STANDARD KEMAHIRAN PEKERJAAN KEBANGSAAN
(NATIONAL OCCUPATIONAL SKILLS STANDARD)

F432-003-3:2017

AIR-CONDITIONING AND MECHANICAL VENTILATION (ACMV)
INSTALLATION & MAINTENANCE OPERATION SUPERVISION

LEVEL 3

JPK

JABATAN PEMBANGUNAN KEMAHIRAN
KEMENTERIAN SUMBER MANUSIA, MALAYSIA

Department of Skills Development (DSD)
Federal Government Administrative Centre
62530 PUTRAJAYA, MALAYSIA

Construction Industry Development Board (CIDB)
Tingkat 35, Menara Dato' Onn
Pusat Dagangan Dunia Putra
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50480 KUALA LUMPUR, MALAYSIA

NATIONAL OCCUPATIONAL SKILLS STANDARD

PENYELIAAN OPERASI PEMASANGAN & PENYENGGARAAN PENGHAWA DINGIN DAN PENGUDARAAN MEKANIKAL

AIR-CONDITIONING AND MECHANICAL VENTILATION (ACMV) INSTALLATION & MAINTENANCE OPERATION SUPERVISION

LEVEL 3

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Abbreviation

1.	ABS	Acrylonitrile Butadiene Styrene
2.	AHU / AH	Air Handling Unit
3.	ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
4.	BTU	British Thermal Unit
5.	CIDB	Construction Industry Development Board
6.	CoCU	Curriculum of Competency Unit
7.	CP	Competency Profile
8.	CPC	Competency Profile Chart
9.	CU	Competency Unit
10.	DKM	Diploma Kemahiran Malaysia
11.	DLKM	Diploma Lanjutan Kemahiran Malaysia
12.	FCU	Fan Coil Unit
13.	GI	Galvanised Iron
14.	JHA	Job Hazard Analysis
15.	JSA	Job Safety Analysis
16.	M&E	Mechanical and Electrical
17.	MS	Malaysian Standard
18.	MS	Malaysian Standard
19.	MSDS	Material Safety Data Sheet
20.	NIOSH	National Institute of Occupational Safety & Health
21.	OSHA	Occupational Safety & Health Act
22.	PE	Polyethylene
23.	PPE	Personal Protective Equipment
24.	PTW	Permit To Work
25.	PU	Polyurethane
26.	QC	Quality Control
27.	R&D	Research & Development
28.	SKM	Sijil Kemahiran Malaysia
29.	SOP	Standard Operating Procedure
30.	ST / EC	Suruhanjaya Tenaga / Energy Commission
31.	STEC	Standard Technical Evaluation Committee
32.	UPVC	Unplasticized Polyvinyl Chloride

Glossary

1.	Air Handling Unit	A central unit consisting of a blower, heating and cooling elements, filter racks or chamber, dampers, humidifier, and other central equipment in direct contact with the airflow. This does not include the ductwork through the building.
2.	Centrifugal Fan	A centrifugal fan is a mechanical device for moving air or other gases.
3.	Chiller	A device that removes heat from a liquid via a vapor-compression or absorption refrigeration cycle. This cooled liquid flows through pipes in a building and passes through coils in air handlers, fan-coil units, or other systems, cooling and usually dehumidifying the air in the building. Chillers are of two types; air-cooled or water-cooled. Air-cooled chillers are usually outside and consist of condenser coils cooled by fan-driven air. Water-cooled chillers are usually inside a building, and heat from these chillers is carried by recirculating water to a heat sink such as an outdoor cooling tower.
4.	Coil	Equipment that performs heat transfer to air when mounted inside an air handling unit or ductwork. It is heated or cooled by electrical means or by circulating liquid or steam within it.
5.	Condenser	A component in the basic refrigeration cycle that ejects or removes heat from the system. The condenser is the hot side of an air conditioner or heat pump. Condensers are heat exchangers, and can transfer heat to air or to an intermediate fluid (such as water or an aqueous solution of ethylene glycol) to carry heat to a distant sink, such as ground (earth sink), a body of water, or air (as with cooling towers).
6.	Controller	A device that controls the operation of part or all of a system. It may simply turn a device on and off, or it may more subtly modulate the set point of components. Most controllers are automatic but have user input such as temperature set points, e.g. a thermostat. Controls may be analogue or digital.
7.	Damper	A plate or gate placed in a duct to control air flow by increasing friction in the duct.
8.	Dehumidifier	A dehumidifier is the equipment that extracts and removes humidity from the air. It works by cooling air to the point where water turns to liquid from vapour form and then the liquid is removed.
9.	Diffuser	A diffuser is placed over ductwork, and it separates air with vanes going in differing directions. It evenly distributes air flow in the desired directions.
10.	Duct	Specialized housing for the air flow.
11.	Fan Coil Unit	A small terminal unit that is often composed of only a blower and a heating and/or cooling coil, as is often used in hotels, condominiums, or apartments.
12.	Fresh Air Intake	An opening through which outside air is drawn into the building. This may be to replace air in the building that has been exhausted by the ventilation system, or to provide fresh air for combustion of fuel.

13. Grille	A facing across a duct opening, often rectangular in shape, containing multiple parallel slots through which air may be delivered or withdrawn from a ventilated space. The grille directs the air flow in a particular direction and prevents the passage of large items.
14. Heavy Commercial ACMV	Heavy Commercial is referring to high rise and industrial building with cooling capacity above 10 horse power (100,000 BTU / hour).
15. Light Commercial ACMV	Light Commercial is referring to small and medium size building with cooling capacity below 10 horse power (100,000 BTU / hour).
16. MS1525:2014	Code of Practice on Energy Efficiency and Use of Renewable Energy for Non-Residential Buildings
17. Shop Drawing	A shop drawing is a drawing or set of drawings produced by the contractor, supplier, manufacturer, subcontractor, or fabricator. Shop drawings are typically required for prefabricated components.
18. Thermostat	A thermostat is a system that monitors and regulates a heating or cooling system. It can be used to set the desired temperature at which it keeps the environment either heated or cooled.

Acknowledgement

The Director General of DSD would like to extend his gratitude to the organisations and individuals who have been involved in developing this Standard including:

i. National Skills Development Council (NSDC)
ii. Standard Technical Committee (STC)
iii. Standard Technical Evaluation Committee (STEC)
iv. Standard Development Committee (SDC)
v. Facilitator
vi. Secretariat
vii. Related Organisation

STANDARD PRACTICE

NATIONAL OCCUPATIONAL SKILLS STANDARD (NOSS) FOR:

AIR-CONDITIONING AND MECHANICAL VENTILATION (ACMV) INSTALLATION & MAINTENANCE OPERATION SUPERVISION

LEVEL 3

1. Introduction

The purpose of air conditioning and mechanical ventilation system is to maintain comfort condition in the air-conditioned space irrespective of the outdoor ambient condition. Comfort condition usually refers to a specific range of temperature, relative humidity, cleanliness and distribution of air to meet the comfort requirements of the occupants in air-conditioned spaces. For a tropical country like Malaysia, outdoor ambient temperature is generally higher than the comfort temperature of the conditioned spaces. Therefore, ACMV systems are required to operate throughout the year to maintain the comfort condition in the commercial building.

This document is the continuation of Air-Conditioning and Mechanical Ventilation Installation & Maintenance Operation Level 2. The content of this NOSS is describing the competencies required and expected by the industry for Level 3 personnel in ACMV operations.

1.1. Occupation Overview

ACMV Supervisor is sharing the same work scope with ACMV Installer / Technician (Level 2). Supervisor is complementing the work of Level 2 personnel and deals with complex and risky tasks in air conditioning practices. A supervisor is responsible for technical coordination and organizing ACMV technical requirements in accordance with related standards and regulatory body requirements. A supervisor shall be able to determine ACMV specifications, coordinate work activities, familiar with related documentations and ensure compliance in accordance with Health, Safety & Environment (HSE) requirement, technical drawings and client requirements.

An ACMV supervisor plays the role of monitoring and coordinating installation & maintenance operations, as well as supervising the work activities of subordinates. A supervisor will oversee the completion of projects by coordinating manpower and equipment, while addressing any maintenance and security needs. Apart from possessing operational and maintenance knowledge, a supervisor must understand management principles and practices.

A supervisor must evaluate installation and repair requests from superior and clients. He/she will be required to apply his/her competence in ACMV practices to determine causes of reported malfunctions and repair needs. A supervisor is expected to offer solutions by directing on procedures of corrective action while observing cost feasibility and company capacities. The aim is to ensure that the company remains effective in its daily operations for profitable completion of projects.

Another role of a supervisor is regularly select and train subordinates to develop a competent manpower. He/she will instil operational knowledge and procedures to subordinates as to ensure consistent performance and proper use of company resources. It is also a duty of a supervisor to supervise subordinates in their everyday operation schedules for compliance with manufacturing requirements and safety procedures. The

overall goal will be to select, train and mobilize personnel to facilitate the achievement of company objectives.

An organization's growth largely depends on proper record-keeping and documentation to enable follow-up and improvement of activities performance. It is the duty of the supervisor to document and record various aspects of ACMV operations. These records include periodic reports, inventory, safety incidences, personnel absenteeism and their respective corrective actions undertaken. Other details that need to be recorded and maintained are materials and equipment coming to workshop / yard to facilitate financial accountability.

In addition, supervisor will need to conduct performance appraisals for subordinates. The aim is to evaluate staff performance to recommend where change is necessary. For instance, a supervisor may advise on salary adjustments, promotions and transfers. He/she may also recommend changes in particular methods and procedures such as procurement of raw materials. The goal is to secure maximum utilization of company resources in achieving its objectives.

1.2. Rationale of NOSS Development

Between 2004 – 2010, the NOSS for ACMV were developed separately under five (5) sub-sectors namely Residential & Light Commercial, Piping, Ducting, Electrical and Maintenance. The existing NOSS has reached the point where the contents are required to be reviewed and revamped as per new format requirements. At this moment, only three (3) NOSS related to Residential & Light Commercial are implemented and the training is offered by Akademi Binaan Malaysia (ABM).

1.3. Rationale of Occupational Structure and Occupational Area Structure

The NOSS development committee has come to a consensus that all the NOSS under ACMV should be integrated to reflect the current practice of the industry. The industry landscape for ACMV is very competitive in which a company is offering full-pledged services from designing to maintenance of ACMV system. Therefore, the manpower should be equipped with related skills in installation, piping, ducting, electrical and maintenance. The merging of the areas is depicted in the Occupational Area Structure (OAS) in the following page.

1.4. Regulatory / Statutory Body Requirements Related to Occupation

The industry is regulated by the followings regulatory/statutory body:

- Department of Occupational Safety & Health
  - Occupational Safety and Health Act 1994 (Act 514)
  - Factory & Machineries Act 1967 (Act 139)

- Energy Commission
  - Electricity Supply Act 1994

- Department of Environment
  - Environmental Quality Act 1974 (Amendment 2012)

- Construction Industry Development Board (CIDB)
  - Act 520 Construction Industry Development Board 1994

1.5. Occupational Pre-Requisite

The minimum requirements set forth by the industry for any interested individual to undertake the job or career in this area are as follows:

i. Having more than 3-year working experience in related industry; and
ii. Physically and mentally healthy.

2. Occupational Structure (OS)

Section	(F) Construction			
Group	(432) Electrical, Plumbing And Other Construction Installation Activities			
Area	Air-Conditioning And Mechanical Ventilation (ACMV)			
	Light Commercial	Heavy Commercial		
		Piping	Ducting	Maintenance
Level 5	ACMV Project Manager			ACMV Maintenance Manager
Level 4	ACMV Project Executive			ACMV Maintenance Executive
Level 3	Light Commercial ACMV Supervisor	ACMV Piping Supervisor	ACMV Ducting Supervisor	ACMV Maintenance Supervisor
Level 2	Light Commercial ACMV Installer	ACMV Piping Installer	ACMV Ducting Installer	ACMV Maintenance Technician
Level 1	No Level	No Level	No Level	No Level

Figure 1: Occupational Structure

3. Occupational Area Structure (OAS)

Section	(F) Construction			
Group	(432) Electrical, Plumbing And Other Construction Installation Activities			
Area	Air-Conditioning And Mechanical Ventilation (ACMV)			
	Light Commercial	Heavy Commercial		
		Piping	Ducting	Maintenance
Level 5	Air-Conditioning and Mechanical Ventilation Technical Operation & Management			
Level 4	Air-Conditioning and Mechanical Ventilation Technical Operation			
Level 3	Air-Conditioning and Mechanical Ventilation Installation & Maintenance Operation Supervision			
Level 2	Air-Conditioning and Mechanical Ventilation Installation & Maintenance Operation			
Level 1	No Level			

Figure 2: Occupational Area Structure

4. Definition of Competency Levels

The NOSS is developed for various occupational areas. Below is a guideline of each NOSS Level as defined by the Department of Skills Development, Ministry of Human Resources, Malaysia.

Level 1: Competent in performing a range of varied work activities, most of which are routine and predictable.

Level 2: Competent in performing a significant range of varied work activities, performed in a variety of contexts. Some of the activities are non-routine and required individual responsibility and autonomy.

Level 3: Competent in performing a broad range of varied work activities, performed in a variety of contexts, most of which are complex and non-routine. There is considerable responsibility and autonomy and control or guidance of others is often required.

Level 4: Competent in performing a broad range of complex technical or professional work activities performed in a wide variety of contexts and with a substantial degree of personal responsibility and autonomy. Responsibility for the work of others and allocation of resources is often present.

Level 5: Competent in applying a significant range of fundamental principles and complex techniques across a wide and often unpredictable variety of contexts. Very substantial personal autonomy and often significant responsibility for the work of others and for the allocation of substantial resources features strongly, as do personal accountabilities for analysis, diagnosis, planning, execution and evaluation.

5. Award of Certificate

The Director General may award, to any person upon conforming to the Standards the following skills qualifications as stipulated under the National Skills Development Act 2006 (Act 652):

- Malaysian Skills Certificate
- Malaysian Skills Diploma
- Malaysian Skills Advanced Diploma
- Statements of Achievement

6. Occupational Competencies

The Air-Conditioning **a**nd Mechanical Ventilation Installation & Maintenance Operation Supervision Level 3 personnel is competent in performing the following core competencies:

- Light Commercial ACMV Installation & Maintenance Works Inspection
- ACMV Ducting Installation Works Inspection
- ACMV Piping Installation Works Inspection
- ACMV System Service and Maintenance Works Inspection
- Heavy Commercial ACMV Installation Supervision
- ACMV Supervisory Functions

7. Work Conditions

Generally, ACMV Installation & Maintenance personnel work in normal working hours from morning to evening depending on organisation nature of business. They may require working extra hours to fulfil internal and external requirements. They also may be needed to work in shift to accommodate work requirements. All personnel need to have valid CIDB Green Card and use / wear appropriate attire (Personal Protective Equipment) during the commencement of their jobs. They may work individually or group in a hazardous and hot environment. They must physical fit due to nature of job in specialised construction activities.

8. Employment Prospects

Malaysia's construction segment is expected to grow between 8% and 10% in 2016 in terms of projects undertaken, driven by government infrastructure projects, these projects ensure consistent growth in the local construction segment, which will contribute to the country's economy as well as its people through employment opportunities.

With new technologies available in today's marketplace older ACMV system is far less efficient than today's models, costing consumers more money to run, offering less comfort and also taking a larger toll on the environment. In an effort to 'go green' while saving money and providing better comfort levels for homes and workplaces, consumers are making the change to newer HVAC systems. Consumers are also more educated on how keeping ACMV system maintained will benefit them in the long run. With projections of system

installations and maintenance on the rise, ACMV personnel are going to be sought after and job market related to ACMV is also expanding.

9. Up Skilling Opportunities

   Supervisors are employed by ACMV related service companies. Supervisors may advance to managerial positions. They may also advance to estimator positions. Estimators review blueprints for proposed work, determine how much material will be needed and how long the work will take as well as projection of costing. Some experienced supervisors may start their own company and offer ACMV installation and maintenance services.

10. Organisation Reference for Sources of Additional Information

The following organisations can be referred as sources of additional information which can assist in defining the document's contents.

a. Construction Industry Development Board (CIDB)
Tingkat 35, Menara Dato' Onn
Pusat Dagangan Dunia Putra
No. 45, Jalan Tun Ismail
50480 Kuala Lumpur
Tel: 03-40477327
Fax: 03-40477310
Email: info@cidb.gov.my

b. Department of Occupational Safety and Health (DOSH)
Level 5 (Main Counter), Block D4, Complex D
Federal Government Administrative Centre, 62530 Putrajaya
Tel: 03-8886 5343
Fax: 03-8889 2443
http://www.dosh.gov.my

c. **Department of Environment**
Ministry of Natural Resources and Environment
Level 1 – 4, Podium 2 & 3, Wisma Sumber Asli
No.25, Persiaran Perdana, Precint 4
Federal Government Administrative Centre
62574 Putrajaya
Tel: 03-8871 2000 / 2200
Fax: 03-8889 1973/75
http://www.doe.gov.my

d. **MASHRAE Secretariat**
Unit 518 Block A, Kelana Business Centre
No. 97 Jalan SS7/2, Kelana Jaya, 47301 Petaling Jaya
Selangor Darul Ehsan
Tel: 011-10988558 or +603-7887 5886
Fax: 03-7887 5886
http://www.ashrae.org.my

e. Energy Commission
No. 12, Jalan Tun Hussein
Precinct 2
62100 Putrajaya
Tel: 03-8870 8500
Fax: 03-8888 8637
http://www.st.gov.my

11. Standard Technical Evaluation Committee

NO	NAME	POSITION & ORGANISATION
1.	Burhanuddin Bin Bahrum	Instructor Akademi Binaan Malaysia Wilayah Utara
2.	Kamarulzaman Bin Mohammad	Instructor Akademi Binaan Malaysia Wilayah Sarawak
3.	Azdikah Bin Abdukah	Instructor Akademi Binaan Malaysia Wilayah Sabah

12. Standard Development Committee

AIR-CONDITIONING AND MECHANICAL VENTILATION INSTALLATION & MAINTENANCE OPERATION SUPERVISION

LEVEL 3

NO	NAME	POSITION & ORGANISATION
1.	En. Peter Tan Chin Wah	Asset & Property Management Director Genesis Prominent Sdn Bhd
2.	En. Zulramly Bin Baharudin	Technical Manager Houz Deport Sdn Bhd
3.	Dato' Andy Kwan Teck Hian	President Malaysian Air-Conditioning & Refrigeration Association (MACRA)
4.	En. Gan Chok Ser	Technical Director Cooling Innovation Sdn Bhd Education Chairman Malaysian Air-Conditioning & Refrigeration Association (MACRA)
5.	En. Abd Walid Bin Abd Hamid	Project Executive CEPSI Training & Services Resources
6.	Ir. Mazlan bin Mahmud	Project Director BMES Maintenance Services Sdn Bhd
7.	En. Mike Lee Wai Hoong	Technical Director Blue Aire Services Sdn Bhd
8.	En. Ahmad Suhaimi Bin Che Din	Senior Asisstant Director (Curriculum Development) Majlis Amanah Rakyat (MARA)
9.	En. Kamarul Bahar Bin Abdul Rahim	Senior Instructor Perbadanan Hal Ehwal Bekas Angkatan Tentera (PERHEBAT) Kem Sungai Buloh
10.	En. Mohd Syarafi Bin Rohseli	President Persatuan Pemerkasaan Pembangunan Kemahiran Dan Kompetensi Malaysia
11.	En. Azrul Nizam Bin Abd Razak	Head of Mechanical & Electrical Unit Akademi Binaan Malaysia (ABM) Wilayah Tengah
FACILITATOR		
1.	En. Abu Musa Bin Mohamad Isa	Facilitator Adimega Sdn Bhd

STANDARD CONTENT

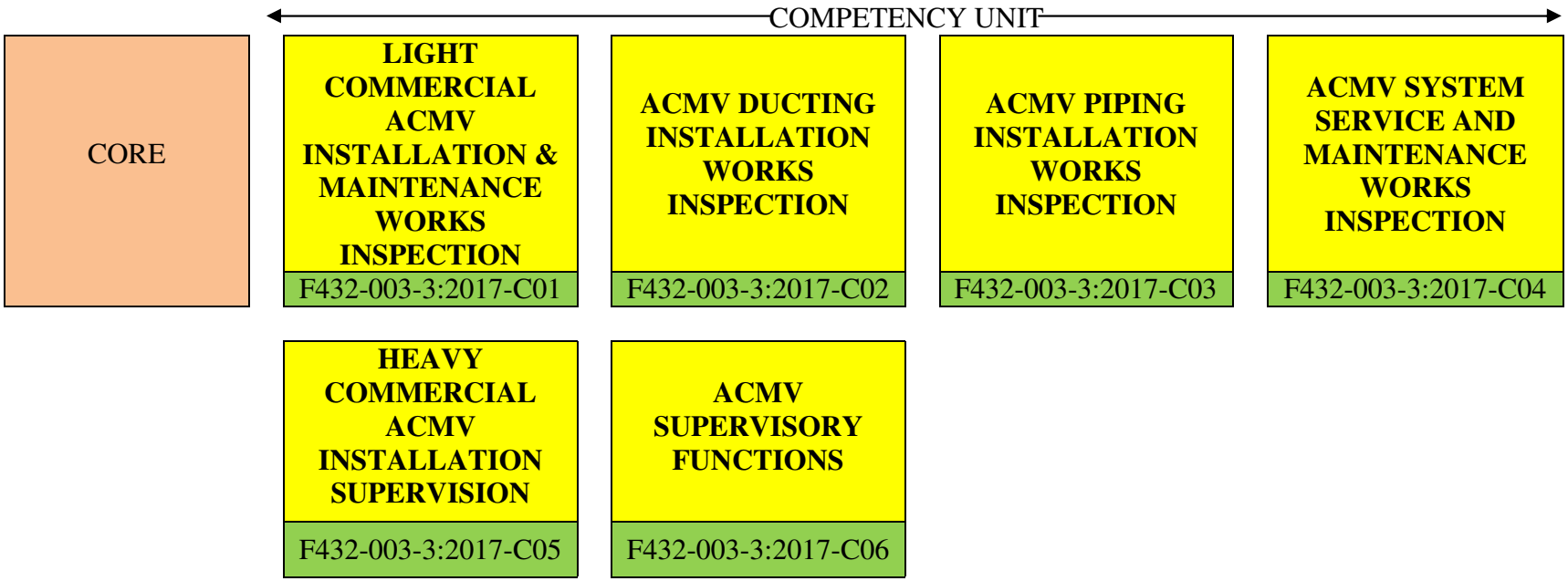
NATIONAL OCCUPATIONAL SKILLS STANDARD (NOSS) FOR:

AIR-CONDITIONING AND MECHANICAL VENTILATION INSTALLATION & MAINTENANCE OPERATION SUPERVISION

LEVEL 3

13. Competency Profile Chart (CPC)

SECTION	(F) Construction		
GROUP	(432) Electrical, Plumbing And Other Construction Installation Activities		
AREA	Air-Conditioning And Mechanical Ventilation (ACMV)		
NOSS TITLE	Air-Conditioning and Mechanical Ventilation Installation & Maintenance Operation Supervision		
NOSS LEVEL	3	NOSS CODE	F432-003-3:2017



14. Competency Profile (CP)

SECTION	(F) Construction		
GROUP	(432) Electrical, Plumbing And Other Construction Installation Activities		
AREA	Air-Conditioning And Mechanical Ventilation (ACMV)		
NOSS TITLE	Air-Conditioning and Mechanical Ventilation Installation & Maintenance Operation Supervision		
NOSS LEVEL	3	NOSS CODE	F432-003-3:2017

CU TITLE & CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
1. Light Commercial ACMV Installation and Maintenance Works Inspection F432-003-3:2017-C01	Light Commercial ACMV Installation and Maintenance Works Inspection describes the competency in monitoring and evaluating installation & maintenance works or project from beginning to completion in accordance with M&E consultant specifications in compliance with MS 1525:2014 and ASHRAE Guidelines. A competent person in this CU shall be able to identify Light Commercial ACMV installation and maintenance works requirements, inspect Light Commercial ACMV installation and maintenance works, identify Light Commercial ACMV installation and maintenance works non-compliance issue, and	1. Identify Light Commercial ACMV installation and maintenance works requirements	1.1 ACMV installation specifications and related standard interpreted according to operation requirements 1.2 ACMV equipment installation and operation checklist prepared as per work requirements 1.3 Method of inspection (visual, physical and testing) determined as per quality control measure
		2. Inspect Light Commercial ACMV installation and maintenance works	2.1 Installation location, equipment, drain pipe, refrigerant pipe and electrical supply checked against installation specifications and related standard 2.2 Accuracy and workmanship of bracket installation checked against work specification and related standard 2.3 Electrical switch board performance confirmed based on inspection and testing result

CU TITLE & CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
	prepare Light Commercial ACMV installation and maintenance works inspection report. The outcome of this competency is the ability to ensure workmanship and response time to issues related to Light Commercial ACMV installation & maintenance works are in compliance with work specifications and regulatory body requirements.		2.4 Electrical control component functionality confirmed based on inspection and testing result 2.5 Air conditioning system functionality confirmed as per work specification and related standard
		3. Identify Light Commercial ACMV installation and maintenance works non-compliance issue	3.1 Root cause to non-compliance issue identified based on troubleshooting result 3.2 Solution to non-compliance issue recommended based on inspection result 3.3 Rectification work assigned to subordinates and work progress monitored 3.4 Air conditioning testing and commissioning coordinated as per work requirement 3.5 Cleanliness and tidiness of work area, tools & equipment storage area confirmed as per site safety and housekeeping requirement
		4. Prepare Light Commercial ACMV installation and maintenance works inspection report	4.1 Light Commercial ACMV installation and maintenance works compliance recorded according to required format 4.2 Light Commercial ACMV installation and maintenance works non-compliance recorded according to required format

CU TITLE & CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
			4.3 Light Commercial ACMV rectification work and work progress recorded according to required format 4.4 Light Commercial ACMV testing and commissioning activities recorded according to required format 4.5 Inspection report prepared and submitted timely and in compliance with required format

CU TITLE & CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
2. ACMV Ducting Installation Works Inspection F432-003-3:2017-C02	ACMV Ducting Installation Works Inspection describes the competency in monitoring and evaluating ducting works installation or project from beginning to completion in accordance with M&E consultant specifications in compliance with MS 1525:2014 and ASHRAE Guidelines. A competent person in this CU shall be able to identify ACMV ducting installation works inspection requirements, inspect ducting installation works, identify ACMV ducting installation works non-compliance issue, and prepare ducting installation works inspection report. The outcome of this competency is the ability to ensure ducting workmanship and response time to issues related to ducting installation works are in compliance with work specifications and regulatory body requirements.	1. Identify ACMV ducting installation works inspection requirements	1.1 ACMV ducting installation specifications and related standard interpreted according to operation requirements 1.2 ACMV ducting installation and operation checklist prepared as per work requirements 1.3 Method of inspection (visual, physical and testing) determined as per quality control measure
		2. Inspect ACMV ducting installation works	3.1 Types of duct, duct route location, size and duct access route determined as per ducting installation specifications 3.2 Accuracy and workmanship of duct tapping off opening checked against installation specification and related standard 3.3 Durability and workmanship of joint insulated duct checked against installation specification 3.4 Fire rated coating carried out as per shop drawing and related standard 3.5 Tidiness and workmanship of ducting finishing checked against installation specification
		3. Identify ACMV ducting installation works non-compliance issue	3.1 Root cause to non-compliance issue identified based on troubleshooting result

CU TITLE & CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
			3.2 Solution to non-compliance issue recommended based on inspection result 3.3 Rectification work assigned to subordinates and work progress monitored 3.4 Air conditioning testing and commissioning coordinated as per work requirement 3.5 Cleanliness and tidiness of work area, tools & equipment storage area confirmed as per site safety and housekeeping requirement
		4. Prepare ACMV ducting installation works inspection report	4.1 ACMV ducting installation works compliance recorded according to required format 4.2 ACMV ducting installation works non-compliance recorded according to required format 4.3 ACMV ducting rectification works and work progress recorded according to required format 4.4 ACMV ducting testing and commissioning activities recorded according to required format 4.5 Inspection report prepared and submitted timely and in compliance with required format

CU TITLE & CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
3. ACMV Piping Installation Works Inspection F432-003-3:2017-C03	ACMV Piping Installation Works Inspection describes the competency in monitoring and evaluating piping works installation or project from beginning to completion in accordance with M&E consultant specifications in compliance with MS 1525:2014 and ASHRAE Guidelines. A competent person in this CU shall be able to identify ACMV piping installation works inspection requirements, inspect piping installation works, identify ACMV piping installation works non-compliance issue, and prepare piping installation works inspection report. The outcome of this competency is the ability to ensure piping workmanship and response time to issues related to piping and ducting installation works are in compliance with work specifications and regulatory body requirements.	1. Identify ACMV piping installation works inspection requirements	1.1 ACMV piping installation specifications and related standard interpreted according to operation requirements 1.2 ACMV piping installation and operation checklist prepared as per work requirements 1.3 Method of inspection (visual, physical and testing) determined as per quality control measure
		2. Inspect ACMV piping installation works	2.1 Types of pipe, pipe route location, size and access route determined as per piping installation specifications 2.2 Accuracy and workmanship of welding work checked against installation specification and related standard 2.3 Accuracy and workmanship of flanges work checked against installation specification and related standard 2.4 Accuracy and workmanship of flexible joint work (single bellow / double bellow) checked against installation specification and related standard

CU TITLE & CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
		3. Identify ACMV piping installation works non-compliance issue	3.1 Root cause to non-compliance issue identified based on troubleshooting result 3.2 Solution to non-compliance issue recommended based on inspection result 3.3 Rectification work assigned to subordinates and work progress monitored 3.4 Air conditioning testing and commissioning coordinated as per work requirement 3.5 Cleanliness and tidiness of work area, tools & equipment storage area confirmed as per site safety and housekeeping requirement
		4. Prepare ACMV piping installation works inspection report	4.1 ACMV piping installation works compliance recorded according to required format 4.2 ACMV piping installation works non-compliance recorded according to required format 4.3 ACMV piping rectification works and work progress recorded according to required format 4.4 ACMV piping testing and commissioning activities recorded according to required format 4.5 Inspection report prepared and submitted timely and in compliance with required format

CU TITLE & CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
4. ACMV System Service & Maintenance Works Inspection F432-003-3:2017-C04	ACMV System Service & Maintenance Works Inspection describes the competency in monitoring and evaluating servicing & maintenance works or project from beginning to completion in accordance with M&E consultant specifications in compliance with MS 1525:2014 and ASHRAE Guidelines. A competent person in this CU shall be able to prepare ACMV system service & maintenance works inspection requirements, inspect ACMV system service & maintenance works, identify ACMV system service & maintenance works non-compliance issue, and prepare ACMV system service & maintenance works inspection report. The outcome of this competency is the ability to ensure ACMV system service & maintenance workmanship and response time to issues related to servicing & maintenance works are in compliance with work	1. Prepare ACMV system service & maintenance works inspection requirements	1.1 Type and purpose of ACMV service & maintenance works determined based on work order and client requirements 1.2 ACMV system service & maintenance specifications and related standard interpreted according to operation requirements 1.3 ACMV system service & maintenance checklist prepared as per operation requirements 1.4 Method of inspection (visual, physical and testing) determined as per quality control measure
		2. Inspect ACMV system service & maintenance works	2.1 Air distribution system functionality confirmed as per ACMV operation requirement 2.2 Refrigerant piping system functionality confirmed as per ACMV operation requirement 2.3 Water piping system functionality confirmed as per ACMV operation requirement 2.4 Condenser or chilled water pump motor system functionality confirmed as per ACMV operation requirement 2.5 Optimum performance, reliability of ACMV system and efficiency of

CU TITLE & CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
	specifications and regulatory body requirements.		service & maintenance confirmed based on inspection result
		3. Identify ACMV system service & maintenance works non-compliance issue	3.1 Root cause to non-compliance issue identified based on troubleshooting result 3.2 Solution to non-compliance issue recommended based on inspection result 3.3 Rectification work assigned to subordinates and work progress monitored 3.4 Air conditioning testing and commissioning coordinated as per work requirement 3.5 Cleanliness and tidiness of work area, tools & equipment storage area confirmed as per site safety and housekeeping requirement
		4. Prepare ACMV system service & maintenance works inspection report	4.1 ACMV system service & maintenance works compliance recorded according to required format 4.2 ACMV system service & maintenance works non-compliance recorded according to required format 4.3 ACMV system service & maintenance rectification works and work progress recorded

CU TITLE & CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
			according to required format 4.4 Air conditioning testing and commissioning activities recorded according to required format 4.5 Inspection report prepared and submitted timely and in compliance with required format

CU TITLE & CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
5. Heavy Commercial ACMV Installation Supervision F432-003-3:2017-C05	Heavy Commercial ACMV Installation Supervision describes the competency in organising and executing installation of air conditioning equipment, and electrical wiring according to M&E consultant specifications in compliance with MS 1525:2014 and ASHRAE Guidelines. A competent person in this CU shall be able to Verify installation work requirements, Coordinate installation initial preparation, Perform air conditioning equipment installation, Perform ACMV pipes works installation, Perform ACMV electrical wiring installation works, Perform air conditioning testing and commissioning, and Coordinate ACMV system service and maintenance activities. The outcome of this competency is the ability to control the installation works and ensure compliance of work specifications and regulatory body requirements.	1. Verify installation work requirements	1.1 Site location, work time frame and manpower confirmed according to work instructions 1.2 Work area, facilities and amenities safety compliance confirmed according to site safety requirements 1.3 Related acts or regulation compliance confirmed as per work requirements 1.4 Related Personal Protective Equipment (PPE) requirements compliance confirmed as per work requirements
		2. Coordinate installation initial preparation	2.1 ACMV installation initial preparation checklist prepared 2.2 Manpower, tools, equipment and materials for refrigerant piping penetration and installation works arranged as per shop drawing 2.3 Manpower, tools, equipment and materials for ACMV wiring penetration and installation works arranged as per shop drawing 2.4 Manpower, tools, equipment and materials for ACMV equipment installation works ` arranged as per shop drawing 2.5 Manpower, tools, equipment and materials for ACMV control

CU TITLE & CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
			devices installation works arranged as per shop drawing 2.6 Installation access route determined as per work requirement 2.7 Cleanliness and tidiness of work area confirmed as per site safety requirement
		3. Supervise ACMV equipment installation	3.1 Air conditioning equipment installation location confirmed as per installation layout plan shop drawing 3.2 Accuracy and workmanship of Fan Coil Unit (FCU), Air Handling Unit (AHU), cooling tower, chiller unit, chilled water / condenser water pump and air conditioning bracket installation works checked against work specifications and related standard 3.3 Air conditioning pipe final connection works verified as per shop drawing 3.4 Air conditioning equipment finishing works carried out as per shop drawing 3.5 Cleanliness and tidiness of work area confirmed as per site safety requirement

CU TITLE & CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
		4. Supervise ACMV pipes works installation	4.1 Accuracy and workmanship of refrigerant pipe bracket installation works checked against pipe drawing and related standard 4.2 Durability and workmanship of refrigerant pipe insulation works checked against work specifications and related standard 4.3 Materials, size and quantity of pipe checked against pipe drawing 4.4 Accuracy and workmanship of piping installation works checked against pipe drawing and related standard 4.5 Accuracy and workmanship of drain pipe installation works checked against pipe drawing and related standard 4.6 Cleanliness and tidiness of work area confirmed as per site safety requirement
		5. Perform ACMV electrical wiring installation works	5.1 Functionality of air conditioning control wiring confirmed as per electrical schematic drawing 5.2 Incoming power supply confirmed as per work specifications and related standard 5.3 Air conditioning power supply connection and termination carried out as per electrical schematic

CU TITLE & CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
			drawing 5.4 Cleanliness and tidiness of work area confirmed as per site safety requirement
		6. Perform ACMV system testing and commissioning	6.1 Air conditioning refrigerant system compliance verified based on testing result and related standard 6.2 ACMV refrigerant system compliance and functionality confirmed according to testing and commissioning procedure 6.3 Testing and commissioning activities carried out according to manufacturing standard and specifications 6.4 Cleanliness and tidiness of work area confirmed as per site safety requirement
		7. Supervise ACMV system service and maintenance activities	7.1 Maintenance schedule prepared based on operation needs and manpower availability 7.2 Manpower, tools, equipment and materials arranged as per service and maintenance logistics requirements 7.3 Service and maintenance works delegated to subordinates based on work schedule

CU TITLE & CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
			7.4 Service and maintenance works progress monitored based on work schedule 7.5 Ad-hoc service and maintenance works carried out (if required) 7.6 Cleanliness and tidiness of work area, tools & equipment storage area confirmed as per site safety and housekeeping requirement 7.7 Service and maintenance report / record prepared and submitted timely and in compliance with required format

CU TITLE & CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
6. ACMV Supervisory Functions F432-003-3:2017-C06	ACMV Supervisory Functions describes the competency in executing administrative responsibilities and to enforce SOP. This competency unit outlines work scope of administrative functions as stipulated in company's job descriptions and SOP. The person who is competent in this competency unit shall be able to coordinate PTW application, check work place safety, confirm facilities and equipment functionality, prepare job schedule, perform internal communication activities, maintain unit/section stock inventory, carry out subordinate appraisal, conduct on job training/coaching and support HR administration. The outcome of this competency is to perform supervisory duties to support operation according to company's requirements and scope of work.	1. Coordinate PTW application	1.1 Types of Permit To Work (PTW) for hot work, cold work, working at height or working at confined space differentiated as per site requirements 1.2 Workflow of Permit To Work (PTW) application interpreted as per PTW requirements 1.3 Supporting documentations arranged as per PTW requirements 1.4 Submission of PTW and Job Safety Analysis (JSA) coordinated according to work schedule 1.5 Status of application followed up in compliance with project timeline 1.6 PTW approval confirmed as per project requirement
		2. Supervise work place safety and hygiene	2.1 Work place safety, hygiene and maintenance monitored as per job description 2.2 Work place incidences investigated according to company's SOP 2.3 Staff safety requirements complied as per safety and health requirements 2.4 Waste disposal activities coordinated according to company's SOP and regulatory

CU TITLE & CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
			bodies requirements 2.5 Work place safety, hygiene and maintenance report prepared according to company's SOP
		3. Prepare job schedule	3.1 Types and function of scheduling determined as per company's scheduling procedure 3.2 Scope of work & job descriptions interpreted as per company's scheduling procedure 3.3 Subordinates competency status validated as per operation requirements 3.4 Number of manpower verified as per staffing record 3.5 Personnel assigned for duty as per operations requirements 3.6 Duty roster / jobs schedule generated based on operations requirements
		4. Perform internal communication activities	4.1 Daily staff briefing conducted as per operation requirement 4.2 Current operational issues communicated during daily staff briefing 4.3 Unit meeting conducted as per meeting procedure 4.4 Agenda of meeting discussed as per meeting procedure

CU TITLE & CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
			4.5 Internal communication activities documented for future reference 4.6 Action carried out as per meeting resolution
		5. Check equipment and materials stock inventory	5.1 Operational stock determined based on inventory record 5.2 Stock level checked against inventory record 5.3 Volume for stock replenishment / replacement determined based on stock checking result 5.4 Stock replenishment / replacement requested according to stock requisition procedure 5.5 Equipment and materials stock replenished / replaced based on requisition 5.6 Inventory record updated as per inventory control procedure
		6. Carry out subordinate appraisal	6.1 Appraisal objective (salary increment, promotion, incentive, etc.) determined 6.2 Appraisal schedule and related documentations checked to determine personnel to be appraised 6.3 Subordinates appraised according to schedule and guideline 6.4 Appraisal results calculated,

CU TITLE & CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
			documented, and recommendation made in accordance with company's SOP and HR guidelines
		7. Conduct on job training / coaching	7.1 Personnel identified and selected based on staff performance report 7.2 Training method determined as per performance enhancement requirements 7.3 Training facilities coordinated in accordance with training programme 7.4 Training effectiveness evaluated based on participants' feedback 7.5 Personnel work performance followed up and progress recorded 7.6 Personnel record updated based on training requirements
		8. Support HR administration	8.1 Type of staffing matters inclusive of leave application, medical claim & training determined as per job function 8.2 Status of staff application for leave confirmed as per job schedule 8.3 Staff medical claim assessed as per company's operation procedure 8.4 Staff welfare activities coordinated as per company's terms & conditions 8.5 New staff orientation activities conducted as per human resource guidelines

CURRICULUM OF COMPETENCY UNIT

NATIONAL OCCUPATIONAL SKILLS STANDARD (NOSS) FOR:

AIR-CONDITIONING AND MECHANICAL VENTILATION INSTALLATION & MAINTENANCE OPERATION SUPERVISION

LEVEL 3

15. Curriculum of Competency Unit

15.1. Light Commercial ACMV Installation & Maintenance Works Inspection

SECTION	(F) Construction		
GROUP	(432) Electrical, Plumbing And Other Construction Installation Activities		
AREA	Air-Conditioning And Mechanical Ventilation (ACMV)		
NOSS TITLE	Air-Conditioning And Mechanical Ventilation Installation & Maintenance Operation Supervision		
COMPETENCY UNIT TITLE	Light Commercial ACMV Installation & Maintenance Works Inspection		
LEARNING OUTCOMES	The person who is competent in this CU shall be able to ensure workmanship and response time to issues related to Light Commercial ACMV installation & maintenance works are in compliance with work specifications and regulatory body requirements. Upon completion of this competency units, trainees will be able to:- 1. Identify Light Commercial ACMV installation and maintenance works requirements 2. Inspect Light Commercial ACMV installation and maintenance works 3. Identify Light Commercial ACMV installation and maintenance works non-compliance issue 4. Prepare Light Commercial ACMV installation and maintenance works inspection report		
TRAINING PRE-REQUISITE	NIL		
CU CODE	F432-003-3:2017-C01	NOSS LEVEL	3

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
1. Identify Light Commercial ACMV installation and maintenance works requirements	1.1 ACMV light commercial installation and operation specifications such as • Installation location • ACMV equipment ▪ Air cooled ▪ Water cooled • Electrical supply 1.2 ACMV equipment installation and	1.1 Interpret ACMV installation specifications and related standard 1.2 Prepare ACMV equipment installation and operation checklist 1.3 Determine method of inspection	<u>ATTITUDE</u> • Resourceful in gathering data or information • Timely in completing tasks • Systematic in organizing work <u>SAFETY</u> • Cautious when handling tools, equipment and materials	1.1 ACMV equipment installation and operation checklist format and content described and applied 1.2 ACMV light commercial installation and operation specifications described and applied 1.3 Method of inspection described and applied

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	operation checklist format and contents 1.3 Method of inspection such as • Visual • Physical • Testing ▪ Leakage ▪ Insulation ▪ Continuity		• Wear related PPE during inspection works <u>ENVIRONMENT</u> • Ensure compliance with related environmental regulations	
2. Inspect light commercial ACMV installation and maintenance works	2.1 Installation works checking parameter such as • Accuracy of installation location • Compliance of specifications • Workmanship • ACMV equipment functionality	2.1 Check installation location, equipment, drain pipe, refrigerant pipe and electrical supply 2.2 Check accuracy and workmanship of bracket installation 2.3 Check electrical switch board performance 2.4 Check electrical control component functionality 2.5 Confirm air conditioning system functionality	<u>ATTITUDE</u> • Attentive to details in validating works of subordinates • Timely in completing tasks • Systematic in organizing work <u>SAFETY</u> • Cautious when handling tools, equipment and materials • Wear related PPE during inspection works <u>ENVIRONMENT</u> • Ensure compliance with related environmental regulations	2.1 Installation location, equipment, drain pipe, refrigerant pipe and electrical supply confirmed and justified 2.2 Accuracy and workmanship of bracket installation confirmed and justified 2.3 Electrical switch board performance confirmed and justified 2.4 Electrical control component functionality confirmed and justified 2.5 Air conditioning system functionality confirmed and justified

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
3. Identify Light Commercial ACMV installation and maintenance works non-compliance issue	3.1 Method and procedure of troubleshooting 3.2 Types of non-compliance issues such as • Faulty part • Non matching parts • ACMV system under performance 3.3 ACMV system testing and commissioning procedure	3.1 Identify root cause to non-compliance issue 3.2 Recommend solution to non-compliance issue 3.3 Assign rectification work to subordinates 3.4 Monitor work progress 3.5 Coordinate air conditioning testing and commissioning 3.6 Check cleanliness and tidiness of work area, tools & equipment storage area requirement	<u>ATTITUDE</u> • Attentive to details in validating works of subordinates • Timely in completing tasks • Systematic in organizing work <u>SAFETY</u> • Cautious when handling tools, equipment and materials • Wear related PPE during inspection works <u>ENVIRONMENT</u> • Ensure compliance with related environmental regulations	3.1 Method and procedure of troubleshooting described and applied 3.2 Types of non-compliance issues listed and explained 3.3 Root cause to non-compliance issue identified based on troubleshooting result 3.4 Solution to non-compliance issue recommended based on inspection result 3.5 Rectification work assigned to subordinates and work progress monitored 3.6 Air conditioning testing and commissioning coordinated as per work requirement 3.7 Cleanliness and tidiness of work area, tools & equipment storage area confirmed as per site safety and housekeeping requirement

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
4. Prepare Light Commercial ACMV installation and maintenance works inspection report	4.1 Inspection report format and contents 4.2 Reporting procedure 4.3 The importance of record keeping	4.1 Record Light Commercial ACMV installation and maintenance works compliance 4.2 Record Light Commercial ACMV installation and maintenance works non-compliance 4.3 Record Light Commercial ACMV rectification work and work progress 4.4 Record Light Commercial ACMV testing and commissioning activities 4.5 Complete inspection report	ATTITUDE • Precise in reporting inspection result • Timely in completing tasks • Systematic in organizing work	4.1 Inspection report format and contents described and applied 4.2 Light Commercial ACMV installation and maintenance works compliance recorded 4.3 Light Commercial ACMV installation and maintenance works non-compliance recorded 4.4 Light Commercial ACMV rectification work and work progress recorded 4.5 Light Commercial ACMV testing and commissioning activities recorded 4.6 Inspection report prepared and submitted timely

Employability Skills

Core Abilities

- Basic Working Communication
- Personal Behaviour Skill
- Work Place Ethics Awareness
- Safety Health And Environment Awareness

Social Values & Social Skills

- Communication skills
- Conceptual skills
- Interpersonal skills
- Learning skills
- Leadership skills
- Multitasking and prioritising
- Self-discipline
- Teamwork

References for Learning Material Development

1 Adithan, M., Laroiya, S.C. 2002. Penyejukan Dan Penyamanan Udara Praktikal. IBS Buku Sdn Bhd. ISBN: 967950154X
2 Althouse, A.D., Turnquist, C.H and Branciano, D.C. 2003. Modern Refrigeration and Air-Conditioning. 18th ed. Goodheart-Willcox Co. ISBN: 1590702808.
3 Atwood, T., Sheldon, P.E. & Fuchs, J.1993. Air Conditioning and Refrigeration Piping Systems. TPC Training System
4 Boylested, R.L. 2014. Introductory Circuit Analysis. Pearson Education Ltd. ISBN: 9780137146666
5 Chadderton, D.V. 2014. Air Conditioning: A Practical Introduction. Routledge. ISBN: 9781317743392
6 Dossat, R.J. and Horan, T.J. 2001. Principles of Refrigeration. 5th ed. Pearson. ISBN: 9780130272706
7 Fahruddin, A. & Sidek, S. 2007. Operation Manual and Study Guide for RSS Technicians. Department of Environment
8 Jenneson, J.R. 2002. Electrical Principles for the Electrical Trades. 5th edition. McGraw-Hill Australia. ISBN 10: 0074711563
9 Moravek, J. 2000. Air Conditioning System Principle, Equipment and Service. Prentice Hall. ISBN-10: 0135179211
10 Roulet, C-A. 2012. Ventilation and Airflow in Buildings: Methods for Diagnosis and Evaluation. BEST (Buildings Energy and Solar Technology) Series. Earthscan. ISBN: 9781849773713
11 Smith, R.E. 2010. Electricity for Refrigeration, Heating and Air Conditioning. 8th ed. ISBN: 9781111038748
12 Whitman, W.C and Johnson, W.M. 2012. Refrigeration & Air-Conditioning Technology. 7th ed. Delmar Cengage Learning. ISBN: 1111644489
13 Occupational Safety and Health Act 1994 (Act 514)
14 Electricity Supply Act 1990
15 Environmental Quality Act 1974 (Amendment 2012)
16 Factory & Machineries Act 1967 (Act 139)
17 Uniform Building By-Law 1984 (UBBL)

15.2. ACMV Ducting Installation Works Inspection

SECTION	(F) Construction		
GROUP	(432) Electrical, Plumbing And Other Construction Installation Activities		
AREA	Air-Conditioning And Mechanical Ventilation (ACMV)		
NOSS TITLE	Air-Conditioning And Mechanical Ventilation Installation & Maintenance Operation Supervision		
COMPETENCY UNIT TITLE	ACMV Ducting Installation Works Inspection		
LEARNING OUTCOMES	The person who is competent in this CU shall be able to ensure ducting workmanship and response time to issues related to ducting installation works are in compliance with work specifications and regulatory body requirements. Upon completion of this competency units, trainees will be able to:- 1. Identify ACMV ducting installation works inspection requirements 2. Inspect ACMV ducting installation works 3. Identify ACMV ducting installation works non-compliance issue 4. Prepare ACMV ducting installation works inspection report		
TRAINING PRE-REQUISITE	NIL		
CU CODE	F432-003-3:2017-C02	NOSS LEVEL	3

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
1. Identify ACMV ducting installation works inspection requirements	1.1 ACMV ducting installation and maintenance checklist format and content 1.2 ACMV ducting installation specifications such as • Duct materials • Duct size 1.3 Method of ACMV ducting inspection such as	1.1 Interpret ACMV ducting drawing and specifications 1.2 Prepare ACMV ducting installation checklist 1.3 Determine method of inspection	<u>ATTITUDE</u> • Attentive to details in validating works of subordinates • Alert to issue of non-compliance • Timely in completing tasks • Systematic in organizing work <u>SAFETY</u>	1.1 ACMV ducting installation and maintenance checklist format and content described and applied 1.2 ACMV ducting installation specifications described and applied 1.3 Method of inspection described and applied

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Visual • Physical • Testing ▪ Air flow ▪ Static pressure ▪ Noise level		• Cautious when handling tools, equipment and materials • Wear related PPE during inspection works <u>ENVIRONMENT</u> • Ensure compliance with related environmental regulations	
2. Inspect ACMV ducting installation works	3.1 ACMV ducting installation work checking parameter such as • Compliance of ducting specifications • Ducting workmanship 3.2 ACMV ducting testing procedure 3.3 ACMV ducting inspection report format and contents	3.1 Identify types of duct, duct route location, size and duct access route 3.2 Check accuracy and workmanship of duct tapping off opening 3.3 Check durability and workmanship of joint insulated duct 3.4 Carry out fire rated coating as per shop drawing and related standard 3.5 Check tidiness and workmanship of ducting finishing	<u>ATTITUDE</u> • Attentive to details in validating works of subordinates • Timely in completing tasks • Systematic in organizing work <u>SAFETY</u> • Cautious when handling tools, equipment and materials • Wear related PPE during inspection works <u>ENVIRONMENT</u> • Ensure compliance with related environmental regulations	3.1 ACMV ducting installation works checking parameter listed and executed 3.2 Accuracy and workmanship of ducting installation confirmed and justified 3.3 Air conditioning system functionality confirmed and justified 3.4 Cleanliness and tidiness of work area, tools & equipment storage area confirmed as per site safety and housekeeping requirement

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
3. Identify ACMV ducting installation works non-compliance issue	4.1 Method and procedure of troubleshooting 4.2 Types of non-compliance issues such as • Faulty part • Non matching parts • ACMV system under performance 4.3 ACMV system testing and commissioning procedure	4.1 Identify root cause to non-compliance issue 4.2 Recommend solution to non-compliance issue 4.3 Assign rectification work to subordinates 4.4 Monitor work progress 4.5 Coordinate air conditioning testing and commissioning 4.6 Check cleanliness and tidiness of work area, tools & equipment storage area requirement	ATTITUDE • Attentive to details in validating works of subordinates • Timely in completing tasks • Systematic in organizing work SAFETY • Cautious when handling tools, equipment and materials • Wear related PPE during inspection works ENVIRONMENT • Ensure compliance with related environmental regulations	4.1 Method and procedure of troubleshooting described and applied 4.2 Types of non-compliance issues listed and explained 4.3 Root cause to non-compliance issue identified based on troubleshooting result 4.4 Solution to non-compliance issue recommended based on inspection result 4.5 Rectification work assigned to subordinates and work progress monitored 4.6 Air conditioning testing and commissioning coordinated as per work requirement 4.7 Cleanliness and tidiness of work area, tools & equipment storage area confirmed as per site safety and housekeeping requirement

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
4. Prepare ACMV ducting installation works inspection report	5.1 Inspection report format and contents 5.2 Reporting procedure 5.3 The importance of record keeping	5.1 Record ACMV ducting installation and maintenance works compliance 5.2 Record ACMV ducting installation non-compliance 5.3 Record ACMV ducting rectification work and work progress 5.4 Record ACMV ducting testing and commissioning activities 5.5 Complete inspection report	ATTITUDE • Precise in reporting inspection result • Timely in completing tasks • Systematic in organizing work	5.1 Inspection report format and contents described and applied 5.2 ACMV ducting installation works compliance recorded 5.3 ACMV ducting installation works non-compliance recorded 5.4 ACMV ducting rectification work and work progress recorded 5.5 ACMV ducting testing and commissioning activities recorded 5.6 Inspection report prepared and submitted timely

Employability Skills

Core Abilities

- Basic Working Communication
- Personal Behaviour Skill
- Work Place Ethics Awareness
- Safety Health And Environment Awareness

Social Values & Social Skills

- Communication skills
- Conceptual skills
- Interpersonal skills
- Learning skills
- Leadership skills
- Multitasking and prioritising
- Self-discipline
- Teamwork

References for Learning Material Development

1 Adithan, M., Laroiya, S.C. 2002. Penyejukan Dan Penyamanan Udara Praktikal. IBS Buku Sdn Bhd. ISBN: 967950154X
2 Althouse, A.D., Turnquist, C.H and Branciano, D.C. 2003. Modern Refrigeration and Air-Conditioning. 18th ed. Goodheart-Willcox Co. ISBN: 1590702808.
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12 Whitman, W.C and Johnson, W.M. 2012. Refrigeration & Air-Conditioning Technology. 7th ed. Delmar Cengage Learning. ISBN: 1111644489
13 Occupational Safety and Health Act 1994 (Act 514)
14 Electricity Supply Act 1990
15 Environmental Quality Act 1974 (Amendment 2012)
16 Factory & Machineries Act 1967 (Act 139)
17 Uniform Building By-Law 1984 (UBBL)

15.3. ACMV Piping Installation Works Inspection

SECTION	(F) Construction		
GROUP	(432) Electrical, Plumbing And Other Construction Installation Activities		
AREA	Air-Conditioning And Mechanical Ventilation (ACMV)		
NOSS TITLE	Air-Conditioning And Mechanical Ventilation Installation & Maintenance Operation Supervision		
COMPETENCY UNIT TITLE	ACMV Piping Installation Works Inspection		
LEARNING OUTCOMES	The person who is competent in this CU shall be able to ensure piping workmanship and response time to issues related to piping installation works are in compliance with work specifications and regulatory body requirements. Upon completion of this competency units, trainees will be able to:- 1. Identify ACMV piping installation works inspection requirements 2. Inspect ACMV piping installation works 3. Identify ACMV piping installation works non-compliance issue 4. Prepare ACMV piping installation works inspection report		
TRAINING PRE-REQUISITE	NIL		
CU CODE	F432-003-3:2017-C03	NOSS LEVEL	3

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
1. Identify ACMV piping installation works inspection requirements	1.1 ACMV piping installation and maintenance checklist format and content 1.2 ACMV piping installation specifications such as • Pipe materials • Pipe size 1.3 Method of ACMV piping inspection such as	1.1 Interpret ACMV piping drawing and specifications 1.2 Prepare ACMV piping installation checklist 1.3 Determine method of inspection	<u>ATTITUDE</u> • Attentive to details in validating works of subordinates • Alert to issue of non-compliance • Timely in completing tasks • Systematic in organizing work <u>SAFETY</u>	1.1 ACMV piping installation and maintenance checklist format and content described and applied 1.2 ACMV piping installation specifications described and applied 1.3 Method of inspection described and applied

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Visual • Physical • Testing ▪ Water pressure ▪ Leakage		• Cautious when handling tools, equipment and materials • Wear related PPE during inspection works <u>ENVIRONMENT</u> • Ensure compliance with related environmental regulations	
2. Inspect ACMV piping installation works	2.1 ACMV piping installation work checking parameter such as • Compliance of piping specifications • Piping installation workmanship 2.2 ACMV piping testing procedure 2.3 ACMV piping inspection report format and contents	2.1 Identify types of pipe, pipe route location, size and access route 2.2 Check accuracy and workmanship of welding work 2.3 Check accuracy and workmanship of flanges work 2.4 Check accuracy and workmanship of flexible joint work (single bellow / double bellow)	<u>ATTITUDE</u> • Attentive to details in validating works of subordinates • Timely in completing tasks • Systematic in organizing work <u>SAFETY</u> • Cautious when handling tools, equipment and materials • Wear related PPE during inspection works <u>ENVIRONMENT</u> • Ensure compliance with related environmental regulations	2.1 ACMV piping installation works checking parameter listed and executed 2.2 Accuracy and workmanship of piping installation confirmed and justified 2.3 ACMV piping testing and commissioning coordination executed 2.4 Cleanliness and tidiness of work area, tools & equipment storage area confirmed as per site safety and housekeeping requirement

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
3. Identify ACMV piping installation works non-compliance issue	3.1 Method and procedure of troubleshooting 3.2 Types of non-compliance issues such as • Faulty part • Non matching parts • ACMV system under performance 3.3 ACMV system testing and commissioning procedure	3.1 Identify root cause to non-compliance issue 3.2 Recommend solution to non-compliance issue 3.3 Assign rectification work to subordinates 3.4 Monitor work progress 3.5 Coordinate air conditioning testing and commissioning 3.6 Check cleanliness and tidiness of work area, tools & equipment storage area requirement	<u>ATTITUDE</u> • Attentive to details in validating works of subordinates • Timely in completing tasks • Systematic in organizing work <u>SAFETY</u> • Cautious when handling tools, equipment and materials • Wear related PPE during inspection works <u>ENVIRONMENT</u> • Ensure compliance with related environmental regulations	3.1 Method and procedure of troubleshooting described and applied 3.2 Types of non-compliance issues listed and explained 3.3 Root cause to non-compliance issue identified based on troubleshooting result 3.4 Solution to non-compliance issue recommended based on inspection result 3.5 Rectification work assigned to subordinates and work progress monitored 3.6 Air conditioning testing and commissioning coordinated as per work requirement 3.7 Cleanliness and tidiness of work area, tools & equipment storage area confirmed as per site safety and housekeeping requirement

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
4. Prepare ACMV piping installation works inspection report	4.1 Inspection report format and contents 4.2 Reporting procedure 4.3 The importance of record keeping	4.1 Record ACMV piping installation and maintenance works compliance 4.2 Record ACMV piping installation non-compliance 4.3 Record ACMV piping rectification work and work progress 4.4 Record ACMV piping testing and commissioning activities 4.5 Complete inspection report	ATTITUDE • Precise in reporting inspection result • Timely in completing tasks • Systematic in organizing work	4.1 Inspection report format and contents described and applied 4.2 ACMV piping installation works compliance recorded 4.3 ACMV piping installation works non-compliance recorded 4.4 ACMV piping rectification work and work progress recorded 4.5 ACMV piping testing and commissioning activities recorded 4.6 Inspection report prepared and submitted timely

Employability Skills

Core Abilities

- Basic Working Communication
- Personal Behaviour Skill
- Work Place Ethics Awareness
- Safety Health And Environment Awareness

Social Values & Social Skills

- Communication skills
- Conceptual skills
- Interpersonal skills
- Learning skills
- Leadership skills
- Multitasking and prioritising
- Self-discipline
- Teamwork

References for Learning Material Development

1 Adithan, M., Laroiya, S.C. 2002. Penyejukan Dan Penyamanan Udara Praktikal. IBS Buku Sdn Bhd. ISBN: 967950154X
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14 Electricity Supply Act 1990
15 Environmental Quality Act 1974 (Amendment 2012)
16 Factory & Machineries Act 1967 (Act 139)
17 Uniform Building By-Law 1984 (UBBL)

15.4. ACMV System Service & Maintenance Works Inspection

SECTION	(F) Construction		
GROUP	(432) Electrical, Plumbing And Other Construction Installation Activities		
AREA	Air-Conditioning And Mechanical Ventilation (ACMV)		
NOSS TITLE	Air-Conditioning And Mechanical Ventilation Installation & Maintenance Operation Supervision		
COMPETENCY UNIT TITLE	ACMV System Service & Maintenance Works Inspection		
LEARNING OUTCOMES	The person who is competent in this CU shall be able to ensure ACMV system service & maintenance workmanship and response time to issues related to servicing & maintenance works are in compliance with work specifications and regulatory body requirements. Upon completion of this competency units, trainees will be able to:- 1. Prepare ACMV system service & maintenance works inspection requirements 2. Inspect ACMV system service & maintenance works 3. Identify ACMV system service & maintenance works non-compliance issue 4. Prepare ACMV system service & maintenance works inspection report		
TRAINING PRE-REQUISITE	NIL		
CU CODE	F432-003-3:2017-C04	NOSS LEVEL	3

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
1. Prepare ACMV system service & maintenance works inspection requirements	1.1 ACMV maintenance instruction checklist format and content 1.2 ACMV system service & maintenance manual 1.3 Type of service & maintenance works such as • Cleaning • Lubrication • Repair	1.1 Interpret work order and client requirements 1.2 Interpret service and maintenance plan schedule 1.3 Determine type and purpose of ACMV service & maintenance works 1.4 Prepare ACMV maintenance	ATTITUDE • Resourceful in gathering information • Timely in completing tasks • Systematic in organizing work SAFETY • Cautious when handling tools, equipment and materials	1.1 ACMV maintenance instruction checklist format and content described and applied 1.2 ACMV system service & maintenance manual described and applied 1.3 Type of service & maintenance works listed and explained 1.4 ACMV system service & maintenance specifications

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Replacement • Adjustment • Refurbishment • Modification 1.4 Method of inspection such as • Visual • Physical	instruction checklist 1.5 Assign service & maintenance works to subordinates 1.6 Determine method of ACMV system service & maintenance works inspection	• Wear related PPE during inspection works <u>ENVIRONMENT</u> • Ensure compliance with related environmental regulations	and related standard interpreted according to operation requirements 1.5 ACMV system service & maintenance checklist prepared as per operation requirements 1.6 Method of inspection (visual, physical and testing) determined as per quality control measure

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
2. Inspect ACMV system service & maintenance works	2.1 ACMV service & maintenance work checking parameter such as • Accuracy of ACMV service & maintenance location • Compliance of ACMV service & maintenance specifications • ACMV service & maintenance workmanship	2.1 Monitor progress of service & maintenance works 2.2 Check air distribution system functionality 2.3 Check refrigerant piping system functionality 2.4 Check water piping system functionality 2.5 Check condenser or chilled water pump motor system functionality 2.6 Verify optimum performance, reliability of ACMV system and efficiency of service & maintenance 2.7 Monitor work area housekeeping, tools & equipment storage	<u>ATTITUDE</u> • Attentive to details in validating works of subordinates • Timely in completing tasks • Systematic in organizing work <u>SAFETY</u> • Cautious when handling tools, equipment and materials • Wear related PPE during inspection works <u>ENVIRONMENT</u> • Ensure compliance with related environmental regulations	2.1 ACMV service & maintenance work checking parameter described and applied 2.2 Air distribution system functionality checked and justified 2.3 Refrigerant piping system functionality checked and justified 2.4 Water piping system functionality checked and justified 2.5 Condenser or chilled water pump motor system functionality checked and justified 2.6 Optimum performance, reliability of ACMV system and efficiency of service & maintenance confirmed and justified 2.7 Cleanliness and tidiness of work area, tools & equipment storage area checked and justified

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
3. Identify ACMV system service & maintenance works non-compliance issue	3.1 Types of non-compliance issues such as • Faulty part • Non matching parts • ACMV system under performance	3.1 Identify root cause to non-compliance issue 3.2 Recommend solution to non-compliance issue 3.3 Assign rectification work to subordinates 3.4 Monitor work progress 3.5 Conduct ACMV system testing and commissioning activities 3.6 Check cleanliness and tidiness of work area, tools & equipment storage area requirement	ATTITUDE • Attentive to details in validating works of subordinates • Timely in completing tasks • Systematic in organizing work SAFETY • Cautious when handling tools, equipment and materials • Wear related PPE during inspection works ENVIRONMENT • Ensure compliance with related environmental regulations	3.1 Method and procedure of troubleshooting described and applied 3.2 Types of non-compliance issues listed and explained 3.3 Root cause to non-compliance issue identified based on troubleshooting result 3.4 Solution to non-compliance issue recommended based on inspection result 3.5 Rectification work assigned to subordinates and work progress monitored 3.6 Air conditioning testing and commissioning activities conducted 3.7 Cleanliness and tidiness of work area, tools & equipment storage area confirmed as per site safety and housekeeping requirement

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
4. Prepare ACMV system service & maintenance works inspection report	4.1 ACMV system service & maintenance works inspection report format and contents 4.2 Reporting procedure 4.3 The importance of record keeping	4.1 Record ACMV system service & maintenance works compliance 4.2 Record ACMV system service & maintenance works non-compliance 4.3 Record ACMV system service & maintenance rectification work and work progress 4.4 Record ACMV system testing and commissioning activities 4.5 Complete inspection report	ATTITUDE • Precise in reporting inspection result • Timely in completing tasks • Systematic in organizing work	4.1 Inspection report format and contents described and applied 4.2 ACMV electrical installation works compliance recorded 4.3 ACMV electrical installation works non-compliance recorded 4.4 ACMV electrical rectification work and work progress recorded 4.5 ACMV electrical testing and commissioning activities recorded 4.6 Inspection report prepared and submitted timely

Employability Skills

Core Abilities

- Basic Working Communication
- Personal Behaviour Skill
- Work Place Ethics Awareness
- Safety Health And Environment Awareness

Social Values & Social Skills

- Communication skills
- Conceptual skills
- Interpersonal skills
- Learning skills
- Leadership skills
- Multitasking and prioritising
- Self-discipline
- Teamwork

References for Learning Material Development

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17 Uniform Building By-Law 1984 (UBBL)

15.5. Heavy Commercial ACMV Installation Supervision

SECTION	(F) Construction		
GROUP	(432) Electrical, Plumbing And Other Construction Installation Activities		
AREA	Air-Conditioning And Mechanical Ventilation (ACMV)		
NOSS TITLE	Air-Conditioning And Mechanical Ventilation Installation & Maintenance Operation Supervision		
COMPETENCY UNIT TITLE	Heavy Commercial ACMV Installation Supervision		
LEARNING OUTCOMES	The person who is competent in this CU shall be able to control the installation works and ensure compliance of work specifications and regulatory body requirements. Upon completion of this competency units, trainees will be able to:- 1. Verify installation work requirements 2. Coordinate installation initial preparation 3. Supervise ACMV equipment installation 4. Supervise ACMV pipes works installation 5. Perform ACMV electrical wiring installation works 6. Perform ACMV system testing and commissioning 7. Supervise ACMV system service and maintenance activities		
TRAINING PRE-REQUISITE	The personnel who are to be competent in this competency must in prior have the following competencies:- i. ACMV Piping Installation (F432-003-2:2017-C02) ii. ACMV Ducting Installation (F432-003-2:2017-C03) iii. ACMV Heavy Commercial Installation (F432-003-2:2017-C06)		
CU CODE	F432-003-3:2017-C05	NOSS LEVEL	3

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
1. Verify installation work requirements	1.1 Work instruction format and contents such as • Site location • Work time frame • Manpower 1.2 Site safety requirements such as	1.1 Interpret work instruction 1.2 Comply with site safety requirements 1.3 Comply with ACMV related standard 1.4 Comply with	ATTITUDE • Attentive to details in validating works of subordinates • Alert to issue of non-compliance • Timely in completing tasks	1.1 Work instruction format and contents elaborated and applied 1.2 Site safety requirements listed and applied 1.3 Malaysian Standard- MS 1525:2014 Code of Practice on Energy Efficiency and Use of Renewable Energy for

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Work area • Facilities • Amenities 1.3 ACMV related standard such as • Malaysian Standard- MS 1525:2014 Code of Practice on Energy Efficiency and Use of Renewable Energy for Non-Residential Buildings • American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Guidelines and Standards 1.4 Related acts or regulation (if required) such as • Occupational Safety and Health Act 1994 (Act 514) • Electricity Supply Act 1990 • Factory &	related acts or regulation (if required) 1.5 Comply with PPE	• Systematic in organizing work <u>SAFETY</u> • Cautious when handling tools, equipment and materials • Wear related PPE during inspection works <u>ENVIRONMENT</u> • Ensure compliance with related environmental regulations	Non-Residential Buildings described and applied 1.4 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Guidelines and Standards described and applied 1.5 Related acts or regulation compliance justified 1.6 Related Personal Protective Equipment (PPE) requirements compliance justified

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	Machineries Act 1967 (Act 139) • Environmental Quality Act 1974 (Amendment 2012) • Act 520 Construction Industry Development Board 1994 1.5 PPE such as • Respirator gas mask (if required) • Dust mask • Gloves • Safety boot / shoes • Goggles • Safety helmet • Safety harness (if required)			

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
2. Coordinate installation initial preparation	2.1 ACMV installation initial preparation checklist format and contents 2.2 Coordination of ACMV installation initial preparation such as • Installation access route survey • Refrigerant piping penetration works • Refrigerant piping installation works • ACMV wiring installation works • ACMV equipment installation works ` • ACMV control devices installation works • ACMV wiring penetration works 2.3 Work area housekeeping requirements such as • 5S concept • Housekeeping procedure	2.1 Prepare ACMV installation initial preparation checklist 2.2 Survey ACMV installation access route 2.3 Arrange refrigerant piping penetration works 2.4 Arrange refrigerant piping installation works 2.5 Arrange ACMV wiring installation works 2.6 Arrange ACMV equipment installation works ` 2.7 Arrange ACMV control devices installation works 2.8 Arrange wiring penetration works 2.9 Monitor work area housekeeping	<u>ATTITUDE</u> • Attentive to details in preparing work requirements • Systematic in organizing work • Timely in completing tasks • Cost conscious <u>SAFETY</u> • Cautious when handling tools, equipment and materials • Wear related PPE during work <u>ENVIRONMENT</u> • Ensure compliance with environmental regulations	2.1 ACMV installation initial preparation checklist format and contents described and applied 2.2 ACMV refrigerant piping penetration works arrangement described and executed 2.3 ACMV refrigerant piping installation works arrangement described and executed 2.4 ACMV wiring installation works arrangement described and executed 2.5 ACMV equipment installation works arrangement described and executed 2.6 ACMV control devices installation works 2.7 Arrange wiring penetration works arrangement described and executed 2.8 Cleanliness and tidiness of work area confirmed as per site safety requirement

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
3. Supervise ACMV equipment installation	3.1 Inspection parameters of ACMV equipment installation such as • Accuracy of installation location • Compliance of specifications • Workmanship 3.2 Air conditioning pipe final connection guidelines 3.3 Air conditioning equipment finishing works guidelines	3.1 Interpret ACMV equipment installation layout plan and shop drawing 3.2 Confirm ACMV equipment installation location 3.3 Inspect ACMV equipment installation works 3.4 Verify ACMV pipe final connection works 3.5 Verify ACMV ducting final connection works 3.6 Verify ACMV equipment installation works 3.7 Monitor work area housekeeping	<u>ATTITUDE</u> • Alert during monitoring works • Systematic in organizing work • Resourceful in resolving operational issues • Cost conscious <u>SAFETY</u> • Cautious when handling tools, equipment and materials • Wear related PPE during work <u>ENVIRONMENT</u> • Ensure compliance with environmental regulations	3.1 Inspection parameters of ACMV equipment installation described and applied 3.2 ACMV air conditioning pipe final connection guidelines described and applied 3.3 ACMV air conditioning equipment finishing works guidelines described and applied 3.4 Air conditioning equipment installation compliance justified 3.5 Cleanliness and tidiness of work area confirmed as per site safety requirement

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
4. Supervise ACMV pipes works installation	4.1 Inspection parameters of ACMV piping installation such as • Accuracy of installation location • Compliance of specifications • Workmanship 4.2 ACMV pipe specifications such as • Materials • Size • Quantity 4.3 Inspection parameters of ACMV piping insulation such as • Accuracy of insulation area • Compliance of insulation specifications • Workmanship	4.1 Interpret ACMV pipe drawing 4.2 Verify pipe specifications compliance 4.3 Inspect refrigerant pipe bracket installation works 4.4 Inspect refrigerant pipe insulation works 4.5 Verify piping installation works compliance 4.6 Verify drain pipe installation works compliance 4.7 Monitor work area housekeeping	<u>ATTITUDE</u> • Alert during monitoring works • Systematic in organizing work • Resourceful in resolving operational issues • Cost conscious <u>SAFETY</u> • Cautious when handling tools, equipment and materials • Wear related PPE during work <u>ENVIRONMENT</u> • Ensure compliance with environmental regulations	4.1 Inspection parameters of ACMV piping installation described and applied 4.2 ACMV pipe specifications listed and explained 4.3 Inspection parameters of ACMV piping insulation described and applied 4.4 Accuracy and workmanship of ACMV pipes installation confirmed and justified 4.5 Durability and workmanship of refrigerant pipe insulation works confirmed and justified 4.6 Cleanliness and tidiness of work area confirmed as per site safety requirement

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
5. Perform ACMV electrical wiring installation works	5.1 ACMV electrical schematic wiring procedure and guidelines 5.2 ACMV equipment control wiring functionality such as • Fan Coil Unit (FCU) • Air Handling Unit (AHU) • Cooling tower • Chiller unit • Chilled water / condenser water pump set 5.3 ACMV control devices wiring functionality such as • Flow switch • Thermostat • Motorized valve • Air vent • Damper actuator • Flow control switch • Control valve • Pressure differential sensor • Pressure differential switch (if required)	5.1 Interpret ACMV electrical schematic drawing 5.2 Verify air conditioning control wiring functionality 5.3 Verify incoming power supply 5.4 Perform air conditioning power supply connection and termination to all ACMV equipment and control devices 5.5 Monitor work area housekeeping	<u>ATTITUDE</u> • Do it right the first time • Alert during installation work • Timely in completing tasks • Cost conscious • Systematic in organizing work <u>SAFETY</u> • Cautious when handling tools, equipment and materials • Wear related PPE during installation work <u>ENVIRONMENT</u> • Ensure compliance with related environmental regulations	5.1 ACMV electrical schematic wiring procedure and guidelines described and applied 5.2 Incoming power supply ACMV electrical board checking procedure described and applied 5.3 Functionality of air conditioning control wiring confirmed and justified 5.4 Incoming power supply confirmed and justified 5.5 Air conditioning power supply connection and termination carried out as per electrical drawing and safety manual 5.6 Cleanliness and tidiness of work area confirmed as per site safety requirement

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Thermostat Control Component • Motor inverter (VFD) 5.4 Incoming power supply ACMV electrical board checking procedure 5.5 Electrical cable and equipment testing such as • Continuity • Insulation • Incoming power supply (ACMV board) 5.6 ACMV electrical cable troubleshooting such as • Replace (if required) 5.7 Work area housekeeping requirements such as • 5S Concept • Housekeeping procedure			

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
6. Perform ACMV system testing and commissioning	6.1 ACMV equipment and control devices testing and commissioning procedure 6.2 Type of ACMV refrigerant system testing such as • Leak test • Flushing • Vacuuming • Charging 6.3 Functionality of ACMV system such as • Open circuit ▪ Condenser water pump ▪ Cooling tower ▪ Flow switch • Closed circuit ▪ Chilled water pump ▪ Flow switch ▪ Thermostat ▪ Motorized valve 6.4 Final ACMV system testing and commissioning report format and content	6.1 Interpret ACMV equipment and control devices testing and commissioning procedure 6.2 Verify ACMV refrigerant system compliance 6.3 Confirm functionality of ACMV system 6.4 Carry out ACMV system testing and commissioning activities 6.5 Prepare final ACMV system testing and commissioning report 6.6 Monitor work area housekeeping	<u>ATTITUDE</u> • Accurate in recording testing result • Alert during testing work • Timely in completing tasks • Systematic in organizing work <u>SAFETY</u> • Cautious when handling tools, equipment and materials • Wear related PPE during installation work <u>ENVIRONMENT</u> • Ensure compliance with related environmental regulations	6.1 ACMV equipment and control devices testing and commissioning procedure described and applied 6.2 Type of ACMV refrigerant system testing listed and explained 6.3 Air conditioning refrigerant system compliance verified and justified 6.4 Functionality of ACMV system verified and justified 6.5 Testing and commissioning executed 6.6 Cleanliness and tidiness of work area confirmed as per site safety requirement

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
7. Supervise ACMV system service and maintenance activities	7.1 Maintenance schedule format and contents 7.2 Service and maintenance logistics requirements such as • Manpower • Tools and consumable • Materials • Equipment 7.3 Service and maintenance report / record format and contents	7.1 Interpret maintenance schedule 7.2 Prepare maintenance instruction checklist 7.3 Arrange service and maintenance logistics requirements 7.4 Delegate service and maintenance works to subordinates 7.5 Monitor service and maintenance works progress 7.6 Carry out service and maintenance ad-hoc works (if required) 7.7 Prepare service and maintenance report / record 7.8 Monitor work area housekeeping, tools & equipment storage	<u>ATTITUDE</u> • Alert during monitoring works • Systematic in organizing work • Resourceful in resolving operational issues • Cost conscious <u>SAFETY</u> • Cautious when handling tools, equipment and materials • Wear related PPE during work <u>ENVIRONMENT</u> • Ensure compliance with environmental regulations	7.1 Maintenance schedule format and contents described and applied 7.2 Service and maintenance logistics requirements listed and applied 7.3 Service and maintenance report / record format and contents described and applied 7.4 Service and maintenance works progress monitored based on work schedule 7.5 Cleanliness and tidiness of work area, tools & equipment storage area confirmed as per site safety and housekeeping requirement 7.6 Service and maintenance report / record prepared and submitted timely

Employability Skills

Core Abilities

- Basic Working Communication
- Personal Behaviour Skill
- Work Place Ethics Awareness
- Safety Health And Environment Awareness

Social Values & Social Skills

- Communication skills
- Conceptual skills
- Interpersonal skills
- Learning skills
- Leadership skills
- Multitasking and prioritising
- Self-discipline
- Teamwork

References for Learning Material Development

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15.6. ACMV Supervisory Functions

SECTION	(F) Construction		
GROUP	(432) Electrical, Plumbing And Other Construction Installation Activities		
AREA	Air-Conditioning And Mechanical Ventilation (ACMV)		
NOSS TITLE	Air-Conditioning And Mechanical Ventilation Installation & Maintenance Operation Supervision		
COMPETENCY UNIT TITLE	ACMV Supervisory Functions		
LEARNING OUTCOMES	The person who is competent in this CU shall be able to perform supervisory duties to support operation according to company's requirements and scope of work. Upon completion of this competency units, trainees will be able to:- 1. Coordinate PTW application 2. Supervise work place safety, health and hygiene 3. Prepare job schedule 4. Perform internal communication activities 5. Check equipment and materials stock inventory 6. Carry out subordinate appraisal 7. Conduct on job training / coaching 8. Support HR administration		
TRAINING PRE-REQUISITE	NIL		
CU CODE	F432-003-3:2017-C06	NOSS LEVEL	3

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
1. Coordinate PTW application	1.1 PTW format and content 1.2 Relevant supporting documents such as • Job Safety Analysis (JSA) report • Job Hazard Analysis (JHA) report • Public liability	1.1 Interpret workflow of Permit To Work (PTW) application 1.2 Arrange site visit 1.3 Prepare PTW documentation 1.4 Arrange PTW submission documentation 1.5 Follow up status of	<u>ATTITUDE</u> • Attentive to details in preparing documentations for PTW application • Adherence to PTW requirements	1.1 Workflow of Permit To Work (PTW) application described 1.2 PTW requirements specified and explained 1.3 Relevant supporting document listed and explained 1.4 Site joint inspection executed 1.5 Site authorisation parties approval procedure followed according to SOP

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	insurance • Workman compensation insurance • List of employees particular, contact number and relevant certification 1.3 Site visit criteria such as • Work zone • Access passage • Overhead obstacles 1.4 PTW preparation requirements such as • Approval lifting procedure • Certification of rigging gears • Working at height • Confined space 1.5 Site authorisation parties approval procedure	application 1.6 Confirm PTW approval		

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
2. Supervise work place safety, health and hygiene	2.1 Work place safety, health, hygiene and activities 2.2 Types and method of handling ACMV waste such as • Refrigerant • Air conditioning chemical • Compressor oil 2.3 Related acts or regulation (if required) such as • Occupational Safety and Health Act 1994 (Act 514) • Factory & Machineries Act 1967 (Act 139) • Environmental Quality Act 1974 (Amendment 2012) • Act 520 Construction Industry Development Board 1994 2.4 Chemical control references such as • Material Safety Data Sheet	2.1 Supervise work place safety, health, and hygiene activities 2.2 Coordinate facilities waste disposal 2.3 Report work place safety, health and hygiene activities status 2.4 Comply with SOP 2.5 Document work place safety, health and hygiene activities	<u>ATTITUDE</u> • Thorough in checking work place safety, hygiene and maintenance • Adherence to environmental requirements	2.1 Work place safety, hygiene and maintenance checked and compliance justified 2.2 Waste disposal procedure compliance justified 2.3 Work place safety, hygiene and maintenance report format and contents described and applied

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	(MSDS) 2.5 Work place safety, hygiene and maintenance report • Report writing skill • Format • Procedure			
3. Prepare job schedule	3.1 Master plan schedule format and content 3.2 Scope of work and job specification 3.3 Type and function of scheduling • Daily • Weekly • Monthly • Special event / ad-hoc 3.4 Job capacity • Number of appointment • Type of services • Personnel for duty 3.5 Job assignment and delegation 3.6 Duty roster format	3.1 Interpret master plan schedule 3.2 Determine type and function of scheduling 3.3 Check scope of work, job descriptions 3.4 Check subordinate's competency status 3.5 Confirm number of personnel 3.6 Check job capacity / productivity 3.7 Assign personnel for duty 3.8 Produce duty roster / jobs schedule	<u>ATTITUDE</u> • Attentive to details in preparing duty roster • Non-bias in assigning job schedule	3.1 Scope of work, job descriptions listed and described 3.2 Number of available personnel specified 3.3 Job capacity listed in accordance with type of services 3.4 Assignments confirmed and personnel to undertake job functions listed 3.5 Duty roster scheduled, formatted and generated

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
4. Perform internal communication activities	4.1 Daily staff briefing • Current and outstanding operational issues • Safety and health matters • Incident and accident post mortem 4.2 Meeting requirements such as • Procedure & protocols of meeting • Type of meeting • Attendee / participant of meeting • Agenda of meeting • Minutes of meeting • Meeting documentation 4.3 Staff Tool Box Session • Work progress • Safety • Good practices • Quality of work • Staff performance • Grievances • Staff feedback	4.1 Conduct daily staff briefing 4.2 Conduct unit meeting 4.3 Conduct safety tool box session 4.4 Execute communication outcome / decision	ATTITUDE • Organised and systematic in arranging meeting • Punctual for meeting • Sound decision making while in meeting	4.1 Daily staff briefing agenda listed and discussed 4.2 Meeting protocols and procedure described and applied 4.3 Monthly staff tool box session conducted 4.4 Decision on meeting specified and executed

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
5. Check equipment and materials stock inventory	5.1 Introduction to inventory system such as • Stock card • Inventory management system • Asset tagging 5.2 Types of ACMV inventory such as • Equipment • Materials • Parts • Consumable 5.3 Inventory concept such as • First In First Out (FIFO) • Last In First Out (LIFO) 5.4 The importance of inventory control 5.5 Stock requisition procedure 5.6 Inventory record format and contents	5.1 Interpret inventory record 5.2 Determine operational stock based on inventory record 5.3 Check stock level against inventory record 5.4 Determine volume for stock replenishment / replacement based on stock checking result 5.5 Request stock replenishment / replacement according to stock requisition procedure 5.6 Replenish / replace equipment and materials stock based on requisition 5.7 Update inventory record as per inventory control procedure	<u>ATTITUDE</u> • Systematic in organizing works • Responsive to arising issue • Timely in completing tasks • Resourceful in solving issues • Precise in calculation <u>SAFETY</u> • Alert with safety needs while at storage area • Practice good ergonomics while at work	5.1 Inventory system listed and explained 5.2 Types of ACMV inventory listed and explained 5.3 Inventory concept listed and explained 5.4 Stock level checked against inventory record 5.5 Volume for stock replenishment / replacement determined based on stock checking result 5.6 Stock replenishment / replacement requested according to stock requisition procedure 5.7 Inventory record updated as per inventory control procedure

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
6. Carry out subordinate appraisal	6.1 Appraisal objectives such as • Performance rating • Promotions • Bonus / incentive 6.2 Company Key Performance Index (KPI) 6.3 Appraisal documentation • Subordinate profiles • Appraisal form 6.4 Subordinate performance records • Disciplines • Client feedback • Compliment / complaints 6.5 Appraisal procedure and confidentiality policy	6.1 Interpret appraisal objective 6.2 Check appraisal schedule 6.3 Obtain appraisal documentation 6.4 Confirm subordinate to be appraised 6.5 Appraise subordinates 6.6 Record appraisal results 6.7 Recommend incentives 6.8 Report appraisal results to superior / authorised personnel	<u>ATTITUDE</u> • Objective and results driven in conducting appraisal session • Fair and transparent in evaluating subordinate performance	6.1 Appraisal objective specified and explained 6.2 Company Key Performance Index (KPI) explained 6.3 Appraisal schedule details determined 6.4 Appraisal documentation compiled, arranged and purposes explained 6.5 Subordinate details evaluated 6.6 Appraisal, recording and reporting procedure followed 6.7 Appraisal technique applied

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
7. Conduct on job training / coaching	7.1 Type of training programme such as • Technical • Soft skills 7.2 Types of training • In house • Out source 7.3 Training objective 7.4 Training method such as • Hands on • Role play • Demonstrations 7.5 Training facilities • Audio visual • Rooms • Materials • Modules 7.6 Training assessment	7.1 Interpret staff performance record 7.2 Determine personnel for training 7.3 Select training programme 7.4 Check training programme details 7.5 Prepare training facilities 7.6 Execute training programme 7.7 Evaluate effectiveness of training programme 7.8 Follow up personnel work performance 7.9 Update personnel record	<u>ATTITUDE</u> • Objective and results driven in conducting training programme • Systematic and organized in preparing training facilities	7.1 Type of training programme specified and explained 7.2 Training programme details listed 7.3 Training conducted as per training schedule 7.4 Training facilities specified and equipment operated

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
8. Support HR administration	8.1 Related acts and regulations such as • Labour Law 1955 • Industrial Law1967 • Company's handbook • Factory & Machineries Act 1967 (Act 139) • Occupational Safety and Health Act 1994 (Act 514) 8.2 Work scope of general HR administration such as • Leave application • Medical • Training • Claims 8.3 Staff welfare activities such as • Corporate Social Responsibility (CSR) activities • Birthday appreciation • Annual gathering • Recreation activity • Funeral • New born	8.1 Interpret company hand books 8.2 Determine scope of works 8.3 Determine type of staffing matters 8.4 Perform general HR administration (leave application, medical & overtime claim) 8.5 Coordinate staff welfare activities 8.6 Conduct new staff orientation	<u>ATTITUDE</u> • Maintain professionalism • Proactive with staff welfare needs	8.1 Related acts and regulations listed and purposes explained 8.2 Type of staffing matters listed and explained 8.3 Workscope of general HR administration interpreted 8.4 Staff welfare activities listed and explained 8.5 New staff orientation conducted

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Marriage • Farewell 8.4 New staff orientation			

Employability Skills

Core Abilities

- Basic Working Communication
- Personal Behaviour Skill
- Work Place Ethics Awareness
- Safety Health And Environment Awareness

Social Values & Social Skills

- Communication skills
- Conceptual skills
- Interpersonal skills
- Learning skills
- Leadership skills
- Multitasking and prioritising
- Self-discipline
- Teamwork

References for Learning Material Development

1 Asgar, J. 2008. The Organizational Role of Supervisors. Las, NV: Practical Management. ISBN: 9781599429694
2 Evans, D. 1999. Supervisory Management: Principles and Practice. London: Continuum. ISBN: 9780826457332
3 Leonard, E.C. 2013. Supervision: Concepts and Practices of Management. Cengage Learning. ISBN: 9781111969790
4 Mosley, D.C. & Pietri, P.H. 2011. Supervisory Management: The Art of Inspiring, Empowering, and Developing People. Cengage Learning. ISBN: 9780538737074
5 Copy of Labour Law 1955
6 Copy of Industrial Law1967

16. Delivery Mode

The following are the **recommended** training delivery modes:-

KNOWLEDGE	SKILL
• Lecture • Group discussion • E-learning, self-paced • E-learning, facilitate • Case study or Problem based learning (PBL) • Self-paced learning, non-electronic • One-on-one tutorial • Shop talk • Seminar	• Demonstration • Simulation • Project • Scenario based training (SBT) • Role play • Coaching • Observation • Mentoring

17. Tools, Equipment and Materials (TEM)

AIR-CONDITIONING AND MECHANICAL VENTILATION
INSTALLATION & MAINTENANCE OPERATION SUPERVISION

LEVEL 3

CU No.	CU CODE	COMPETENCY UNIT TITLE
CU1	F432-003-3:2017-C01	Light Commercial ACMV Installation & Maintenance Works Inspection
CU2	F432-003-3:2017-C02	ACMV Ducting Installation Works Inspection
CU3	F432-003-3:2017-C03	ACMV Piping Installation Works Inspection
CU4	F432-003-3:2017-C04	ACMV System Service and Maintenance Works Inspection
CU5	F432-003-3:2017-C05	Heavy Commercial ACMV Installation Supervision
CU6	F432-003-3:2017-C06	ACMV Supervisory Functions

* Items listed refer to TEM's **minimum requirement** for skills delivery only.

No	ITEM*	RATIO (TEM : Trainees)	CU1	CU2	CU3	CU4	CU5	CU6
A. Tools			**Tick (√) where relevant**					
1	Pliers	1:1	√	√	√	√	√	
2	Screw drivers	1:1	√	√	√	√	√	
3	Spanner set	1:1	√	√	√	√	√	
4	Allen key	1:1	√	√	√	√	√	
5	Adjustable spanner	1:1	√	√	√	√	√	
6	Hammer / mallet	1:1	√	√	√	√	√	
7	Test pen	1:1	√	√	√	√	√	
8	Measuring tape	1:1	√	√	√	√	√	
9	Hacksaw	1:1	√	√	√	√	√	

No	ITEM*	RATIO (TEM : Trainees)	CU1	CU2	CU3	CU4	CU5	CU6
10	Levels	1:1	√	√	√	√	√	
11	Multimeter	1:5	√	√	√	√	√	
12	Clamp on meter (Amprobe)	1:5	√	√	√	√	√	
13	Insulation tester (Mega ohm meter)	1:5	√	√	√	√	√	
14	Phase rotation meter	1:5	√	√	√	√	√	
15	Tachometer	1:5	√	√	√	√	√	
16	Vice grip plier	1:1	√	√	√	√	√	
17	Cable stripper	1:1	√	√	√	√	√	
18	Cable crimper	1:1	√	√	√	√	√	
19	Hand drill	1:2	√	√	√	√	√	
20	Jigsaw	1:10	√	√	√	√	√	
21	Grinder	1:10	√	√	√	√	√	
22	Temporary structure	As required	√	√	√	√	√	
23	Temporary lighting	As required	√	√	√	√	√	
24	Extension cable	As required	√	√	√	√	√	
25	Insulation tape	1:1	√	√	√	√	√	
26	High tension tape	1:1	√	√	√	√	√	
27	Rags	As required	√	√	√	√	√	
28	Respirator gas mask	As required	√	√	√	√	√	
29	Dust mask	1:1	√	√	√	√	√	
30	Gloves	1:1	√	√	√	√	√	
31	Safety boot / shoes	1:1	√	√	√	√	√	
32	Goggles	1:1	√	√	√	√	√	
33	Safety helmet	1:1	√	√	√	√	√	
34	Safety harness	1:1	√	√	√	√	√	
35	Computer with internet and peripherals							√
36	Office facilities (printer, fax, machine)							√

No	ITEM*	RATIO (TEM : Trainees)	CU1	CU2	CU3	CU4	CU5	CU6
A. Equipment			**Tick (√) where relevant**					
1	Lifting equipment	1:25	√	√	√	√	√	
B. Materials			**Tick (√) where relevant**					
1	Copy of Occupational Safety and Health Act 1994 (Act 514)	1:1	√	√	√	√	√	
2	Copy of Electricity Supply Act 1990	1:1	√	√	√	√	√	
3	Copy of Factory & Machineries Act 1967 (Act 139)	1:1	√	√	√	√	√	
4	Copy of Environmental Quality Act 1974 (Amendment 2012)	1:1	√	√	√	√	√	
5	Copy of Act 520 Construction Industry Development Board 1994	1:1	√	√	√	√	√	
6	Copy of Malaysian Standard- MS 1525:2014 Code of Practice on Energy Efficiency and Use of Renewable Energy for Non-Residential Buildings	1:1	√	√	√	√	√	
7	Copy of American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Guidelines and Standards	1:1	√	√	√	√	√	
8	Copy of ACMV system service and maintenance schedule format and contents	1:1	√	√	√	√	√	
9	Copy of ACMV system service and maintenance reporting format and procedure	1:1	√	√	√	√	√	
10	Copy of Uniform Building By-Laws 1984	1:1	√	√	√	√	√	
11	Copy of ACMV system service and maintenance master plan schedule	1:1	√	√	√	√	√	

No	ITEM*	RATIO (TEM : Trainees)	CU1	CU2	CU3	CU4	CU5	CU6
12	ACMV equipment installation and operation checklist	1:1	√	√	√	√	√	
A. Materials			**Tick (√) where relevant**					
13	ACMV light commercial inspection report	1:1	√					
14	ACMV piping installation and maintenance checklist	1:1	√		√			
15	ACMV piping inspection report	1:1	√		√			
16	ACMV ducting installation and maintenance checklist	1:1	√	√				
17	ACMV ducting inspection report	1:1	√	√				
18	ACMV maintenance instruction checklist	1:1	√	√	√	√		
19	Shop drawing	1:1	√	√	√	√	√	
20	ACMV equipment layout drawing	1:5	√	√	√	√	√	
21	Schematic diagram	1:1	√	√	√	√	√	
22	Electrical drawing	1:1	√	√	√	√	√	
23	Single line drawing	1:1	√	√	√	√	√	
24	ACMV installation initial preparation checklist	1:1	√	√	√	√	√	
25	Service and maintenance report	1:1	√	√	√	√	√	
26	Maintenance schedule	1:1	√	√	√	√	√	
27	Final ACMV system testing and commissioning report	1:1	√	√	√	√	√	
28	ACMV pipe drawing	1:1	√	√	√	√	√	
29	Sample of company policies and various procedures manual (SOP, transaction, recording, reporting, documentation, facilities waste disposal, company hand book, etc.)							√

No	ITEM*	RATIO (TEM : Trainees)	CU1	CU2	CU3	CU4	CU5	CU6
30	Sample of duty roster format							√
31	Sample of inventory list							√
32	Sample of meeting documentations (agenda, minutes of meeting, etc.)							√
33	Sample of Company Key Performance Index (KPI) document							√
34	Sample appraisal documentations (subordinates list, subordinate profiles, appraisal form)							√

18. Training Hour Summary

The following table shows the nominal training hours based on recommendations made by the Standard Development Committee (SDC). For purpose of Malaysian Skills Certification through accredited centre training, the program duration is subject to Malaysian Skills Certification System.

AIR-CONDITIONING AND MECHANICAL VENTILATION INSTALLATION & MAINTENANCE OPERATION SUPERVISION LEVEL 3

CU CODE	COMPETENCY UNIT TITLE	WORK ACTIVITIES	RELATED KNOWLEDGE (HOURS)	RELATED SKILLS (HOURS)	TRAINING DURATION (HOURS)	SKILLS CREDIT
F432-003-3:2017-C01	Light Commercial ACMV Installation & Maintenance Works Inspection	1. Identify Light Commercial ACMV installation and maintenance works requirements	11	25	180	18
		2. Inspect Light Commercial ACMV installation and maintenance works	24	57		
		3. Identify Light Commercial ACMV installation and maintenance works non-compliance issue	14	32		
		4. Prepare Light Commercial ACMV installation and maintenance works inspection report	5	13		
F432-003-3:2017-C02	ACMV Ducting Installation Works Inspection	1. Identify ACMV ducting installation works inspection requirements	11	25	180	18
		2. Inspect ACMV ducting installation works	24	57		
		3. Identify ACMV ducting installation works non-compliance issue	14	32		
		4. Prepare ACMV ducting installation works inspection report	5	13		

CU CODE	COMPETENCY UNIT TITLE	WORK ACTIVITIES	RELATED KNOWLEDGE (HOURS)	RELATED SKILLS (HOURS)	TRAINING DURATION (HOURS)	SKILLS CREDIT
F432-003-3:2017-C03	ACMV Piping Installation Works Inspection	1. Identify ACMV piping installation works inspection requirements	11	25	180	18
		2. Inspect ACMV piping installation works	24	57		
		3. Identify ACMV piping installation works non-compliance issue	14	32		
		4. Prepare ACMV piping installation works inspection report	5	13		
F432-003-3:2017-C04	ACMV System Service & Maintenance Works Inspection	1. Prepare ACMV system service & maintenance works inspection requirements	11	25	180	18
		2. Inspect ACMV system service & maintenance works	24	57		
		3. Identify ACMV system service & maintenance works non-compliance issue	14	32		
		4. Prepare ACMV system service & maintenance works inspection report	5	13		
F432-003-3:2017-C05	Heavy Commercial ACMV Installation Supervision	1. Verify installation work requirements	6	15	360	36
		2. Coordinate installation initial preparation	22	50		
		3. Supervise ACMV equipment installation	16	38		
		4. Supervise ACMV pipes works installation	16	38		
		5. Perform ACMV electrical wiring installation works	22	50		
		6. Perform ACMV system testing and commissioning	13	30		
		7. Supervise ACMV system service and	13	30		

CU CODE	COMPETENCY UNIT TITLE	WORK ACTIVITIES	RELATED KNOWLEDGE (HOURS)	RELATED SKILLS (HOURS)	TRAINING DURATION (HOURS)	SKILLS CREDIT
		maintenance activities				
F432-003-3:2017-C06	ACMV Supervisory Functions	1. Coordinate PTW application	5	13	120	12
		2. Supervise work place safety and hygiene	5	13		
		3. Prepare job schedule	5	13		
		4. Perform internal communication activities	4	8		
		5. Check equipment and materials stock inventory	4	8		
		6. Carry out subordinate appraisal	4	8		
		7. Conduct on job training / coaching	5	13		
		8. Support HR administration	4	8		
TOTAL HOURS (CORE COMPETENCY)			360	840	1200	120