of feasibility study for air-conditioning and refrigeration project</p> <ul style="list-style-type: none"> ◆ Understand the concept of feasibility study for air-conditioning and refrigeration project, including: <ul style="list-style-type: none"> • Functions and importance of project feasibility study • Procedures and details of project feasibility study <p>6.2 Methods and procedures for feasibility study of air-conditioning and refrigeration project</p> <ul style="list-style-type: none"> ◆ Conduct feasibility study of a air-conditioning and refrigeration project, including: <ul style="list-style-type: none"> • Collecting information, put forward suggestions and draft a feasibility study report • Compiling the air-conditioning and refrigeration feasibility study report <p>6.3 Professionalism in feasibility study for air-conditioning and refrigeration project</p> <ul style="list-style-type: none"> ◆ Conduct air-conditioning and refrigeration project feasibility study according to legal requirements and codes of practice
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply a wide range of technical and professional knowledge and skills, and analyze, reformat and evaluate all kinds of information so as to complete the feasibility study for air-conditioning and refrigeration project.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of air-conditioning and refrigeration system and project management.

1. Title	Perform completion commissioning management for air-conditioning and refrigeration projects	
2. Code	EMACPM507A	
3. Range	Apply a wide range of technical and professional knowledge and skills, and carry out project planning, design and control at project management office or work sites, so as to perform completion commissioning management for air-conditioning and refrigeration projects.	
4. Level	5	
5. Credit	12	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of completion commissioning management for air-conditioning and refrigeration project</p> <ul style="list-style-type: none"> ◆ Understand the details of project completion commissioning, including: <ul style="list-style-type: none"> • Commissioning details of technical data of project • Commissioning details of integrated data of project • Commissioning details of financial data of project • Commissioning details of installation work of project <p>6.2 Methods and procedures for completion commissioning management of air-conditioning and refrigeration project</p> <ul style="list-style-type: none"> ◆ Check and ratify the completion quality of the air-conditioning and refrigeration project according to design specifications and contract requirements ◆ Make preparations for completion commissioning of the air-conditioning and refrigeration project, including: <ul style="list-style-type: none"> • Formulate a completion commissioning plan for the air-conditioning and refrigeration project • Consolidate technical data for the commissioning of the air-conditioning and refrigeration project • Set up a commissioning unit for the air-conditioning and refrigeration project ◆ Carry out air-conditioning and refrigeration project completion commissioning , including: <ul style="list-style-type: none"> • Organizing the filing of air-conditioning and refrigeration project contract documents • Carrying out air-conditioning and refrigeration project completion commissioning • Organizing tasks for completion of air-conditioning and refrigeration project contract 	

	<p>6.3 Professionalism in completion commissioning management for air-conditioning and refrigeration project</p> <ul style="list-style-type: none"> ◆ Perform completion commissioning management for air-conditioning and refrigeration projects according to legal requirements and codes of practice
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply a wide range of technical and professional knowledge and skills, and carry out project planning, design and control, so as to complete the completion commissioning management tasks for air-conditioning and refrigeration projects.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of air-conditioning and refrigeration system and project management.</p>

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"> ◆ Understand engineering operation management including: <ul style="list-style-type: none"> • Supervisory management techniques for projects • Management techniques for work site environment • Workflow of electrical works project <p>6.2 Implement engineering operation and supervisory management</p> <ul style="list-style-type: none"> ◆ 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. ◆ Implement engineering supervisory management such as analyzing and arranging works so that the project can complete in time ◆ Understand the tendering strategy and assist the company in project quotation and bidding tenders
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	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"> ◆ Understand different kinds of electrical and mechanical engineering risks such as: <ul style="list-style-type: none"> • Different kinds of potential hazards and risks caused by them • 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. • Other risk related factors such as occupational safety and health, management systems, Factories and Industrial Undertakings Ordinance, etc. • Risk control and risk management plans <p>6.2 Implement risk management for electrical and mechanical services</p> <ul style="list-style-type: none"> ◆ Identify potential hazards and their kinds (e.g. chemical hazards, electrical hazards, etc.), the chance of happening and the consequences ◆ Conduct risk assessment and analysis <ul style="list-style-type: none"> • Conduct risk assessment for the working procedure, work type, machinery and organization according to the chance of happening and the consequences of the hazard • Analyze the price for the accident and the advantages of safe operation • Consider comprehensively the aspects of occupational safety and health as well as environmental protection when conducting risk assessment ◆ Control and management risks <ul style="list-style-type: none"> • Formulate risk control levels based on risk assessment data • 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 ◆ Implement risk management for electrical and mechanical services according to the risk control and management plan 	

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"> ◆ Understand the operation of the occupational safety and health management system, including: <ul style="list-style-type: none"> • Goals of the management system • Monitoring mechanism • Training methods • Contingency measures • Review measures <p>6.2 Formulation of basic occupational safety and health management system</p> <ul style="list-style-type: none"> ◆ 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"> • Setting goals for the management system • Organizing management committee and setting its terms of reference • Establishing management system mechanism • Designing monitoring mechanism • Formulating training plans • Establishing work site contingency measures • Formulating review measures
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"> ◆ 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"> • Scheme targets • schedule • Effectiveness review • Manpower arrangement • Budget, etc. <p>6.2 Formulation of occupational safety and health and environmental protection scheme</p> <ul style="list-style-type: none"> ◆ 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"> • Collect opinions of staff on occupational safety and health and environmental protection management • Set the company's targets on occupational safety and health and environmental protection management • Identify the difference between the company's targets and staff awareness of occupational safety and health and environmental protection management ◆ Formulate plans to enhance staff's awareness of occupational safety and health and environmental protection management <ul style="list-style-type: none"> • 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. • Collect staff's opinions on safety, health and environmental improvement • Collect staff's opinions on the enhancement scheme • Use other organizations' successful experience in organizing activities to enhance staff's awareness of occupational safety and health and environmental protection 	

	<ul style="list-style-type: none"> • 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. • Manpower arrangement for the implementation of the scheme ◆ Review the effectiveness of the scheme <ul style="list-style-type: none"> • Ensure good communication during the implementation of the scheme • Measure and review the effectiveness of the scheme after implementation
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"> ◆ Understand the engineering work and environment according to engineering working guidelines and on-site observation ◆ Understand the potential risks and hazards according to the accident reports <p>6.2 Perform risk assessment</p> <ul style="list-style-type: none"> ◆ 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 ◆ Compile risk assessment reports for engineering procedures, including <ul style="list-style-type: none"> • Hazards and their identification • Risk assessment methods • Calculation and assessment of risks • Methods to reduce or eliminate risks • Conclusions and recommendations
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"> ◆ Understand the legal requirements on environmental protection, including the areas of emissions, waste water, noise, solid waste, chemical waste, etc. ◆ Understand the operation of a basic environmental protection management system, including: <ul style="list-style-type: none"> • Goals of the management system • Monitoring mechanism • Contingency measures • Review measures • ISO 14001, etc. <p>6.2 Formulation of basic environmental protection management system</p> <ul style="list-style-type: none"> ◆ Formulate a basic environmental protection management system according to the legal requirements on environmental protection, including the following: <ul style="list-style-type: none"> • Goals of the management system • Management system mechanism • Monitoring mechanism • Contingency measures • Review measures
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"> ◆ Understand the objectives and contents of general occupational safety and health and environmental protection courses and training ◆ Understand the characteristics and needs of training targets <p>6.2 Implementation of general occupational safety and health and environmental protection courses and training</p> <ul style="list-style-type: none"> ◆ Investigate the needs of training targets within the organization <ul style="list-style-type: none"> • 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. ◆ Implement occupational safety and health and environmental protection courses and training projects <ul style="list-style-type: none"> • Make relevant arrangements for enrolment and admission procedures, venue and duration for the course, teaching materials and aids, etc ◆ Enhance staff's safety awareness <ul style="list-style-type: none"> • 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

7. Assessment Criteria	The integrated outcome requirements of this unit of competency are: <ul style="list-style-type: none">(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	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"> ◆ Understand the electrical and mechanical engineering quality management concept and culture, including the 'Plan-Do-Check-Act' Quality Management Cycle <p>6.2 Formulate and implement quality management courses and training programmes</p> <ul style="list-style-type: none"> ◆ 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. ◆ Formulate the basic course on 'Plan-Do-Check-Act' Quality Management Cycle ◆ Formulate basic level quality management courses or training programmes ◆ Implement quality management courses or training programmes to enhance the staff's awareness of quality management, including: <ul style="list-style-type: none"> • Basic requirements and application of ISO 9000 quality management and quality assurance standards • Promoting quality management culture • Urging the staff to constantly review and improve the engineering process performance ◆ Review and improve the quality management courses regularly to enhance the effectiveness of staff training
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"> ◆ Understand the format and key points of quality assurance report on electrical and mechanical services <p>6.2 Formulate and analyze quality assurance reports</p> <ul style="list-style-type: none"> ◆ 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"> • Analyze all quality management issues and problems, formulate quality assurance reports and report to the management
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"> ◆ Understand the culture and targets of the organization in quality management <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"> ◆ Collect staff's understanding and opinions on quality management ◆ Identify the deviation between targets of the organization and staff's performance on quality management ◆ Analyze the quality management culture of the organization, and draft forms of enhancement measures, such as training courses, quiz competitions and seminars, etc. ◆ Collect staff's opinions on the enhancement scheme ◆ Implement Quality Circle activities ◆ 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. ◆ Measure and review the effectiveness of the scheme after implementation
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"> ◆ Understand quality management system, such as: <ul style="list-style-type: none"> • ISO 9000 • Total quality management • Quality circle • Business Process Re-engineering <p>6.2 Implement quality management courses</p> <ul style="list-style-type: none"> ◆ Set targets for the courses <ul style="list-style-type: none"> • Identify staff's training needs and formulate a training plan accordingly • Set targets for each course according to the training plan ◆ 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"> • Working procedure system • Working instruction system • Document control system ◆ Set the teaching mode of the quality management courses, including: <ul style="list-style-type: none"> • Lesson mode • Interactive mode • Workshop mode • Assessment mode ◆ Review the effectiveness of courses <ul style="list-style-type: none"> • Use questionnaires to collect opinions of the staff concerned • Check with the department-in-charge the progress of the staff concerned after receiving the training
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"> ◆ Understand ISO 9000 Quality Management and Quality Assurance Standard Series, including the quality assurance system and management mechanism <p>6.2 Implement ISO quality management standards</p> <ul style="list-style-type: none"> ◆ Implement ISO 9000 Quality Management and Quality Assurance Standard Series, including: <ul style="list-style-type: none"> • Quality management responsibilities of staff at different levels • Quality assurance system • Inspection mechanism • Document and information management mechanism • Procurement management mechanism • Work process audit mechanism • Improper works control and correction system • Quality record control system • Internal quality audit system
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	Carry out market analysis and forecast for air-conditioning and refrigeration equipment
2. Code	EMACMS501A
3. Range	Apply a broad range of technical and professional knowledge and skills to carry out market analysis and forecast for air-conditioning and refrigeration equipment in the office or work sites by analyzing, reformatting and evaluating all kinds of information.
4. Level	5
5. Credit	12
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 knowledge of market analysis and forecast</p> <ul style="list-style-type: none"> ◆ Understand the formulation of market research plan ◆ Understand the design of questionnaire ◆ Understand the organization of market research activities ◆ Understand customers' behaviour pattern and decision for buying air-conditioning and refrigeration equipment ◆ Understand the method of forecasting air-conditioning and refrigeration equipment sales <p>6.2 Methods and procedures of air-conditioning and refrigeration equipment market analysis and forecast</p> <ul style="list-style-type: none"> ◆ Organize market research for the air-conditioning and refrigeration equipment, including: <ul style="list-style-type: none"> • Formulating a plan for the market research • Conducting the market research • Compiling a report for the market research ◆ Carry out market analysis for the air-conditioning and refrigeration equipment, including: <ul style="list-style-type: none"> • Analyzing the opportunities and challenges brought to the company by the air-conditioning and refrigeration equipment sales market • Adopting appropriate sales strategy according to customer's buying behaviour and process ◆ Carry out market forecast for air-conditioning and refrigeration equipment, including: <ul style="list-style-type: none"> • Calculating the potential sales volume of the overall market and regional market of the air-conditioning and refrigeration equipment • Forecasting the market sales volume of the air-conditioning and refrigeration equipment

	<p>6.3 Professionalism in air-conditioning and refrigeration equipment market analysis and forecast</p> <ul style="list-style-type: none"> ◆ Carry out air-conditioning and refrigeration equipment market analysis and forecast according to the code of practice
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply a broad range of technical and professional knowledge and skills to complete market analysis and forecast for air-conditioning and refrigeration equipment by analyzing, reformatting and evaluating all kinds of information.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of air-conditioning and refrigeration system and sales.</p>

Competency Level 6

1. Title	Design silencing and vibration reduction measures for air-conditioning systems	
2. Code	EMACDE601A	
3. Range	Use highly specialized knowledge and innovative techniques, assess a wide range of information and design silencing and vibration reduction measures for different types of air-conditioning systems at design studios.	
4. Level	6	
5. Credit	12	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of silencing and vibration reduction design for air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Understand the noise sources of different types of air-conditioning equipment ◆ Understand different types of silencing design ◆ Understand different types of vibration reduction design <p>6.2 Methods and procedures of silencing and vibration reduction design for air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Determine the acceptable standard of indoor noise according to the functions and needs of the space, including: <ul style="list-style-type: none"> • Determining the acceptable standard of noise for general buildings (including residential premises, shopping malls, hospitals, schools and offices) according to relevant international standards • Determining the acceptable standard of noise for special buildings (such as recording studios and language laboratories) according to relevant international standards ◆ Determine the noise attenuation required by air-conditioning systems, including: <ul style="list-style-type: none"> • Selecting suitable air-conditioning systems according to noise control requirements • Calculating the sound pressure level of air-conditioning system equipment (including ventilation fans, motors and air-conditioning refrigeration units) • Calculating the overall sound pressure level of air-conditioning equipment • Calculating the natural noise attenuation of air-conditioning systems • Calculating the airflow noise of air-conditioning systems • Calculating the noise attenuation required by air-conditioning systems • Assessing whether the airflow noise from the supply air grilles of air-conditioning systems comply with design requirements 	

	<ul style="list-style-type: none">◆ Design silencers for air-conditioning systems, including:<ul style="list-style-type: none">• Selecting the suitable type of silencer and the required quantity according to design requirements and characteristics• Designing suitable silencers according to design requirements of air-conditioning systems• Determining the correct installation position for silencers◆ Design noise control methods for fan coil unit systems, including:<ul style="list-style-type: none">• Using noise assessment curve to analyze the noise range of fan coil units• Determining the installation position for fan coil units for maximized silencing• Selecting fan coil units of low noise emission◆ Design noise control methods for cooling towers, including:<ul style="list-style-type: none">• Calculating the noise range of cooling towers• Measuring and assess the noise emission of cooling towers• Determining the correct installation position for cooling towers so as to reduce the noise impact on the surroundings• Selecting cooling towers of low noise emission• Designing noise barriers to control the noise emission of cooling towers◆ Design methods to control noise emission from air-conditioning system rooms, including:<ul style="list-style-type: none">• Selecting the correct location for air-conditioning system rooms so as to reduce the noise impact on the surroundings• Designing noise barriers for the building enclosure of in air-conditioning system rooms• Designing noise absorption materials and structure to reduce noise emission from air-conditioning system rooms• Designing noise enclosures to reduce noise emission from air-conditioning system rooms◆ Design vibration reduction methods by the mounting foundation design of air-conditioning equipment, including:<ul style="list-style-type: none">• Determining the requirements for vibration reduction of air-conditioning equipment• Selecting suitable mounting foundation• Selecting suitable devices for vibration reduction• Formulating procedures for installation of vibration reduction devices
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	<ul style="list-style-type: none"> ◆ Design vibration reduction methods for the pipings of air-conditioning equipment, including: <ul style="list-style-type: none"> • Selecting suitable flexible tubes for air-conditioning equipment so that the duct vibration can comply with operation requirements • Designing air-conditioning ducts with vibration reduction structure and relevant installation methods so that the duct vibration can comply with operation requirements ◆ Understand legal requirements and codes of practice, analyze and assess a wide range of information and use highly specialized knowledge and techniques to design innovative silencing and vibration reduction measures for air-conditioning systems <p>6.3 Professionalism in handling silencing and vibration reduction design for air-conditioning systems</p>
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to design innovative silencing and vibration reduction measures for air-conditioning systems systematically and efficiently.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of air-conditioning systems, silencing and vibration reduction.</p>

1. Title	Select chiller plants
2. Code	EMACDE602A
3. Range	Apply highly specialized technical research and scholastic skills, and make complex information analysis, planning and judgement, so as to select chiller plant in design studios.
4. Level	6
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 knowledge of selecting chiller plant</p> <ul style="list-style-type: none"> ◆ Understand the characteristics and using requirements of various types of refrigeration compressors, including: <ul style="list-style-type: none"> • Reciprocating compressor • Screw compressor • Centrifugal compressor ◆ Understand the characteristics and using requirements of various types of condensers and evaporators ◆ Understand the characteristics and using requirements of metering devices and auxiliary equipment <p>6.2 Methods and procedures of selecting chiller plant</p> <ul style="list-style-type: none"> ◆ Confirm the thermodynamic data of refrigeration cycle, including: <ul style="list-style-type: none"> • Calculating the thermodynamic parameters of single stage compression cycle, two-stage compression cycle, multi-stage compression cycle • Confirming the type of compression cycle mode for the chiller • Selecting appropriate refrigerants • Calculating the thermodynamic parameters of practical compression refrigeration cycle (including the coefficient of performance C.O.P., capacity and power of compressor, heat load of evaporator and condenser, etc.) ◆ Select appropriate compressor according to the refrigeration system requirements ◆ Select condensers and evaporators, including: <ul style="list-style-type: none"> • Selecting appropriate condenser according to the refrigeration system requirements • Selecting appropriate evaporator according to the refrigeration system requirements ◆ Select metering devices and auxiliary equipment, including: <ul style="list-style-type: none"> • Selecting appropriate metering devices according to the refrigeration system requirements • Selecting appropriate oil separator and heat exchanger according to the refrigeration system requirements • Selecting appropriate auxiliary equipment according to the refrigeration system requirements

	6.3 Professionalism in selecting chiller plant	◆ Select chiller plant according to legal requirements and codes of practice
7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: (i) Capable to apply highly specialized technical research and scholastic skills, and make complex information analysis, planning and judgement, so as to complete the task of selecting chiller plant.	
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of air-conditioning and refrigeration systems.	

1. Title	Select air-handling equipment
2. Code	EMACDE603A
3. Range	Apply highly specialized techniques and knowledge and make complex data analysis, planning, design and judgement, at design studios, so as to select air-handling equipment.
4. Level	6
5. Credit	12
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of selecting air-handling equipment</p> <ul style="list-style-type: none"> ◆ Understand the construction, characteristics and application range of horizontal, suspended and packaged types of air-handling units ◆ Understand the construction , characteristics and application range of fan coil units ◆ Understand the classification, characteristics and application range of air filters ◆ Understand the construction , characteristics and application range of different types of air purifiers <p>6.2 Methods and procedures of selecting air-handling equipment</p> <ul style="list-style-type: none"> ◆ Select air-handling equipment, including: <ul style="list-style-type: none"> • Determine the type and arrangement of air-handling unit according to uses and building conditions • Determine the type and arrangement of fan coil unit, and its intake of fresh air according to uses and building conditions ◆ Perform audit checks for the surface air cooler of the selected air-conditioning plant to ensure that the unit plant the design requirements ◆ Select suitable air filters according to use requirements ◆ Select suitable air purifiers according to use requirements <p>6.3 Professionalism in selecting air-handling equipment</p> <ul style="list-style-type: none"> ◆ Select air-handling equipment according to legal requirements and codes of practice
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to use highly specialized techniques and academic skills and make complex data analysis, planning, designing and judgement so as to select suitable air-handling equipment.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of air-conditioning and refrigeration.

1. Title	Design smoke prevention, smoke extraction, staircase pressurization and VAC systems for buildings
2. Code	EMACDE604A
3. Range	Use highly specialized knowledge and innovative skills, at design studios, and assess a wide range of information, so as to design different types of smoke prevention, smoke extraction, staircase pressurization and VAC systems for buildings.
4. Level	6
5. Credit	12
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of designing smoke prevention, smoke extraction, staircase pressurization and VAC systems for buildings</p> <ul style="list-style-type: none"> ◆ Understand the design requirements of smoke prevention, smoke extraction, staircase pressurization and VAC systems, including: <ul style="list-style-type: none"> • Explaining the concept of fire prevention zones and smoke prevention zones in high-rise buildings • Explaining the importance and classification of smoke prevention, smoke extraction, staircase pressurization and VAC systems in high-rise buildings • Explaining the design requirements of static smoke extraction systems • Explaining the design requirements of dynamic smoke extraction systems • Explaining the design requirements for smoke extraction through the atrium of a high-rise building • Explaining the design requirements of staircase pressurization systems • Explaining the design requirements of smoke prevention and smoke extraction systems in super high-rise buildings • Explaining the design requirements of VAC systems ◆ Analyze regulations, international standards and strategies relevant to smoke prevention, smoke extraction, staircase pressurization and VAC systems ◆ Analyze whether the smoke prevention, smoke extraction, staircase pressurization and VAC system in a high-rise building comply with legal requirements ◆ Analyze whether the smoke prevention, smoke extraction, staircase pressurization and VAC system in a high-rise building comply with safety and economical requirements

	<p>6.2 Methods and procedures of designing smoke prevention, smoke extraction, staircase pressurization and VAC systems for buildings</p> <ul style="list-style-type: none"> ◆ Design smoke prevention, smoke extraction, staircase pressurization and VAC systems for high-rise buildings according to the requirements of the Fire Services Department ◆ Formulate and assess the design requirements of smoke prevention, smoke extraction, staircase pressurization and VAC systems for high-rise buildings, including: <ul style="list-style-type: none"> • Determining the design requirements of smoke prevention, smoke extraction, staircase pressurization and VAC systems for high-rise buildings • Assessing whether the smoke prevention, smoke extraction, staircase pressurization and VAC systems and equipment in a high-rise building comply with legal, safety and economical requirements ◆ Formulate and assess the technical specifications of smoke prevention, smoke extraction, staircase pressurization and VAC systems ◆ Formulate and assess the technical requirements for testing and repairing smoke prevention, smoke extraction, staircase pressurization and VAC systems <p>6.3 Professionalism in designing smoke prevention, smoke extraction, staircase pressurization and VAC systems for buildings</p> <ul style="list-style-type: none"> ◆ Understand legal requirements and codes of practice, analyze and assess different types of information and use highly specialized knowledge and techniques to design innovative smoke prevention, smoke extraction, staircase pressurization and VAC systems for buildings
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to design innovative, practical and economical smoke prevention, smoke extraction, staircase pressurization and VAC systems for buildings systematically and effectively.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of smoke prevention, smoke extraction, staircase pressurization and VAC systems for buildings.</p>

1. Title	Design refrigeration systems for the cold storage	
2. Code	EMACDE605A	
3. Range	Use highly specialized techniques and academic skills at design studios and perform tasks of designing refrigeration systems for the cold storage through complex data analysis, planning, design and judgement.	
4. Level	6	
5. Credit	12	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of designing refrigeration systems for the cold storage</p> <ul style="list-style-type: none"> ◆ Understand the design details of the refrigeration system for the cold storage ◆ Understand the criteria for selection of the refrigeration compressor for the cold storage ◆ Understand the criteria for selection of auxiliary equipment for the refrigeration system of the cold storage ◆ Understand the criteria for selection of the cooling equipment and condenser for the cooling spaces <p>6.2 Methods and procedures of designing refrigeration systems for the cold storage</p> <ul style="list-style-type: none"> ◆ Calculate the cooling load of the cold storage, including: <ul style="list-style-type: none"> • Identifying the indoor and outdoor temperature and relative humidity • Calculating the cooling capacity and storage capacity of the cold storage • Calculating the heat load of the cooling spaces • Calculating the cooling equipment load and mechanical load • Estimating the cooling load of the cold storage according to empirical data ◆ Select the type of refrigeration system, compressor and auxiliary equipment, including: <ul style="list-style-type: none"> • Determining major operating parameters for the refrigeration system • Selecting the type of refrigeration system • Determining the type of compressor • Selecting suitable refrigeration compressors • Selecting suitable motors and auxiliary equipment 	

	<ul style="list-style-type: none"> ◆ Select cooling equipment and refrigerators for the cooling spaces including: <ul style="list-style-type: none"> • Determining the type of cooling equipment • Calculating the cooling area covered by the cooling equipment • Selecting suitable cooling equipment • Selecting suitable condensers ◆ Design the defrost system for the cooling equipment of the cooling spaces, including: <ul style="list-style-type: none"> • Determining the type of defrost system according to design requirements • Designing the defrost system ◆ Design the refrigeration pipe, including: <ul style="list-style-type: none"> • Determining the diameter of the refrigeration pipe • Designing the arrangement of the ammonia pipe • Designing the arrangement of the fluorine pipe • Determining the installation specifications of pipe support • Determining the specifications of insulation materials for the pipe ◆ Design the automatic control system and safety protection system for the refrigeration system <p>6.3 Professionalism in handling refrigeration systems for the cold storage</p> <ul style="list-style-type: none"> ◆ Perform tasks of designing refrigeration systems for the cold storage according to legal requirements and codes of practice
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to use highly specialized techniques and academic skills to complete tasks of designing refrigeration systems for the cold storage through complex data analysis, planning, designing and judgement.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of cold storage and refrigeration systems.</p>

1. Title	Design ventilation systems	
2. Code	EMACDE606A	
3. Range	Apply highly specialized technical research and scholastic skills, and make complex information analysis, planning and judgement, so as to perform tasks of designing ventilation systems in design studios.	
4. Level	6	
5. Credit	12	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 knowledge of ventilation system design</p> <ul style="list-style-type: none"> ◆ Understand the working principles and selection criteria of total ventilation systems ◆ Understand the working principles and selection criteria of spot ventilation systems ◆ Understand the working principles, characteristics and application range of various types of air-purifying equipment <p>6.2 Methods and procedures of ventilation system design</p> <ul style="list-style-type: none"> ◆ Design total ventilation systems, including: <ul style="list-style-type: none"> • Calculating amount of air change for total ventilation • Designing replacement ventilation systems • Designing accident ventilation systems • Designing tunnel ventilation systems ◆ Design compound-type (hybrid/mixed mode) ventilation systems ◆ Design spot ventilation systems, including: <ul style="list-style-type: none"> • Spot air delivery system • Spot air exhausting system • Air exhausting cowl ◆ Use hi-tech simulation calculation method / software for professional evaluation, analysis and design of ventilation systems ◆ Select appropriate air-purifying equipment (including dust extractor and harmful gas purifier) so as to meet the design requirements ◆ Design ventilation ducts, including: <ul style="list-style-type: none"> • Determining the configuration of air ducts and accessories • Determining the diameter and size of air ducts • Calculating the energy loss for air flow inside the air duct • Selecting appropriate air-handling unit and motor • Evaluating the ventilation duct system according to the design requirements, operation requirements and economical requirements 	

	6.3 Professionalism in ventilation system design	◆ Perform tasks of designing ventilation systems according to legal requirements and codes of practice
7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: (i) Capable to apply highly specialized technical research and scholastic skills, and make complex information analysis, planning and judgement, so as to complete the design of ventilation systems	
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of ventilation systems.	

1. Title	Formulate indoor air quality improvements
2. Code	EMACOR601A
3. Range	Use complex planning, technical and management functions, in the absence of information, to formulate indoor air quality improvements at air-conditioned areas.
4. Level	6
5. Credit	12
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of indoor air quality management</p> <ul style="list-style-type: none"> ◆ Understand the details of indoor air quality management ◆ Understand the strategies and procedures of indoor air quality management ◆ Understand the knowledge of indoor air quality improvements <p>6.2 Formulate indoor air quality improvements</p> <ul style="list-style-type: none"> ◆ Formulate measures to improve indoor air quality, including: <ul style="list-style-type: none"> • Formulate measures to improve indoor air quality according to relevant regulations and guidelines in Hong Kong as well as codes of practice and guidelines adopted internationally • Prepare indoor air quality management plan ◆ formulate indoor air quality management strategies, including: <ul style="list-style-type: none"> • Comparing the advantages and disadvantages of typical ways for indoor air quality improvements • Identifying potential indoor air quality problems in the stage of building design • Formulating indoor air quality management strategies with reference to the environment factor of the building, legal and users' requirements ◆ Monitor the implementation of the indoor air quality management strategies, including: <ul style="list-style-type: none"> • Assessing the effectiveness of indoor air quality management ◆ Modify the management, plan and strategies of indoor air quality according to the effectiveness of indoor air quality management in order to enhance the indoor air quality standard <p>6.3 Professionalism in indoor air management</p> <ul style="list-style-type: none"> ◆ Perform indoor air quality management according to legal requirements and codes of practice
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <p>(i) Capable to use the ability of complex planning, technical and management to formulate indoor air quality improvements; and</p> <p>(ii) Capable to formulate indoor air quality management strategies and assess their effectiveness.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of indoor air quality.

1. Title	Manage the operation, repair and maintenance of air-conditioning and refrigeration systems
2. Code	EMACOR602A
3. Range	Apply complicated planning, technical and management functions to manage the operation, repair and maintenance of air-conditioning and refrigeration systems at air-conditioning and refrigeration system sites through information analysis and evaluation.
4. Level	6
5. Credit	12
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of managing the operation, repair and maintenance of air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Understand the effectiveness, details, common problems and solutions of managing the operation, repair and maintenance of air-conditioning and refrigeration systems ◆ Understand the effectiveness of typical tools for managing the operation, repair and maintenance of air-conditioning and refrigeration systems ◆ Understand the characteristics of urgent repair and regular maintenance <p>6.2 Methods and procedures of managing the operation, repair and maintenance of air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Develop the strategies for the operation, repair and maintenance of air-conditioning and refrigeration systems, including: <ul style="list-style-type: none"> • Formulating the mission statement for the operation, repair and maintenance of air-conditioning and refrigeration systems • Formulating the needs for the operation, repair and maintenance of air-conditioning and refrigeration systems according to the mission statement • Determining the resources required for the operation, repair and maintenance of air-conditioning and refrigeration systems • Managing the required resources • Analyze the advantages and disadvantages of different strategies for operation, repair and maintenance and select the most appropriate strategy ◆ Formulate the mechanism for the operation, repair and maintenance of air-conditioning and refrigeration systems, including: <ul style="list-style-type: none"> • Formulating the staff organisation for operation, repair and maintenance • Formulating the workflow for operation, repair and maintenance • Assessing the system for safe operation of air-conditioning and refrigeration equipment

	<ul style="list-style-type: none"> • Formulating the training system for the staff of operation, repair and maintenance • Formulating major plans for maintaining, constructing and modifying air-conditioning and refrigeration systems ◆ Assess the strategies for the operation, repair and maintenance of air-conditioning and refrigeration systems, including: <ul style="list-style-type: none"> • Analyzing the report for the operation, repair and maintenance of air-conditioning and refrigeration systems and other information so as to propose improvements for the overall running of the unit of operation, repair and maintenance • Assessing the quality management of the unit of operation, repair and maintenance and making improvements <p>6.3 Professionalism in managing the operation, repair and maintenance of air-conditioning and refrigeration systems</p> <ul style="list-style-type: none"> ◆ Perform tasks of managing the operation, repair and maintenance of air-conditioning and refrigeration systems according to legal requirements and codes of practice
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply complicated planning, technical and management functions to complete the tasks of managing the operation, repair and maintenance of air-conditioning and refrigeration systems, including system and strategy formulation, through information analysis and evaluation.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of the operation, repair and maintenance of air-conditioning and refrigeration systems.</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"> ◆ Use professional knowledge and knowledge of engineering environment to analyze the reasons of non-fulfillment or non-performance of project contracts by considering the following factors: <ul style="list-style-type: none"> • Technical concerns • Cost effectiveness • Change in project environment • Political, social and legal concerns • Contractor-related concerns <p>6.2 Handle unfulfilled or unperformed project contracts</p> <ul style="list-style-type: none"> ◆ Consider all solutions according to the above concerns, and calculate the costs and price for each solution ◆ Identify the most beneficiary solution to both sides and draft details of the solution ◆ Base on the drafted solution to negotiate with the contractor in order to come up with a solution accepted by both sides ◆ Know which part of the contract is unfulfilled or unperformed, and arrange to call for tender for that part again ◆ Be capable to provide sufficient and clear information should legal actions are required to solve the contract issues
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	Manage feasibility studies for air-conditioning and refrigeration projects
2. Code	EMACPM601A
3. Range	Demonstrate highly complex planning, technical and management abilities, and analyze and evaluate all kinds of information so as to manage feasibility studies for air-conditioning and refrigeration projects at work sites or office.
4. Level	6
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of feasibility study management of air-conditioning and refrigeration project</p> <ul style="list-style-type: none"> ◆ Understand the details and working procedures of air-conditioning and refrigeration project feasibility study management ◆ Understand the evaluation method of air-conditioning and refrigeration project feasibility study management <p>6.2 Methods and procedures of feasibility study management of air-conditioning and refrigeration project</p> <ul style="list-style-type: none"> ◆ Organize feasibility study for the air-conditioning and refrigeration project ◆ Evaluate the feasibility study report for the air-conditioning and refrigeration project, including: <ul style="list-style-type: none"> • Evaluating whether the feasibility study report meets the requirements as expected • Making investment decision according to the conclusion and recommendations of the feasibility study report <p>6.3 Professionalism in feasibility study management of air-conditioning and refrigeration project</p> <ul style="list-style-type: none"> ◆ Perform feasibility study management for air-conditioning and refrigeration projects according to the code of practice
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to demonstrate highly complex planning, technical and management abilities, and analyze and evaluate all kinds of information so as to manage feasibility studies for air-conditioning and refrigeration projects.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of feasibility study management of air-conditioning and refrigeration project.

1. Title	Perform risk management for air-conditioning and refrigeration projects
2. Code	EMACPM602A
3. Range	Demonstrate highly complex planning, technical and management abilities, and analyze and evaluate all kinds of information so as to perform risk management for air-conditioning and refrigeration projects at work sites or the office.
4. Level	6
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of risk management for air-conditioning and refrigeration project</p> <ul style="list-style-type: none"> ◆ Understand the concept of risk management, including: <ul style="list-style-type: none"> • Definition of project management • Relationship between risk management and project management • Purpose of risk management • Project risk management process ◆ Understand the range of application of different strategies and measures for handling project risks <p>6.2 Risk management methods and procedures for air-conditioning and refrigeration project</p> <ul style="list-style-type: none"> ◆ Manage the risks of air-conditioning and refrigeration projects, including: <ul style="list-style-type: none"> • Providing suitable strategies and measures against different risks according to the conclusions of the air-conditioning and refrigeration project risk assessment report • Formulating a risk management scheme for the air-conditioning and refrigeration project • Formulating an emergency plan for the air-conditioning and refrigeration project ◆ Monitor the risks of the air-conditioning and refrigeration project, including: <ul style="list-style-type: none"> • Monitoring the change in risks of the air-conditioning and refrigeration project • Modifying the risk management scheme according to the risk change • Suggesting ways to reduce or eliminate the project risks according to the characteristics of risk factors • Assessing the risk management results

	<p>6.3 Professionalism in risk management of air-conditioning and refrigeration project</p> <ul style="list-style-type: none"> ◆ Perform risk management for air-conditioning and refrigeration projects according to the code of practice
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to demonstrate highly complex planning, technical and management abilities, and analyze and evaluate all kinds of information so as to complete the risk management tasks for air-conditioning and refrigeration projects.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of air-conditioning and refrigeration project management.</p>

1. Title	Perform post-project management for air-conditioning and refrigeration projects
2. Code	EMACPM603A
3. Range	Demonstrate highly complex planning, technical and management abilities, and analyze and evaluate all kinds of information so as to perform post-project management for air-conditioning and refrigeration projects at the office.
4. Level	6
5. Credit	9
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of post-project management for air-conditioning and refrigeration project</p> <ul style="list-style-type: none"> ◆ Understand the concept of post-project assessment, including: <ul style="list-style-type: none"> • Meaning of post-project assessment management • Purpose of post-project assessment management • Content of post-project assessment management ◆ Understand post-project assessment methods ◆ Understand the indicators of post-project assessment <p>6.2 Post-project management methods and procedures for air-conditioning and refrigeration project</p> <ul style="list-style-type: none"> ◆ Perform post-project assessment management for the air-conditioning and refrigeration project, including setting up project assessment group to conduct project management assessment and post- project assessment <p>6.3 Professionalism in post-project assessment for the air-conditioning and refrigeration project</p> <ul style="list-style-type: none"> ◆ Perform post-project assessment management for the air-conditioning and refrigeration project according to the code of practice
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to demonstrate highly complex planning, technical and management abilities, and analyze and evaluate all kinds of information so as to complete the post-project assessment management tasks for air-conditioning and refrigeration projects.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of air-conditioning and refrigeration project management.

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"> ◆ Understand the safety, health and environmental protection management system and policy goals of the organization, including: <ul style="list-style-type: none"> • Long-term and short-term goals • Measurement of performance • Management system • Review mechanism <p>6.2 Overall safety, health and environmental protection policy of the organization</p> <ul style="list-style-type: none"> ◆ Formulate long-term and short-term goals for the overall safety, health and environmental protection policy <ul style="list-style-type: none"> • 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 ◆ Identify the deviations between safety, health and environmental protection management goals and current performance <ul style="list-style-type: none"> • 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 	

	<ul style="list-style-type: none"> ◆ Formulate and implement safety, health and environmental protection management policy <ul style="list-style-type: none"> • 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"> ▶ Safety, health and environmental protection policy ▶ Long-term and short-term goals for safety, health and environmental protection ▶ Resources arrangement for implementation of the safety, health and environmental protection policy and performance review ▶ Operating mode of the management system for the safety, health and environmental protection policy ▶ Measurement of performance of the safety, health and environmental protection management system ▶ Review mechanism ▶ Improvement mechanism ▶ Communication channels
7. Assessment 'Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> (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 (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.
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"> ◆ Understand the occupational safety and health policy and management system of the enterprise, such as: <ul style="list-style-type: none"> • Work safety and health pledge made by the enterprise and its safety policy • Framework for the implementation of the work safety and health pledge • Staff trained with the knowledge of working safely in conditions not hazardous to their health • Internal safety regulations to attain the goal of safety management • Identify dangers and conduct remedial inspection schemes accordingly on a regular basis or as deemed necessary • Identify potential dangers to workers and work out plans to deal with these dangers • Safety committee • Enhance, develop and maintain the awareness of safety and health at work site <p>6.2 Improvement plans for occupational safety and health</p> <ul style="list-style-type: none"> ◆ 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"> • 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 	

	<ul style="list-style-type: none"> ◆ 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"> • 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 • Formulate an overall management system improvement plan for items or operating mode of the system that need to be improved ◆ Formulate improvement plans for the occupational safety and health management system for benchmarking enhancement <ul style="list-style-type: none"> • Identify and confirm items or operating mode of the system that need to be improved for benchmarking enhancement • Formulate an overall management system improvement plan for items or operating mode of the system that need to be improved ◆ Consult and communicate sufficiently when formulating improvement plans <ul style="list-style-type: none"> • Consult the staff and stakeholders extensively and establish good communication channels with them during the formulation of the improvement plans
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> (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 (ii) Capable to formulate effective improvement plans for benchmarking enhancement of the organization.
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"> ◆ Understand the environmental protection policy and management system of the organization, including: <ul style="list-style-type: none"> • Policy goals • Operating mode of the management system • Monitoring procedures • Measurement of performance <p>6.2 Environmental protection improvement plans</p> <ul style="list-style-type: none"> ◆ 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"> • Operating mode • Implementation and monitoring • System management • budgeting • Measurement of performance • Review, workflow and schedule for implementation ◆ 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"> • Identify and confirm items or operating mode of the system that need to be improved • Formulate an overall management system improvement plan for items or operating mode of the system that need to be improved ◆ Consult and communicate sufficiently when formulating improvement plans <ul style="list-style-type: none"> • Consult the staff and stakeholders extensively and establish good communication channels with them during the formulation of the improvement plans 	

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"> ◆ Understand the concept of excellent quality management awards such as: <ul style="list-style-type: none"> • Deming Prize • Baldrige Quality Award • European Quality Award • Hong Kong Award for Industry <p>6.2 Formulation of quality management strategy</p> <ul style="list-style-type: none"> ◆ Identify the deviations between quality management goals and the current quality management system ◆ Identify the deviations between quality management goals and the performance of current quality management system ◆ Formulate quality management strategy <ul style="list-style-type: none"> • 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"> ▶ Quality management policy ▶ Quality management goals ▶ Operating mode of the quality management system under the quality management policy ▶ Measurement of the quality management system performance ▶ Review mechanism ▶ Improvement mechanism ▶ Communication channels
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"> ◆ Understand total quality management (TQM) methods and techniques such as: <ul style="list-style-type: none"> • Quality Function Deployment • Business Process Reengineering • Process Improvement • Strategic Outsourcing • Rapid Product Development ◆ Understand the concepts of quality economics, including: <ul style="list-style-type: none"> • Quality costs • Quality costs calculation system of quality economics <p>6.2 Implementation of total quality management</p> <ul style="list-style-type: none"> ◆ Implement total quality management <ul style="list-style-type: none"> • Apply the following TQM methods to assist the implementation of total quality management strategy <ul style="list-style-type: none"> ▸ Quality Function Deployment ▸ Business Process Reengineering ▸ Process Improvement ▸ Strategic Outsourcing ▸ Rapid Product Development ◆ Build up the concept of catering customers' needs in a correct way <ul style="list-style-type: none"> • implement the concept of catering customers' needs in a correct way, including <ul style="list-style-type: none"> ▸ internal and external customers ▸ customers' voices ▸ customers' level of satisfaction ▸ customers' loyalty ▸ the importance of customers to the organization ◆ Apply the concept of quality economics to analyze quality costs <ul style="list-style-type: none"> • 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

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

1. Title	Formulate air-conditioning and refrigeration equipment sales strategies	
2. Code	EMACMS601A	
3. Range	Apply highly specialized technical research and scholastic skills, and make complex information analysis, planning and judgement, so as to formulate air-conditioning and refrigeration equipment sales strategies in the office.	
4. Level	6	
5. Credit	9	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of formulating air-conditioning and refrigeration equipment sales strategies</p> <ul style="list-style-type: none"> ◆ Understand methods of air-conditioning and refrigeration equipment sales analysis ◆ Understand the implementation of new air-conditioning and refrigeration equipment sales ◆ Understand the details and purposes of sales and marketing plan ◆ Understand the details and purposes of air-conditioning and refrigeration equipment sales strategies <p>6.2 Methods and procedures of formulating air-conditioning and refrigeration equipment sales strategies</p> <ul style="list-style-type: none"> ◆ Position and select the market for the air-conditioning and refrigeration equipment ◆ Formulate a market competition strategy for the air-conditioning and refrigeration equipment according to the condition of the company ◆ Formulate a sales strategy for the air-conditioning and refrigeration equipment, including: <ul style="list-style-type: none"> • Determining the sales goal for the air-conditioning and refrigeration equipment • Analyzing the overall business of the company and formulating the sales strategy for the air-conditioning and refrigeration equipment • Formulating sales strategy for new air-conditioning and refrigeration equipment <p>6.3 Professionalism in formulating air-conditioning and refrigeration equipment sales strategies</p> <ul style="list-style-type: none"> ◆ Formulate air-conditioning and refrigeration equipment sales strategies according to the code of practice 	

7. Assessment Criteria	The integrated outcome requirement of this unit of competency is: (i) Capable to apply highly specialized technical research and scholastic skills, and make complex information analysis, planning and judgement, so as to complete the formulation of air-conditioning and refrigeration equipment sales strategies in the office.
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of air-conditioning and refrigeration equipment sales.

1. Title	Manage air-conditioning and refrigeration equipment sales	
2. Code	EMACMS602A	
3. Range	Demonstrate complex planning, technical and management abilities in air-conditioning and refrigeration equipment sales management by analyzing and evaluating all kinds of information.	
4. Level	6	
5. Credit	12	
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of air-conditioning and refrigeration equipment sales management</p> <ul style="list-style-type: none"> ◆ Understand the details and process of air-conditioning and refrigeration equipment sales management, including: <ul style="list-style-type: none"> • Product and price management • Sales channel management • Sales promotion management • Customer management <p>6.2 Methods and procedures of air-conditioning and refrigeration equipment sales management</p> <ul style="list-style-type: none"> ◆ Manage air-conditioning and refrigeration equipment sales activities, including: <ul style="list-style-type: none"> • The whole process of air-conditioning and refrigeration equipment sales • Adopt sales strategies based on different needs ◆ Carry out product and price management for the air-conditioning and refrigeration equipment, including: <ul style="list-style-type: none"> • Formulating launch plan for new air-conditioning and refrigeration equipment • Judge the life span of the air-conditioning and refrigeration equipment and propose an appropriate sales strategy • Use pricing strategy and techniques to facilitate the transaction of air-conditioning and refrigeration equipment ◆ Carry out sales channel management, including: <ul style="list-style-type: none"> • Formulating and implementing air-conditioning and refrigeration equipment sales channel strategies • Designing an appropriate air-conditioning and refrigeration equipment sales channel system • Establishing the air-conditioning and refrigeration equipment sales channel system ◆ Formulate a sales promotion plan, including: <ul style="list-style-type: none"> • Formulating an air-conditioning and refrigeration equipment sales promotion plan • Evaluate the effectiveness of the air-conditioning and refrigeration equipment sales promotion plan 	

	<ul style="list-style-type: none"> ◆ Perform customer management, including: <ul style="list-style-type: none"> • Establishing customer record • Managing accounts receivable • Handling customer complaints ◆ Perform sales service management, including: <ul style="list-style-type: none"> • Designing a sales service quality evaluation system • Evaluating sale service quality <p>6.3 Professionalism in air-conditioning and refrigeration equipment sales management</p> <ul style="list-style-type: none"> ◆ Perform air-conditioning and refrigeration equipment sales management according to the code of practice
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to demonstrate complex planning, technical and management abilities, and analyze and evaluate all kinds of information so as to complete air-conditioning and refrigeration equipment sales management tasks.</p>
8. Remarks	<p>The credit value of this unit of competency is set on the presumption that the person already possesses general knowledge of air-conditioning and refrigeration equipment sales.</p>

Competency Level 7

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"> ◆ Understand the development trends of society and the electrical and mechanical trade ◆ Understand clearly the influence of legislations, especially ordinances related to safety, health and environmental protection, on the industry ◆ Master social and economic information <p>6.2 Formulate overall operation development direction and strategy</p> <ul style="list-style-type: none"> ◆ Analyze strengths of the organization <ul style="list-style-type: none"> • 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 • Use internal questionnaire survey for analysis and reference • Use the comparison with industrial benchmarking for analysis and reference ◆ Formulate development goals for the organization according to the analysis of the its strengths, the social and industrial environment and trend, and stakeholders' needs ◆ Use operation management techniques to formulate an overall operation development direction and strategy according to development goals, including: <ul style="list-style-type: none"> • Business development strategy • Business operation strategy • Human resources management strategy • Financial strategy • Product development strategy • Risk management strategy • Communication channels 	

	<ul style="list-style-type: none"> ◆ Formulate mechanisms to measure, review and improve the operation development direction and strategy ◆ Lead the organization for a forward-looking development according to the following social and industrial changes <ul style="list-style-type: none"> • Product or service requirements • Technological development • Human resources and all kinds of costs in comparison with competitors or the region
7. Assessment Criteria	<p>The integrated outcome requirements of this unit of competency are:</p> <ul style="list-style-type: none"> (i) Capable to formulate an overall operation development direction and strategy according to the situation of an electrical and mechanical organization; (ii) Capable to formulate for the organization mechanisms to measure, review and improve the operation development direction and strategy; and (iii) Capable to lead the organization for a forward-looking development according to social and industrial changes.
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	Apply building physics to sustainable architectural design
2. Code	EMACDE701A
3. Range	Apply highly specialized and advanced technical research and scholastic skills, and make complex information analysis, planning and judgement, so as to carry out sustainable environmental design in design studios.
4. Level	7
5. Credit	36
6. Competency	<p style="text-align: center;"><u>Performance Requirements</u></p> <p>6.1 Knowledge of applying building physics to sustainable architectural design</p> <ul style="list-style-type: none"> ◆ Understand the physical phenomenon and characteristics of motion of sound, light and heat ◆ Understand the application value of building physics ◆ Understand the comprehensive building plan, the architectural design and the selection of building equipment ◆ Understand the details and requirements of sustainable architectural design <p>6.2 Methods and procedures of applying building physics to sustainable architectural design</p> <ul style="list-style-type: none"> ◆ Use building's physical environment simulation software for building's physical environment simulation analysis, including: <ul style="list-style-type: none"> • Analysis of building's heat environment and comfortableness • Analysis of building's light environment and base sunshine and shadow • Analysis of building's sound environment and building's energy consumption ◆ Use data of building's physical environment simulation analysis and a range of advanced technologies to design innovative, sustainable buildings by making full use of natural resources, highly-efficient and energy-saving equipment <p>6.3 Professionalism in applying building physics to sustainable architectural design</p> <ul style="list-style-type: none"> ◆ Understand the legal requirements and code of practice, analyze and evaluate a wide range of information, and apply highly specialized knowledge and skills to design sustainable buildings that are innovative, green, safe, practical and comfortable
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply highly specialized technical research and scholastic skills, and make complex information analysis, planning and judgement, so as to complete the design of sustainable buildings that are innovative, green, safe, practical and comfortable.</p>
8. Remarks	The credit value of this unit of competency is set on the presumption that the person already possesses professional knowledge of air-conditioning and refrigeration systems.

1. Title	Design advanced and highly-efficient air-conditioning systems	
2. Code	EMACDE702A	
3. Range	Apply highly specialized technical research and scholastic skills, and make complex information analysis, planning and judgement, so as to design advanced and highly-efficient air-conditioning systems in design studios.	
4. Level	7	
5. Credit	36	
6. Competency	<p>6.1 Knowledge of advanced and highly-efficient air-conditioning system design</p>	<p style="text-align: center;"><u>Performance Requirements</u></p> <ul style="list-style-type: none"> ◆ Understand the factors affecting the energy consumption of air-conditioning systems, including: <ul style="list-style-type: none"> • Thermal conductivity of building enclosure • Outdoor meteorological parameters and psychrometric conditions • Outdoor design parameters • Performance and efficiency of various air-conditioning system equipment • Overall performance of air-conditioning systems • Ways of operation and operation management status of air-conditioning systems ◆ Understand the impact of the selection of refrigerants on environmental protection and energy saving ◆ Understand the impact of different types of refrigeration systems on energy saving ◆ Understand the working principles and selection criteria for different types of air-conditioning and refrigeration energy-saving equipment ◆ Understand various types of energy-saving methods for air-conditioning systems, including: <ul style="list-style-type: none"> • Energy-saving methods for air-handling units • Energy-saving methods for air-conditioning water systems • Energy-saving methods for variable air-volume air-conditioning systems • Energy-saving methods for heat recovery of air-conditioning system

	<p>6.2 Methods and procedures of designing advanced and highly-efficient air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Design advanced and highly-efficient air-conditioning systems, including: <ul style="list-style-type: none"> • Select a reasonable design • Select the best type of air-conditioning system and air flow pattern • Select advanced and highly-efficient equipment • Design highly-efficient operation mode for the system • Design energy recovery system • Design advanced and highly-efficient CCMS of air-conditioning system <p>6.3 Professionalism in designing advanced and highly-efficient air-conditioning systems</p> <ul style="list-style-type: none"> ◆ Understand the legal requirements and code of practice, analyze and evaluate a wide range of information, and apply highly specialized knowledge and skills to design advanced and highly-efficient air-conditioning systems which are innovative, reliable, reasonably-priced and with good control in system operation
7. Assessment Criteria	<p>The integrated outcome requirement of this unit of competency is:</p> <p>(i) Capable to apply highly specialized technical research and scholastic skills, and make complex information analysis, planning and judgement, so as to complete the design of advanced and highly-efficient air-conditioning systems which are innovative, reliable, reasonably-priced and with good control in system 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 air-conditioning and refrigeration systems.</p>

Appendix I

Generic Level Descriptors

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

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

Generic Level Descriptors				
Level	Knowledge & Intellectual Skills	Processes	Application, Autonomy & Accountability	Communications, IT & Numeracy
3	<ul style="list-style-type: none"> - Apply knowledge and skills in a range of activities, demonstrating comprehension of relevant theories - Access, organize and evaluate information independently and make reasoned judgements in relation to a subject or discipline - Employ a range of responses to well defined, but sometimes unfamiliar or unpredictable, problems - Make generalizations and predictions in familiar contexts. 	<ul style="list-style-type: none"> - Operate in a variety of familiar and some unfamiliar contexts, using a known range of technical or learning skills - Select from a considerable choice of predetermined procedures - Give presentations to an audience 	<ul style="list-style-type: none"> - 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 - Engage in self-directed activity with guidance/evaluation - Accept responsibility for quantity and quality of output - Accept well defined but limited responsibility for the quantity and quality of the output of others 	<ul style="list-style-type: none"> - Use a wide range of largely routine and well practiced skills — for example: - 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. - Select and use standard applications to obtain, process and combine information - Use a wide range of numerical and graphical data in routine contexts, which may have some non-routine elements.

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

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

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

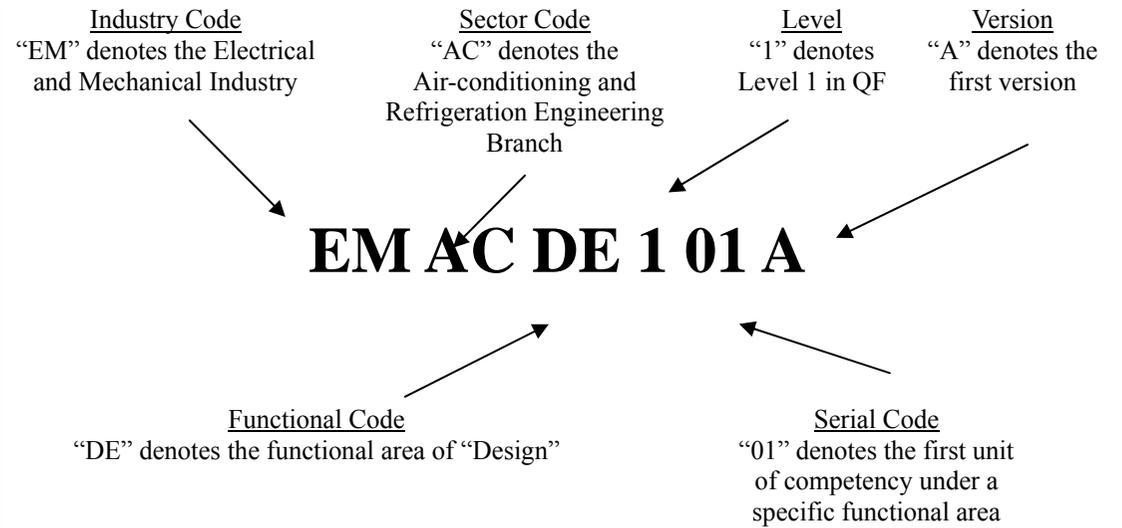
Generic Level Descriptors				
Level	Knowledge & Intellectual Skills	Processes	Application, Autonomy & Accountability	Communications, IT & Numeracy
7	<ul style="list-style-type: none"> - Demonstrate and work with a critical overview of a subject or discipline, including an evaluative understanding of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

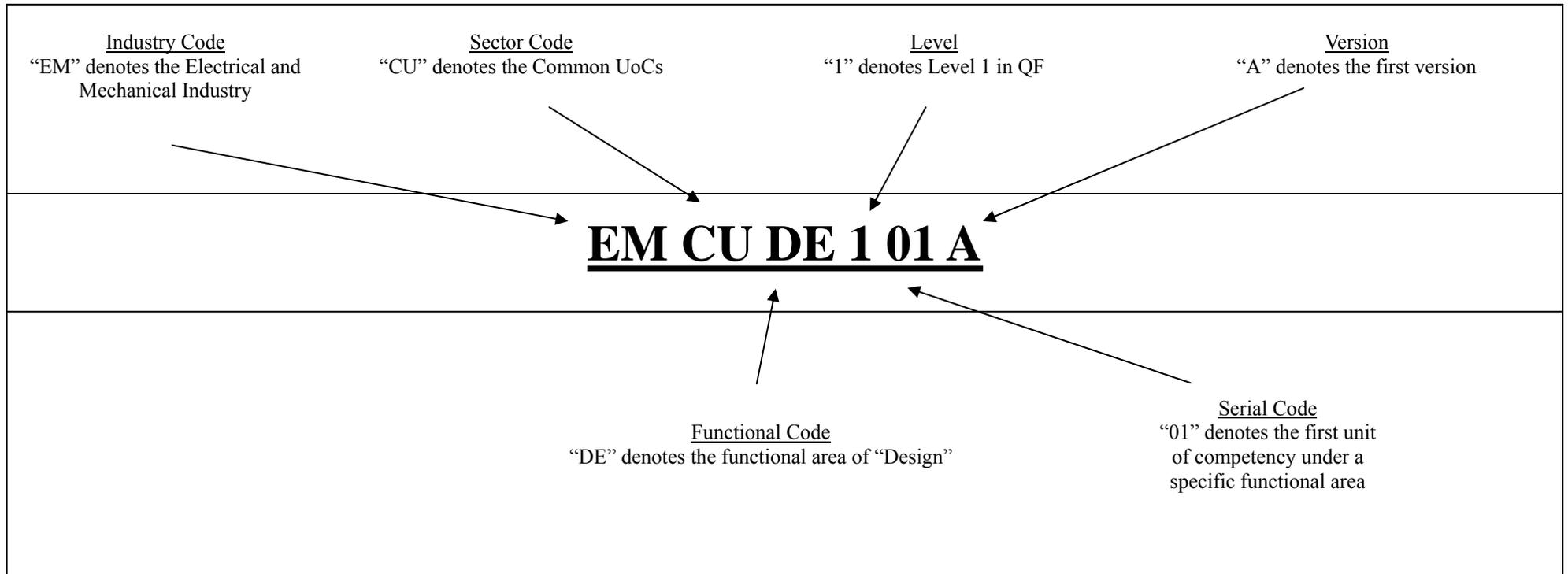
Appendix II

Coding Criteria

Coding Criteria

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



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.