STANDARD KEMAHIRAN PEKERJAAN KEBANGSAAN
(NATIONAL OCCUPATIONAL SKILL STANDARD)

STANDARD PRACTICE & STANDARD CONTENT FOR

COMMERCIAL VEHICLE AIR CONDITIONING INSTALLATION AND MAINTENANCE LEVEL 3 TP-122-3:2013

JPK

Jabatan Pembangunan Kemahiran
Kementerian Sumber Manusia, Malaysia

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STANDARD PRACTICE

NATIONAL OCCUPATIONAL SKILLS STANDARD (NOSS) FOR COMMERCIAL VEHICLE AIR CONDITIONING INSTALLATION AND MAINTENANCE LEVEL 3

1. INTRODUCTION

A commercial vehicle is a type of motor vehicle that is used for transporting goods or passengers. It includes excursion bus, public bus, freight vehicles, etc. Rapid development in tourism industry and logistic industry in Malaysia stimulate demand in commercial vehicles. These scenarios create important job area known as Commercial Vehicle Air Conditioning Installation and Maintenance.

The Commercial Vehicle Air Conditioning Installation and Maintenance (Level 3) personnel who are also known as Commercial Vehicle Air Condition Technician responsible in handling fabrication, electrical wiring and installation of commercial vehicle air conditioning. Besides that, the personnel are required to maintain commercial vehicle air conditioning unit and sub-engine. In addition, the personnel are also responsible to repair the air condition mechanical components and electrical components.

While performing their job, the personnel are required to comply regulatory requirements in conducting refrigerant retrofitting and emission control to protect from refrigerant leaks and direct emission that could harm the environment in accordance with Regulation 3, 4, 5 and 6 of the Environmental Quality (Refrigerant Management) Act 451/2004. The personnel are also required to adhere occupational safety practice when performing their duties.

The Commercial Vehicle Air Conditioning Installation and Maintenance (Level 3) personnel report to the level 4 personnel who give them production job order. The personnel may advance their career up management level.

Career path for this job area is promising due to pace growth of local commercial vehicle as well as rapid growth of automotive industry.

Authorities and Regulatory bodies:-

a. Department of Environment (DOE)

The Department of Environment has given mandate to promote, enhance and sustain sound environmental management in the process of nation building through Act 127, the Environmental Quality Act 1974 and a few Regulations. The Regulation 51 subsection (p) and (q) mention that any person handling, storing or using oil or mixture containing oil are prohibited to discharges and spillages of oil or mixture containing oil into Malaysian waters. In addition, the Environmental Quality (Refrigerant Management) Regulation 1999 of the Act 127 outlines the handling refrigerant from any refrigeration system, vehicle air-conditioner or any air conditioning.

b. Department of Occupational Safety and Health (DOSH)

The department is the regulatory body to regulate The Occupational Safety and Health Act is an Act (Act 541) which provides the legislative framework to secure the safety, health and welfare among all Malaysian workforces and to protect others against risks to safety or health in connection with the activities of persons at work including in the motorcycle assembly factory.

Pre-requisite

The entry requirement for this course is with minimum age at 16 years old and must be able to read and write in Bahasa Malaysia.

2. OCCUPATIONAL STRUCTURE

The Commercial Vehicle Air Conditioning Installation and Maintenance (Level 3) falls under the Commercial Vehicle Air conditioning job area and after sales sub sector. Figure 1 illustrates the Occupational Structure, while Figure 2 illustrates Occupational Area Structure of Motorcycle Assembly Operation Level 3

Entry level for this job area is at Level 3 due to their nature of work where generally they work by following instructions and job assignment schedules that is prepared by a superior. The personnel perform a significant range of varied work activities in a variety of context, which most of the tasks are complex and non-routine.

Sector	AUTOMOTIVE INDUSTRY				
Sub Sector	**After Sales**				
Area	**Heavy Commercial Vehicle**				
Job Area	**Heavy Commercial Vehicle**		**Commercial Vehicle Air conditioning**	**Commercial Vehicle Tyre**	**Coach Building**
Level 5	**Commercial Vehicle After Sales Manager**				Commercial Vehicle Body Building Manager
Level 4	**Commercial Vehicle After Sales Executive**				Commercial Vehicle Body Building Executive
Level 3	Commercial Vehicle Senior Technician	Commercial Vehicle Service Consultant	**Commercial Vehicle Air Conditioning Senior Technician**	Commercial Vehicle Tyre Servicing Technician	Commercial Vehicle Body Building Senior Craftsman
Level 2	Commercial Vehicle Technician		**Commercial Vehicle Air Conditioning Technician**	No Level	Commercial Vehicle Body Building Craftsman
Level 1	Commercial Vehicle Maintenance Technician		No Level	No Level	Commercial Vehicle Body Building Junior Craftsman

Figure1: Occupational Structure for Commercial Vehicle Air Conditioning Installation and Maintenance

Sector	AUTOMOTIVE INDUSTRY			
Sub Sector	**After Sales**			
Area	**Heavy Commercial Vehicle**			
Job Area	**Heavy Commercial Vehicle**	**Commercial Vehicle Air conditioning**	**Tyre**	**Coach Building**
Level 5	Commercial Vehicle After Sales Management			Commercial Vehicle Body Building Management
Level 4	Commercial Vehicle After Sales Management			Commercial Vehicle Body Building Management
Level 3	Commercial Vehicle Servicing & Maintenance	**Commercial Vehicle Air Conditioning Installation and Maintenance**	Commercial Vehicle Tyre Servicing & Maintenance	Commercial Vehicle Body Building Operation
Level 2	Commercial Vehicle Servicing & Maintenance	Embedded to level 3	No Level	No Level
Level 1	Commercial Vehicle Maintenance Technician	No Level	No Level	No Level

Figure 2: Occupational Area Structure for Commercial Vehicle Air Conditioning Installation and Maintenance

3. DEFINITION OF COMPETENCY LEVEL

The NOSS is developed for various occupational areas. Candidates for certification must be assessed and trained at certain levels to substantiate competencies. Below is a guideline of each NOSS Level as defined by the Department of Skills Development, Ministry of Human Resources Malaysia.

Malaysia Skills Certificate Level 1	:	Competent in performing a range of varied work activities, most of which are routine and predictable
Malaysia Skills Certificate 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.
Malaysia Skills Certificate 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 in often required.
Malaysia Skills Diploma Level 4	:	Competent in performing a broad range of complex technical or professional work activities, performed in a variety of contexts, and with substantial degree of personal responsibility and autonomy. Responsibility for the work of others and allocation of resources is often present.
Malaysia Skills Advanced Diploma 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.

4. MALAYSIAN SKILL CERTIFICATION

The candidate after being assessed, verified and fulfilled Sijil Kemahiran Malaysian requirements shall be awarded Sijil Kemahiran Malaysia (SKM) – Level 3 in Commercial Vehicle Air Conditioning Installation and Maintenance

5. JOB COMPETENCIES

Core competencies for Commercial Vehicle Air Conditioning Installation and Maintenance Level 3 are:

i. Commercial Vehicle Air Conditioning Fitting Parts Fabrication
ii. Commercial Vehicle Air Conditioning Sub- Wire Harness Fabrication
iii. Commercial Vehicle Air Conditioning Unit Installation
iv. Commercial Vehicle Air Conditioning Maintenance
v. Commercial Vehicle Air Conditioning Mechanical Components Repair
vi. Commercial Vehicle Air Conditioning Electrical Components Repair
vii. Commercial Vehicle Air Conditioning Workshop Administration And Supervision

The elective competency unit for Commercial Vehicle Air Conditioning Installation Maintenance Level 3 is:

i. Commercial Vehicle Sub-Engine Servicing

6. WORKING CONDITIONS

The Commercial Vehicle Air Conditioning Installation and Maintenance (Level 3) personnel generally work under similar operating hours of the organisation / company. Sometimes they may have to work beyond the normal hours including on weekends to meet project deadlines. They are required to comply with Department of Environmental regulation regarding waste storage, waste handling and waste disposal.

While performing their duties, they are regularly exposed to fumes or airborne particles, toxic or caustic chemicals and risk of electrical shock. They are frequently exposed to wet and/or humid conditions, and working near moving mechanical parts and machinery, which can be a potential hazard if being mishandled. Moreover, they are occasionally exposed to vibration and noisy environment. It is therefore, very important for all personnel to ensure that the health and safety requirements are being followed at all times.

In addition, they need to be able to work both independently and as part of a team and be able to work well under pressure. Ideally, they should possess problem-solving ability and good communication skills for dealing with customer and colleagues.

7. EMPLOYMENT PROSPECTS

The Commercial Vehicle Air Conditioning Installation and Maintenance (Level 3) personnel are employed by commercial vehicle services centres and after sales service workshops. Besides that they are also have brighter job opportunities in other job areas of automotive industry and other industries.

Other related occupations with respect to employment opportunities are:

- Motor vehicle technician
- Service advisor

Other related industries /job area with respect to employment opportunities are:

- Motor vehicle workshop
- Motor vehicle service centre

8. TRAINING INDUSTRIAL/PROFESSIONAL RECOGNITION, OTHER QUALIFICATIONS AND ADVANCEMENT

8.1 Training:-

Currently, there is no standard reference of professional qualification with respect to this particular job area. As per career advancement, most competent commercial vehicle air conditioning installation and maintenance personnel learn their competency on the job. They usually begin as qualified Commercial Vehicle Air Conditioning Technician and gradually learn their skills as they gain experience for career advancement.

8.2 Industrial / Professional Recognition:-

Currently, there is no standard reference of professional recognition is given with respect to this job area.

9. SOURCES OF ADDITIONAL INFORMATION

- **Department of Environment (DOE)**
  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, Malaysia
  Phone: +603-8871 2000, Fax: +603-8889 1973/75
  Website: www.doe.gov.my

- **Department of Occupational Safety and Health (DOSH)**
  Level 2, 3 & 4, Block D3, Complex D
  Federal Government Administrative Centre
  62530 W. P. Putrajaya
  Phone: +603 – 8886 5000, Fax: +603 – 8889 2443
  Website: www.dosh.gov.my

- **Department of Road Transport**
  Aras 5, Blok D 4, Kompleks D
  Pusat Pentadbiran Kerajaan Persekutuan
  62620 Putrajaya
  Telefon: 03 88866405, Faks: 03 88810875
  Website: www.jpj.gov.my

10. ACKNOWLEDGEMENT

The Director General of DSD would like to extend his gratitude to the organizations and individuals who have been involved in developing this standard.

11. NOSS DEVELOPMENT COMMITTEE MEMBERS

THE COMMERCIAL VEHICLE AIR CONDITIONING INSTALLATION DAN MAINTENANCE LEVEL 3

PANEL OF EXPERTS		
1.	Azman Bin Mohd Said	Manager TKR Sdn. Bhd.
2.	Hasbi Mat Hassan	Executive Denso (M) Sdn Bhd
3.	Mohd Khairulakmal Bin Ridzuan	Supervisor Fire Fighting and Rescue Department
4.	Osman Md Said	Senior Manager West Starr Maxux Sdn. Bhd.
5.	Razman Bin Sabtu	Senior Technician Department of Public Work (JKR)
6.	Ridzwan bin Baharin	Senior Manager Weststar Maxus Distributor Sdn. Bhd.
7.	Shamsul Ahmad Bin Yusof	Senior Manager Volvo Heavy Service Centre, Glenmarie
8.	Yuvarajah A/L Parameswaran	Manager Pam Global
FACILITATOR		
9.	Isvaran a/l P.Ramasamy	Portray Sdn. Bhd.
CO-FACILITATOR		
10.	Jaiyah Binti Shahbudin	Portray Sdn. Bhd.

COMPETENCY PROFILE CHART (CPC)

SECTOR	AUTOMOTIVE		
SUB SECTOR	AFTER SALES SERVICES		
JOB AREA	COMMERCIAL VEHICLE AIR CONDITIONING		
NOSS TITLE	COMMERCIAL VEHICLE AIR CONDITIONING INSTALLATION & MAINTENANCE		
JOB LEVEL	THREE (3)	NOSS CODE	TP-122-3:2013

← COMPETENCY →

← COMPETENCY UNIT →

CORE	COMMERCIAL VEHICLE AIR CONDITIONING FITTING PARTS FABRICATION TP-122-3:2013-C01	COMMERCIAL VEHICLE AIR CONDITIONING SUB-WIRE HARNESS FABRICATION TP-122-3:2013-C02	COMMERCIAL VEHICLE AIR CONDITIONING UNIT INSTALLATION TP-122-3:2013-C03	COMMERCIAL VEHICLE AIR CONDITIONING MAINTENANCE TP-122-3:2013-C04
	COMMERCIAL VEHICLE AIR CONDITIONING MECHANICAL COMPONENTS REPAIR TP-122-3:2013-C05	COMMERCIAL VEHICLE AIR CONDITIONING ELECTRICAL COMPONENTS REPAIR TP-122-3:2013-C06	COMMERCIAL VEHICLE AIR CONDITIONING WORKSHOP ADMINISTRATION AND SUPERVISION TP-122-3:2013-C07	
ELECTIVE	COMMERCIAL VEHICLE AIR CONDITIONING SUB-ENGINE SERVICING TP-122-3:2013-E01			

CURRICULUM of COMPETENCY UNIT (CoCU)

Sub Sector	**AFTER SALES SERVICES**						
Job Area	**COMMERCIAL VEHICLE AIR CONDITIONING**						
NOSS Title	**COMMERCIAL VEHICLE AIR CONDITIONING INSTALLATION AND MAINTENANCE**						
Competency Unit Title	**COMMERCIAL VEHICLE AIR-CONDITIONING FITTING PARTS FABRICATION**						
Learning Outcomes	The outcome of this competency is to prepare air conditioning bracket, ducting and piping system according to installation manual which are ready to be installed to the commercial vehicle air conditioning system. Upon completion of this competency unit, trainees will be able to: • Organize air conditioning fitting parts fabrication tools, equipment and materials • Fabricate air conditioning compressor bracket • Fabricate air conditioning ducting • Fabricate air conditioning piping						
Competency Unit ID	**TP-122-3:2013-C01**	**Level**	3	**Training Duration**	230	**Credit Hours**	23

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
1. Organize air conditioning fitting parts fabrication tools, equipment, materials	i. Introduction of Commercial vehicle air conditioning system ii. Types of commercial vehicle air conditioning fitting parts • Compressor bracket • Ducting • Piping iii. Types and function of fitting parts fabrication tools and equipment,			10 hours	Lecture & Group discussion	i. Air conditioning fitting part listed out and described ii. Compressor's bracket material, size and measurement determined according to air conditioning fitting diagram. iii. Ducting's

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	such as: • Measuring tools, such as: Measuring tape, Vanier Calliper, Ruler, Straight Edge, L-square • Cutting equipment, such as: Metal Cutter, Copper pipe cutter • Bending equipment, such as: Pipe bender, Plate bender machine • Joining equipment, such as: Rivet tool, Welding equipment (such as: Oxy-acetylene welding equipment, Arc welding equipment, Tungsten Inert Gas (TIG) welding equipment), brazing equipment • Machine for fabrication works, such as: Shear Machine, Hand Grinding Machine,					material, size and measurement determined according to air conditioning ducting diagram iv. Piping material, size and length determined according to air conditioning piping diagram v. Fabrication tools and equipment operated according to manufacturer's operating manual

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	Drilling Machine, Bending Machine iv. Types of fitting parts fabrication materials: • Metal plate • Fibre glass sheet • Aluminium sheet • Copper pipe • Insulator v. Types and usage of fitting parts fabrication consumable items: • Fastener: bolt, screw • Glue • Sealant • Etc. vi. Fabrication job order contents • Installation date • Vehicle Model • Chassis number • Engine number • Commercial vehicle Engineering drawing vii. Fabrication work schedule					

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	viii. Type and usage of Personal Protective Equipment					
		i. Interpret air conditioning fitting parts fabrication job order ii. Determine compressor bracket specification iii. Determine air conditioning ducting specification iv. Determine piping specification v. Select fitting parts materials, fabrication tools and equipment vi. Operate fabrication equipment and machine	*Attitude:* i. Detail when interpret fabrication job order ii. Precise when identify fabrication tools, equipment and	20 hours	Observation, Demonstration & Group Discussion	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			materials iii. Accurate when determining compressor bracket, ducting and pipe specification <u>*Safety/Environment*</u>: i. Safety cautions when planning fabrication works			
2. Fabricate air conditioning compressor bracket	i. Compressor bracket specification ii. Metal plate fabrication method • Metal plate cutting process • Metal plate welding process • Bracket finishing process iii. Types of metal plate fabrication finishing work: • Trimming • Grinding • Painting			15 hours	Lecture & Group discussion	i. Fabrication method, technique demonstrated in according with general engineering applications ii. Metal plate cut, jointed, shaped, trimmed and grinded in according with compressor bracket drawing specification iii. Compressor

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	iv. Anti rust application v. Types of compressor bracket fitting test • Compressor bracket Slant Angle Testing procedure • Compressor bracket Alignment Testing procedure vi. *Work Hazard related to workshop, such as:* • *Defective tools* • *High voltage* vii. *Workplace risk control, such as:* • *Usage of PPE* • *Workplace safety procedure*					bracket painted in according with drawing specification iv. Compressor bracket slant angle checked in according with drawing specification v. Compressor bracket alignment checked in according with drawing specification vi. Paint and anti-rust applied in according with compressor bracket drawing specification
		i. Carry out metal plate cutting work ii. Perform metal plate welding work iii. Carry out compressor bracket grinding work iv. Carry out compressor bracket trimming work v. Conduct Compressor bracket Slant Angle Test		45 hours	Demonstration & Project	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
		vi. Carry out Compressor bracket Alignment Test vii. Carry out compressor bracket anti rust application viii. Carry out compressor bracket paint work	*Attitude:* i. Accurate when determine air conditioning compressor bracket design and size ii. Careful when carrying out metal plate cutting using cutting machine iii. Systematic when performing compressor bracket metal plate joining			

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			Safety/Environment: i. Safety caution when operating machines and performing welding works ii. Adhere to workshop Practice iii. Warning and Caution in fabrication = work			
3. Fabricate air conditioning ducting	i. Types of air conditioning ducting • Aluminium ducting • Fibreglass ducting ii. Ducting specification iii. Ducting fabrication method • Cutting process • Bending process • Joining process • Grinding process • Trimming process • Insulation process • Visual check			20 hours	Lecture & Group discussion	i. Types of air conditioning ducting unit identified ii. Aluminium and fibreglass sheet cutting technique demonstrated iii. Aluminium and fibreglass ducting parts joint in according with ducting drawing specification iv. Ducting parts trimmed,

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
		i. Carry out ducting material cutting work ii. Carry out aluminium ducting bending work iii. Perform aluminium ducting part joining work iv. Perform fibreglass ducting part joining work v. Carry out ducting parts trimming work vi. Carry out ducting parts grinding work vii. Insulate ducting unit viii. Check ducting unit fitting quality.	*Attitude:* i. Accurate when cutting and joining ducting materials ii. Meticulous when troubleshooting and rectifying ducting fabrication abnormalities iii. Through when checking ducting quality	60 hours	Demonstration & project	grinded in according with ducting drawing specification v. Ducting unit insulated in according with ducting drawing specification .

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			<u>*Safety/Environment*</u>: i. Safety caution when using cutting tools ii. Adhere to workshop Practice iii. Warning and Caution in fabrication = work			
4. Fabricate air conditioning piping	i. Pipe specification ii. Piping fabrication method • Cutting process • Bending process • Joining process • Piping insulation process • Fitting quality check iii. Pipe leakage testing process			15 hours	Lecture & Group discussion	i. Pipe measured and cut in according with air conditioning piping drawing specification ii. Pipe bended in according with piping drawing specification iii. Pipe jointed in according with piping drawing specification iv. Pipe insulated in according with piping drawing specification

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
		i. Carry our pipe cutting work ii. Carry out pipe joining work iii. Carry out bending work iv. Insulate air conditioning piping v. Check ducting unit fitting quality vi. Conduct piping leakage test	*Attitude:* i. Careful when cutting pipe ii. Systematic when carrying out piping insulation iii. Meticulous when troubleshooting and rectifying piping fabrication abnormalities iv. Thorough when checking pipe fabrication quality	45 hours	Demonstration & project	v. Air conditioning piping leakage tested in according with service manual

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			Safety/Environment: i. Safety caution when using c cutting tool s and bending tools ii. Adhere to workshop Practice			

Employability Skills

Core Abilities	Social Skills
01.01 Identify and gather information 01.02 Document information, procedures or processes. 01.03 Utilize basic IT applications 01.04 Analyze information 01.05 Utilize the internet to locate and gather information 01.06 Utilize word processor to process information 01.07 Utilize database applications to locate and process information 01.08 Utilize spreadsheets applications to locate and process information 01.09 Utilize business graphic application to process information 01.10 Apply a variety of mathematical techniques 01.11 Apply thinking skills and creativity 02.01 Interpret and follow manuals, instructions and SOP's 02.02 Follow telephone/telecommunication procedures 02.03 Communicate clearly 02.04 Prepare brief reports and checklists using standard forms 02.05 Read / interpret flowcharts and pictorial information 02.06 Write memos and letters 02.07 Utilize local area network (LAN) Internet to exchange information 02.08 Prepare pictorial and graphic information. 02.09 Prepare flowcharts 02.10 Prepare reports and instructions 02.11 Convey information and ideas to people 03.01 Apply cultural requirements to the workplace. 03.02 Demonstrate integrity and apply ethical practices. 03.03 Accept responsibility for own work and work area. 03.04 Seek and act constructively upon feedback about performance 03.05 Demonstrate safety skills 03.06 Respond appropriately to people and situations 03.07 Resolve interpersonal conflicts 03.08 Develop and maintain a cooperation within work group	1. Communication skills 2. Conceptual skills 3. Interpersonal skills 4. Learning skills 5. Leadership skills 6. Multitasking and prioritizing 7. Self-discipline 8. Teamwork

03.09 Manage and improve performance of individuals 03.10 Provide consultation and counselling 03.11 Monitor and evaluate performance of human resources 03.12 Provide coaching/on-the job training 03.13 Develop and maintain team harmony and resolve conflicts 03.14 Facilitate and coordinate teams and ideas 03.15 Liaise to achieve identified outcomes 03.16 Identify and assess client / customer needs 03.17 Identify staff training needs and facilitate access to training 04.01 Organize own work activities 04.02 Set and revise own objectives and goals 04.03 Organize and maintain own workplace 04.04 Apply problem-solving strategies 04.05 Demonstrate initiative and flexibility 04.06 Allocate work	

Tools, Equipment and Materials (TEM)

ITEMS	RATIO (TEM: Trainees)
1. Adhesive material - Glue, Sealant	As per required
2. Company SOP	1:1
3. Cutting tools: Metal cutter, Hacksaw, Hand file	1:4
4. Fabrication material, such as: - Fibre Glass sheet, Aluminium sheet, Metal plate, Copper pipe, Insulator, Bolt, nut, Discharge pipe, Suction pipe, Metal plate	As per required
5. Layout Drawing - Aluminium Ducting layout drawing - Compressor bracket layout drawing - Fibreglass Ducting layout drawing - Piping layout drawing	1:4
6. Measuring tools: Measuring tape, Vanier calliper, Ruler, Straight edge , L-square	1:4
7. Installation Manual	1:4
8. Machine: - Drilling machine - Bending machine / tools - Shear machine - Hand grinding machine - Riveting tools	1:4
9. Personal Protective Equipment (PPE)	
10. Sample of fabrication job order	
11. Sample of Air conditioning compressor bracket fabrication checklist	1:1 1:1 1:1

12. Sample of Air conditioning ducting fabrication checklist 13. Sample of Air conditioning piping fabrication checklist 14. Welding equipment - Oxy-acetylene welding - Arc welding - Tungsten Inert Gas (TIG) welding	 1:1 1:1 1:4

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CURRICULUM of COMPETENCY UNIT (CoCU)

Sub Sector	**AFTER SALES SERVICES**
Job Area	**COMMERCIAL VEHICLE AIR CONDITIONING**
NOSS Title	**COMMERCIAL VEHICLE AIR CONDITIONING INSTALLATION AND MAINTENANCE**
Competency Unit Title	**COMMERCIAL VEHICLE AIR-CONDITIONING SUB-WIRE HARNESS FABRICATION**
Learning Outcomes	The outcome of this competency is to produce a sub-wire harness for commercial vehicle air conditioning that is safe and comply with regulatory body regulation. Upon completion of this competency unit, trainees will be able to: • Organize sub-wire harness fabrication tools and materials • Fabricate air conditioning sub-wire harness • Carry out air conditioning sub-wire harness 'pre-installation' functionality test

Competency Unit ID	**TP-122-3:2013-C02**	**Level**	3	**Training Duration**	180	**Credit Hours**	18

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
1. Organize sub-wire harness fabrication tools and materials	i. Introduction of air conditioning Electrical wiring diagram and symbol ii. Type, size, colour code and length of wire specification iii. Type and usage of wire connector iv. Type and size of Spiral conduit specification, v. Types and function of wire fabrication tools and equipment, such			10 hours	Lecture & Group discussion	i. Electrical wiring diagram interpreted ii. Wire specification and spiral conduit determined in according with air conditioning wiring diagram iii. Sub-wire harness fabrication tools determined and operated in

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	as: • Wire striper • Wire cutter • Soldering iron set • Multi meter • Ampere meter • Wire terminal clamping tools vi. Types and usage of sub-wire harness fabrication materials, such as: • Wire tape • Wire socket terminal • Cable tie vii. Sub-wire harness fabrication job order contents • Installation Date • Vehicle Model • Chassis number • Engine number • Commercial vehicle air conditioning electrical drawing					according with manufacturer's operation manual

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
		i. Interpret air conditioning sub-wire harness fabrication job order contents ii. Interpret electrical wiring diagram iii. Determine wire and spiral conduit specification iv. Select and operate wire fabrication tools	*Attitude:* i. Accuracy in interpreting wiring diagram ii. Thorough in determine sub-wire harness specification	20 hours	Demonstration Group Discussion and practical	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			iii. Detail in determining types of installation tools, equipment and testing devices <u>*Safety/Environment*</u>: i. Safety caution when planning electrical fabrication works			
2. Fabricate air conditioning sub-wire harness	i. Wire fabrication method • Cutting process • Joining process • Wire insulation process ii. Wire cutting procedure iii. Wire laying procedure iv. Types of wire joining method • Stripping process • Crimping process • Soldering process			35 hours	Lecture & Group discussion	i. Air conditioning wring routing determined in according with electrical wiring drawing ii. Wire cut to length in according with air conditioning electrical wiring drawing iii. Wire assembled according to wiring diagram

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	v. Wire assembled and spiral conduit binding procedure					iv. Wire bonded in Spiral conduit in according with wiring drawing
		i. Measure and cut wire based on vehicle body length ii. Lay wire based on wiring diagram iii. Carry out wire stripping works iv. Carry out wire crimping works v. Carry out wire soldering works vi. Carry out wire insulation vii. Wire assembling work viii. Spiral conduit binding technique ix. Connect wire to socket terminal	*Attitude:* i. Accurate when cutting the wire ii. Careful when laying wire and assemble spiral conduit	85 hours	Demonstration Practical or Project	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			iii. Detail and safety conscious when fabricating sub-wire harness <u>*Safety/Environment*</u>: i. Safety cautions when carrying sub-wire harness fabrication works ii. Adhere to Workshop Practice			
3. Carry out air conditioning sub-wire harness 'pre-installation' functionality test	i. Introduction of Ohm law ii. Types of sub-wire harness functionality test: • Wire resistance retesting procedure • Wire voltage testing procedure • Wire continuity testing procedure i. *Work Hazard related to electrical work, such as:* • *High voltage*			10 hours	Lecture & Group discussion	i. Ohm Law described ii. Wire resistance tested in according with service manual iii. Wire voltage tested in according with service manual iv. Wire continuity tested in according with service manual v. Wire connector

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	ii. *Workplace risk control, such as:* • *Usage of PPE* • *Workplace safety procedure*					tested in according with service manual
		i. Check wire harness terminal and socket ii. Conduct wire resistance test iii. Conduct wire voltage test iv. Conduct wire continuity test v. Conduct wire connector test	*<u>Attitude:</u>* i. Detail in conducting wire resistance test and wire voltage test ii. Accurate in interpreting test result	20 hours	Demonstration & Project	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			Safety/Environment: i. Adhere to safety procedure when conducting testing and commissioning			

Employability Skills

Core Abilities	Social Skills
01.01 Identify and gather information 01.02 Document information, procedures or processes. 01.03 Utilize basic IT applications 01.04 Analyze information 01.05 Utilize the internet to locate and gather information 01.06 Utilize word processor to process information 01.07 Utilize database applications to locate and process information 01.08 Utilize spreadsheets applications to locate and process information 01.09 Utilize business graphic application to process information 01.10 Apply a variety of mathematical techniques 01.11 Apply thinking skills and creativity 02.01 Interpret and follow manuals, instructions and SOP's 02.02 Follow telephone/telecommunication procedures 02.03 Communicate clearly 02.04 Prepare brief reports and checklists using standard forms 02.05 Read / interpret flowcharts and pictorial information 02.06 Write memos and letters 02.07 Utilize local area network (LAN) Internet to exchange information 02.08 Prepare pictorial and graphic information. 02.09 Prepare flowcharts 02.10 Prepare reports and instructions 02.11 Convey information and ideas to people 03.01 Apply cultural requirements to the workplace. 03.02 Demonstrate integrity and apply ethical practices. 03.03 Accept responsibility for own work and work area. 03.04 Seek and act constructively upon feedback about performance 03.05 Demonstrate safety skills 03.06 Respond appropriately to people and situations 03.07 Resolve interpersonal conflicts 03.08 Develop and maintain a cooperation within work group 03.09 Manage and improve performance of individuals	1. Communication skills 2. Conceptual skills 3. Interpersonal skills 4. Learning skills 5. Leadership skills 6. Multitasking and prioritizing 7. Self-discipline 8. Teamwork

03.10 Provide consultation and counselling 03.11 Monitor and evaluate performance of human resources 03.12 Provide coaching/on-the job training 03.13 Develop and maintain team harmony and resolve conflicts 03.14 Facilitate and coordinate teams and ideas 03.15 Liaise to achieve identified outcomes 03.16 Identify and assess client / customer needs 03.17 Identify staff training needs and facilitate access to training 04.01 Organize own work activities 04.02 Set and revise own objectives and goals 04.03 Organize and maintain own workplace 04.04 Apply problem-solving strategies 04.05 Demonstrate initiative and flexibility 04.06 Allocate work	

Tools, Equipment and Materials (TEM)

ITEMS	RATIO (TEM: Trainees)
1. Installation Manual	1:4
2. Personal Protective Equipment (PPE)	1:1
3. Sub-wire harness fabrication tools (Wire Crimping, Wire striper, Wire cutter, Soldering iron set, Multi meter, Ampere meter)	1:4 1:1
4. Sample of sub-wire harness fabrication work plan	1:4
5. Sample of Electrical circuit diagram	1:1
6. Sample of sub-wire harness fabrication checklist	1:1
7. Sample of sub-wire pre-installation functionality test checklist	1:1
8. Sub-wire harness fabrication materials (Wire tape, Wire, Spiral conduit, Cable tie)	As per required
9. Wire (Heat resistant wire, Command wire)	As per required

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3. Thomas L. Floyd , David M. Buchla (2009). *Electric Circuits Fundamentals* (8th Edition) Prentice Hall. ISBN-13: 978-0-13-507293-6, ISBN: 0-13-507293-X
4. Vince Fischelli (2006). *Wire Harness Troubleshooting*. ISBN-13: 978-1-934161-09-8, ISBN: 1-934161-09-8
5. William H. Crouse, Donald L. Anglin, William Harry Crouse, (2008), *Automotive Air Conditioning*, Mcgraw Hill Higher Education ISBN-13: 978-0-07-014591-7, ISBN: 0-07-014591-1

CURRICULUM of COMPETENCY UNIT (CoCU)

Sub Sector	**AFTER SALES SERVICES**						
Job Area	**COMMERCIAL VEHICLE AIR CONDITIONING**						
NOSS Title	**COMMERCIAL VEHICLE AIR CONDITIONING INSTALLATION AND MAINTENANCE**						
Competency Unit Title	**COMMERCIAL VEHICLE AIR-CONDITIONING UNIT INSTALLATION**						
Learning Outcomes	The outcome of this competency is to set up a complete air conditioning system for the commercial vehicle. Upon completion of this competency unit, trainees will be able to: • Organize air conditioning unit installation tools, equipment and materials • Install air conditioning unit mechanical parts • Install air conditioning sub-wire harness and electrical parts • Perform air conditioning refrigerant system charging • Carry out air conditioning unit testing and commissioning						
Competency Unit ID	**TP-122-3:2013-C03**	**Level**	3	**Training Duration**	350	**Credit Hours**	35

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
1. Organize air conditioning unit installation tools, equipment and materials	i. Introduction of air conditioning installation layout ii. Types and function of air conditioning system unit components • Mechanical components • Electrical components iii. Types and function of air conditioning unit			10 hours	Lecture & Group discussion	i. Air conditioning unit installation layout interpreted ii. Air conditioning system components prepared according to the air conditioning installation drawing

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	installation tools and equipment, such as: • Common hand tools • Torque wrench • Hand drill • Rivet gun • Sealant Gun • Manifold gauge • Micron Gauge • Air conditioning Gas Recovery And Recycle Machine • Refrigerant Gas Leak Detector • Air conditioning Refrigerant Analyser • Thermometer iv. Types and usage of air conditioning unit installation materials and consumable items , such as: • Sealant • Insulation tape • Refrigerant oil • Wire					iii. Installation tools and equipment determined and operated in according with operation manual iv. Installation materials and consumable items determined and selected v. Air conditioning refrigerant recovery, recycle and recharging machine operated

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
		i. Interpret air conditioning installation layout ii. Identify air conditioning unit and components specification iii. Determine and select installation tools and equipment iv. Determine and select installation materials and fitting parts v. Operate air conditioning refrigerant recovery, recycle and recharging machine	*Attitude:* i. Accurate in interpreting air conditioning installation layout drawing ii. Thorough in identifying air conditioning specification iii. Detail in determining types of	30 hours	Observation, Demonstration & Group Discussion	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			installation tools, equipment and testing devices <u>*Safety/Environment*</u>: i. Adhere to workplace housekeeping practice when preparing tools, equipment, machines and consumable items			
2. Install air conditioning unit mechanical components	i. Air conditioning "package roof unit" installation procedure ii. Air conditioning compressor bracket installation procedure iii. Air conditioning compressor unit installation procedure iv. Air conditioning ducting installation procedure v. Air conditioning piping and hoses installation procedure			40 hours	Lecture & Group discussion	i. Air conditioning "package roof unit" installed in according with installation manual ii. Compressor bracket installed according to installation manual iii. Compressor unit installed according to installation manual

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	vi. Air conditioning thermostatic expansion valve installation procedure					iv. Ducting unit installed according to installation manual
		i. Install air conditioning "package roof unit" ii. Install air conditioning compressor bracket iii. Install and align air conditioning compressor unit iv. Install and adjust air conditioning compressor belting v. Install air conditioning ducting unit vi. Install and connect air conditioning piping and hoses	*Attitude:* i. Detail in carrying out air conditioning mechanical parts installation ii. Safety cautious when operating machines by following the	110 hours	Demonstration & Project	v. Suction and discharge pipes and hoses installed and connected according to installation manual

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			machine operating procedure <u>*Safety/Environment*</u>: i. Adhere to safety procedure when carrying out installation works ii. Adhere to work area ergonomics practice when executing job			
3. Install air conditioning sub-wire harness and electrical parts	i. Fundamental of electricity • Electron flow • Ohm Law • Kirchhoff Law • Series and parallel circuit • Magnetism, solenoid and relay • AC current and DC current ii. Electrical circuit diagram of Commercial vehicle air conditioning system			25 hours	Lecture	i. Sub-wire harness installed in according with air conditioning electrical wiring installation diagram ii. Display control panel installed in according with installation manual iii. Roof control panel installed in according with installation manual

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	iii. Sub-wire Harness installation procedure iv. Climate Control Panel installation procedure v. Alternator installation procedure vi. Wire terminal fitting technique					iv. Additional alternator installed in according with installation manual
		i. Install sub-wire harness ii. Install Climate Control Panel iii. Install roof control panel iv. Install additional alternator	*Attitude:* i. Detail in installing sub-wire harness ii. Precise in carrying out wire terminal fitting *Safety/Environment*: i. Adhere to safety procedure	75 hours	Demonstration & Project	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			during installation ii. Adhere to workshop practice			
4. Carry out air conditioning refrigerant system charging	i. Quantity and specification of compressor oil ii. Quantity and specification of refrigerant iii. Operation and connection of vacuum pump. iv. Operation and reading of gauge manifold set. v. Operation of air conditioning refrigerant system recover, recycling and recharge unit.			5 hours	Lecture & Group discussion	i. Air conditioning compressor oil quantity and specification described ii. Air conditioning refrigerant quantity and specification described. iii. Top up compressor oil in according with service manual iv. Air conditioning refrigerant system recovery, recycling and recharge unit operated in according with manufacturer's operation manual
		i. Top up air conditioning compressor oil ii. Operate refrigerant recover, recycle and recharging unit iii. Carry out air conditioning system		15 hours	Demonstration & project	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
		vacuuming and evacuation iv. Carry out air conditioning refrigerant charging	*Attitude:* i. Careful when Carry out air conditioning system vacuuming and evacuation and carry out air conditioning refrigerant charging *Safety/Environment*: i. Adhere to safety procedure ii. Adhere to workshop practice			v. Vacuum pump operated in according with service manual vi. Manifold Gauge set operated in according with service manual
5. Carry out air conditioning unit testing and commissioning	i. Climate control panel functionality testing procedure ii. Power supply testing		In according with service manual	10 hours	Lecture & Group discussion	i. Vehicle battery terminal connected in according with

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	procedure iii. Blower Motor Air Flow testing procedure iv. Air conditioning system functionality testing procedure i. Vehicle engine oil level inspection procedure ii. Vehicle battery terminal connection inspection procedure iii. Vehicle water level cooling system inspection procedure v. Vehicle air conditioning testing arrangement procedure for: • Road endurance test • Noise test • Cool down test					service manual ii. Vehicle engine oil level checked in according with service manual iii. Climate control panel tested in according with service manual iv. Power supply tested in according with service manual v. Blower Motor Air Flow tested in according with service manual vi. Air conditioning system functionality tested in according with service manual vii. Vehicle road test arranged
		iv. Conduct climate control panel functionality test v. Conduct power supply test vi. Conduct Blower Motor		30 hours	Demonstration & practical	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
		Air Flow functionality test vii. Conduct air conditioning system functionality test viii. Inspect vehicle engine oil level ix. Inspect vehicle battery terminal connection x. Inspect vehicle water level cooling system	*Attitude:* i. Analytical in conducting test ii. Detail in carrying vehicle water level cooling system inspection *Safety/Environment*: i. Safety caution when carrying out air conditioning unit testing and commissioning			

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			ii. Adhere to safety procedure when conducting test			

Employability Skills

Core Abilities	Social Skills
01.01 Identify and gather information 01.02 Document information, procedures or processes. 01.03 Utilize basic IT applications 01.04 Analyze information 01.05 Utilize the internet to locate and gather information 01.06 Utilize word processor to process information 01.07 Utilize database applications to locate and process information 01.08 Utilize spreadsheets applications to locate and process information 01.09 Utilize business graphic application to process information 01.10 Apply a variety of mathematical techniques 01.11 Apply thinking skills and creativity 02.01 Interpret and follow manuals, instructions and SOP's 02.02 Follow telephone/telecommunication procedures 02.03 Communicate clearly 02.04 Prepare brief reports and checklists using standard forms 02.05 Read / interpret flowcharts and pictorial information 02.06 Write memos and letters 02.07 Utilize local area network (LAN) Internet to exchange information 02.08 Prepare pictorial and graphic information. 02.09 Prepare flowcharts 02.10 Prepare reports and instructions 02.11 Convey information and ideas to people 03.01 Apply cultural requirements to the workplace. 03.02 Demonstrate integrity and apply ethical practices. 03.03 Accept responsibility for own work and work area. 03.04 Seek and act constructively upon feedback about performance 03.05 Demonstrate safety skills 03.06 Respond appropriately to people and situations 03.07 Resolve interpersonal conflicts 03.08 Develop and maintain a cooperation within work group	1. Communication skills 2. Conceptual skills 3. Interpersonal skills 4. Learning skills 5. Leadership skills 6. Multitasking and prioritizing 7. Self-discipline 8. Teamwork

03.09 Manage and improve performance of individuals 03.10 Provide consultation and counselling 03.11 Monitor and evaluate performance of human resources 03.12 Provide coaching/on-the job training 03.13 Develop and maintain team harmony and resolve conflicts 03.14 Facilitate and coordinate teams and ideas 03.15 Liaise to achieve identified outcomes 03.16 Identify and assess client / customer needs 03.17 Identify staff training needs and facilitate access to training 04.01 Organize own work activities 04.02 Set and revise own objectives and goals 04.03 Organize and maintain own workplace 04.04 Apply problem-solving strategies 04.05 Demonstrate initiative and flexibility 04.06 Allocate work	

Tools, Equipment and Materials (TEM)

ITEMS	RATIO (TEM: Trainees)
1. Air conditioning Gas Recovery And Recycle Machine	1:15
2. Air conditioning unit Mechanical components	
- Air Conditioning Roof Unit	1:5
- Air Conditioning Compressor	
- Air Conditioning Ducting	
- Air Conditioning Piping	
3. Air conditioning unit Electrical components	
- Sub-wire Harness	
- Climate Control Panel	1:5
- Roof Control Panel	
- Alternator	
4. Electrical materials	
- Wire tape, Wire, Spiral conduit, Cable tie	As per required
5. Installation materials and consumable items	As per required
- Sealant, Insulation tape, Refrigerant oil	
6. Installation tools	1:5
- Common hand tools, Torque wrench, Hand drill, Rivet gun, Sealant gun	
7. Installation Manual	1:5
8. Personal Protective Equipment (PPE)	1:1
9. Refrigerant equipment	
- Refrigerant gas leak detector	1:5
- Air conditioning refrigerant analyser	
- Thermometer	

10. Sample of installation work plan	1:1
11. Sample of installation company SOP	1:1
12. Sample of pre-delivery inspection checklist	1:1
13. Commissioning checklist test checklist	1:1
14. Wire: Heat resistant wire, Command wire	As per required

References

REFERENCES
1. Commercial Vehicle Air Conditioning Installation Manual 2. Boyce H. Dwiggins (2009) *Automotive Air Conditioning* 4th Edition, Delmar Publisher ISBN-13: 978-0-7668-0788-4, ISBN: 0-7668-0788-6 3. Lu Yu Jun, (2007), Bus Air Conditioning Unit, China Railway Publishing House, ISBN-13: 978-7-113-08340-3, ISBN: 7-113-08340-4 4. James D. Haldaman (2009) *Automotive Technology, Principles, Diagnosis and Services* 3rd Edition, Pearson Prantice Hall 5. Norman Norville. (2003). *School Bus Air Conditioning Systems and Controls Motor Age Self-Study Guide for ASE Certification*. ISBN-13: 978-1-933180-30-4, ISBN: 1-933180-30-7 6. Thomas S. Birch , Martin Duvic , Tom Birch (2011). *Automotive Heating and Air Conditioning* (6th Edition) Prentice Hall. ISBN-13: 978-0-13-255153-3, ISBN: 0-13-255153-5 7. William H. Crouse, Donald L. Anglin, William Harry Crouse, (2008), *Automotive Air Conditioning*, Mcgraw Hill Higher Education ISBN-13: 978-0-07-014591-7, ISBN: 0-07-014591-1

CURRICULUM of COMPETENCY UNIT (CoCU)

Sub Sector	**AFTER SALES SERVICES**
Job Area	**COMMERCIAL VEHICLE AIR-CONDITIONING**
NOSS Title	**COMMERCIAL VEHICLE AIR CONDITIONING INSTALLATION AND MAINTENANCE**
Competency Unit Title	**COMMERCIAL VEHICLE AIR-CONDITIONING MAINTENANCE**
Learning Outcomes	The outcome of this competency is to produce excellent condition of the air conditioning unit in term of performance and functionality in providing cold and comfort environment and to meet passengers'' requirement. Upon completion of this competency unit, trainees will be able to: • Organise commercial vehicle air conditioning maintenance • Carry out "Compressor *Drive System*" (CDS) maintenance • Carry out cooling unit system maintenance • Carry out condensing unit system maintenance • Carry out air conditioning refrigerant cycle system maintenance

Competency Unit ID	**TP-122-3:2013-C04**	**Level**	3	**Training Duration**	220	**Credit Hours**	22

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
1. Organise commercial vehicle air conditioning maintenance	i. Air conditioning periodical maintenance schedule ii. Vehicle date and Air conditioning maintenance record iii. Types and function of maintenance tools and equipment, such as: • Torque wrench • Multi meter			7 hours	Lecture & Group discussion	i. Maintenance tools and equipment selected according to maintenance schedule ii. Materials and consumable items selected according to

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	• Common hand tools • Vernier calliper • Feeler gauge • Water jet • Gas Recovery And Recycle Machine • Flushing Machine • Refrigerant Gas Leak Detector • Air conditioning Refrigerant Analyser • Thermometer • Air flow meter iv. Types and usage of air conditioning unit maintenance materials and consumable items, such as: • Sealant • Insulation tape • Molybdenum Grease • Nitrogen • Compressor oil • Air conditioning Compressor oil • Air conditioning					maintenance schedule iii. Air conditioning unit replaceable spare parts prepared according to maintenance schedule

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	refrigerant v. Types and function of air conditioning unit replaceable / serviceable spare parts, such as: • Drier • Pollen filter • Cabin air filter • Suction & discharge flexible hoses • O-ring • Expansion valve • V-Belt • V-Belt tensioner					
		i. Interpret commercial vehicle air conditioning maintenance job order contents ii. Select commercial vehicle air conditioning maintenance tools and equipment iii. Select commercial vehicle air conditioning maintenance materials iv. Prepare air		23 hours	Demonstration & practical	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
		conditioning unit replaceable / serviceable spare parts	*Attitude:* i. Detail when interpret maintenance job order contents ii. Analytical mind when interpreting commercial vehicle air conditioning previous maintenance record iii. Rational in selecting maintenance tools and equipment v. Precise in determine required replaceable spare parts			

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			Safety/Environment: i. Adhere to workplace housekeeping practice when preparing tools, equipment and materials.			
2. Carry out "Compressor Drive System" (CDS) maintenance	i. Type and function of compressor drive system (CDS) components • Compressor drive system • Compressor service valve • Magnetic clutch • Shaft seal ii. Compressor Drive System (CDS) maintenance procedure iii. Type and specification of air conditioning • compressor oil • air conditioning belting iv. Manifold gauge set operating procedure			10 hours	Lecture & Group discussion	i. Air conditioning compressor service valve closed in according with servicing manual ii. Compressor refrigerant evacuated in according with service manual iii. Compressor oil replaced in according with manufacturer's specification iv. Compressor shaft seal replaced in according with repair manual v. Air conditioning

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	v. Air conditioning recover, recycle and charging equipment operating procedure vi. Compressor shaft seal replacing procedure vii. Belting adjustment procedure					compressor vacuumed in according with service manual vi. Air conditioning compressor refrigerant top up in according with manufacturer's specification
		i. Close Compressor service valve ii. Connect and operate manifold gauge set / Recovery, recycle and recharge unit iii. Evacuate refrigerant in the compressor iv. Replace air conditioning compressor oil v. Replace compressor shaft seal vi. Vacuum air conditioning compressor vii. Top up Air conditioning compressor refrigerant viii. Re-open compressor unit service valve		40 hours	Demonstration Practical or Project	vii. Air conditioning compressor service valve re-open in according with service manual viii. Compressor belt removed and replaced according to service manual ix. Belt tension adjusted in according with manufacturer's specification

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
		ix. Remove and replace compressor belting x. Adjust belt tension	<u>*Attitude:*</u> i. Through when inspecting "*Compressor Drive System*" (CDS) components and parts condition ii. Careful when performing maintenance works iii. Meticulous when troubleshooting and rectifying components abnormalities <u>*Safety/Environment*</u>: i. Adhere to safety procedure when carrying out maintenance works			

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			ii. Adhere to work area ergonomics practice when executing job			
3. Carry out evaporator unit assembly maintenance	i. Type and function of air conditioning evaporator assembly's components: • Evaporator blower motor • Evaporator air filter • Evaporator coils • Thermal expansion valve • Liquid line solenoid valve • Drain port / hose ii. Evaporator air filter cleaning / replacement procedure iii. Evaporator blower cleaning procedure iv. Evaporator coils assembly cleaning procedure v. Evaporator blower air flow specification			10 hours	Lecture	i. Types of evaporator assembly components listed out and described ii. Evaporator Air filter cleaned or replaced according to service manual iii. Evaporator blower inspected and cleaned in according to service manual iv. Evaporator coils assembly inspected and cleaned according to service manual v. Evaporator blower air flow tested in

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	vi. System “pump down” procedure vii. Thermal expansion valve replacement procedure viii. Liquid line solenoid valve replacement procedure ix. Drain port / hose replacement procedure					according with manufacturer’s specification vi. System “pump down” carry out in according with service manual vii. Thermal expansion valve removed and replaced in according with service manual viii. Liquid line solenoid valve removed and replaced in according with service manual ix. Drain port / hose removed and replaced in according with service manual
		i. Clean, or replace evaporator air filter ii. Inspecting and cleaning evaporator blower iii. Inspecting and Cleaning evaporator coils iv. Test evaporator blower air flow specification v. Carry out system “pump down” activates vi. Remove and replace thermal expansion valve vii. Remove and replace liquid line solenoid		40 hours	Demonstration & Practical or Project	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
		valve viii. Remove and replace drain port / hose	*Attitude:* i. Meticulous inspecting cooling unit components and parts ii. Detail and precise in carrying out cooling unit system maintenance *Safety/Environment*: i. Do not use a disposable refrigerant container to recover / store the refrigerant, an explosion may occur. ii. The filter drier may contain liquid refrigerant. Slowly open the flare nuts avoid contact with exposed skin or			

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			eyes iii. Adhere to safety procedure when carry out cooling unit system maintenance			
4. Carry out condensing unit assembly maintenance	i. Types and function of condensing unit assembly serviceable components and parts: • Condenser coils assembly • Condenser fan motor • Filter-drier • Ambient air switch • Refrigerant receiver tank ii. Condenser cooling fan cleaning procedure iii. Condenser coils cleaning procedure iv. Filter-drier replacement procedure v. Ambient air switch replacement procedure vi. Refrigerant receiver tank replacement			10 hours	Lecture & Group discussion	i. Types of condensing unit system components listed out and described ii. Fan blade inspected, cleaned or replaced in according with service manual iii. Condenser coils inspected and cleaned in according with service manual iv. Condenser fan motor air flow tested in according with manufacturer's specification

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	procedure vii. Condenser motor air flow specification					v. Filter-drier replaced in according to service manual
		i. Inspect and clean condensing coils assembly ii. Inspected, clean or replace condenser cooling fan blade iii. Remove and replace ambient air switch iv. Remove and replace refrigerant receiver tank v. Operate air flow meter vi. Check condenser motor air flow .	<u>*Attitude:*</u> i. Detail and precise in carrying out condensing unit system maintenance	40 hours	Demonstration Practical or & project	vi. Ambient air switch replaced in according to service manual vii. Refrigerant receiver tank replaced in according with service manual

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			Safety/Environment: i. Do not use a disposable refrigerant container to recover / store the refrigerant, an explosion may occur. ii. Adhere to safety procedure when carry out condensing unit system maintenance iii. Adhere to Workshop Practice work area ergonomics practice when executing job			
5. Carry out air conditioning refrigerant system maintenance	i. Refrigerant system leakage test procedure ii. Type and function of air conditioning refrigerant system components and parts • Suction hose and discharge hose • Suction pipe and discharge pipe			10 hours	Lecture & Group discussion	i. Type of air conditioning refrigerant system components and listed out and described ii. Refrigerant leakage test conducted

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	• O-Ring • Low pressure and high pressure switch iii. System "pump down" procedure iv. Manifold gauge set / recovery, recycle and recharge unit connecting and operating procedure v. Suction hose and discharge hose replacement procedure vi. O-Ring replacement procedure vii. Low and high pressure switch replacement procedure					according to service manual iii. System "pumpdown" carry out according to service manual iv. Suction hose and discharge hose removed and replaced according to repair manual. v. O-Ring removed and replaced according to repair manual vi. Low pressure and high pressure switch ~~service valve~~ removed and replaced according to repair manual
		i. Conduct Air conditioning refrigerant system leakage test ii. Carry out system "pump down" iii. Connect and operate manifold gauge set / recovery, recycle and		30 hours	Demonstration & Practical or project	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
		recharge unit iv. Evacuate air conditioning system's refrigerant v. Remove and replace suction and discharge hoses and pipes vi. Remove and replace O-ring vii. Remove and replace high and low pressure switches	*Attitude:* i. Meticulous inspecting refrigerant cycle system components and parts ii. Detail and precise in carrying out refrigerant cycle system maintenance iii. Analytical mind when interpreting suction hose and discharge hose leak test result			

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			Safety/Environment: i. Adhere to safety procedure when carry out refrigerant cycle system maintenance ii. Adhere to Workshop Practice and work area ergonomics practice when executing job			

Employability Skills

Core Abilities	Social Skills
01.01 Identify and gather information 01.02 Document information, procedures or processes. 01.03 Utilize basic IT applications 01.04 Analyze information 01.05 Utilize the internet to locate and gather information 01.06 Utilize word processor to process information 01.07 Utilize database applications to locate and process information 01.08 Utilize spreadsheets applications to locate and process information 01.09 Utilize business graphic application to process information 01.10 Apply a variety of mathematical techniques 01.11 Apply thinking skills and creativity 02.01 Interpret and follow manuals, instructions and SOP's 02.02 Follow telephone/telecommunication procedures 02.03 Communicate clearly 02.04 Prepare brief reports and checklists using standard forms 02.05 Read / interpret flowcharts and pictorial information 02.06 Write memos and letters 02.07 Utilize local area network (LAN) Internet to exchange information 02.08 Prepare pictorial and graphic information. 02.09 Prepare flowcharts 02.10 Prepare reports and instructions 02.11 Convey information and ideas to people 03.01 Apply cultural requirements to the workplace. 03.02 Demonstrate integrity and apply ethical practices. 03.03 Accept responsibility for own work and work area. 03.04 Seek and act constructively upon feedback about performance 03.05 Demonstrate safety skills 03.06 Respond appropriately to people and situations 03.07 Resolve interpersonal conflicts 03.08 Develop and maintain a cooperation within work group	1. Communication skills 2. Conceptual skills 3. Interpersonal skills 4. Learning skills 5. Leadership skills 6. Multitasking and prioritizing 7. Self-discipline 8. Teamwork

03.09 Manage and improve performance of individuals 03.10 Provide consultation and counselling 03.11 Monitor and evaluate performance of human resources 03.12 Provide coaching/on-the job training 03.13 Develop and maintain team harmony and resolve conflicts 03.14 Facilitate and coordinate teams and ideas 03.15 Liaise to achieve identified outcomes 03.16 Identify and assess client / customer needs 03.17 Identify staff training needs and facilitate access to training 04.01 Organize own work activities 04.02 Set and revise own objectives and goals 04.03 Organize and maintain own workplace 04.04 Apply problem-solving strategies 04.05 Demonstrate initiative and flexibility 04.06 Allocate work	

Tools, Equipment and Materials (TEM)

ITEMS	RATIO (TEM: Trainees)
1. Air conditioning unit maintenance tools (Torque wrench. Multi meter, Common hand tools, Vernier calliper)	1:4
2. Air conditioning gas recovery and recycle machine	1:10
3. Air conditioning refrigerant analyser	1:10
4. Compressor oil	As required
5. Growler machine	1:10
6. Installation materials (Sealant, Insulation tape, Molybdenum Grease, Nitrogen)	As required
7. Personal Protective Equipment (PPE)	1:1
8. Refrigerant gas leak detector	1:10
9. Refrigeration oil	As required
10. Service manual	1:1
11. Sample of company SOP	1:1
12. Thermometer	1:4
13. Water jet	1:10

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CURRICULUM of COMPETENCY UNIT (CoCU)

Sub Sector	**AFTER SALES SERVICES**
Job Area	**COMMERCIAL VEHICLE AIR CONDITIONING**
NOSS Title	**COMMERCIAL VEHICLE AIR CONDITIONING INSTALLATION AND MAINTENANCE**
Competency Unit Title	**COMMERCIAL VEHICLE AIR CONDITIONING MECHANICAL COMPONENTS REPAIR**
Learning Outcomes	The outcome of this competency is to provide effective, timely, and satisfactory repair, replacements and overhaul works of the air conditioning mechanical components to ensure the air conditioning system is in the good state of performance in providing cold and comfort environment to meet passengers'' requirement. Upon completion of this competency unit, trainees will be able to: • Perform commercial vehicle air conditioning troubleshooting • Repair compressor magnetic clutch • Overhaul air conditioning compressor unit • Repair cooling unit • Repair condenser unit • Repair air conditioning refrigerant cycle system • Carry out conditioning mechanical performance test

Competency Unit ID	**TP-122-3:2013-C05**	**Level**	3	**Training Duration**	360	**Credit Hours**	36

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
1. Perform commercial vehicle air conditioning troubleshooting	i. Types and function of tools and equipment for troubleshooting works, such as: • Common tools • Recovery and Recycle Machine			7 hours	Lecture & Group discussion	i. Air conditioning troubleshooting tools and equipment selected and prepared in according with job order

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	• Manifold Gauge • Refrigerant leak detector • Air flow meter • Thermometer • Multi meter • Feeler gauge • Torque wrench ii. Compressor drive system components and parts troubleshooting procedure iii. Cooling unit components and parts troubleshooting procedure iv. Condensing unit system components and parts troubleshooting procedure v. Air conditioning refrigerant cycle system components and parts troubleshooting procedure					ii. Air conditioning compressor system troubleshoot in according with repair manual iii. Evaporator system troubleshoot in according with repair manual iv. Air conditioning condenser system troubleshoot in according with repair manual v. Air conditioning refrigerant system troubleshoot in according with service manual vi. Air conditioning refrigerant system troubleshoot in

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
						according with repair manual
		i. Operate air conditioning troubleshooting tools and equipment ii. Troubleshoot compressor drive system iii. Troubleshoot air conditioning evaporator system iv. Troubleshoot air conditioning condenser system v. Troubleshoot air conditioning refrigerant system	*Attitude:* i. Detail in determining types of tools, equipment for repair work. ii. Analytical when interpreting troubleshooting result and identifying problem root cause	23 hours	Demonstration Practical & Group Discussion	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			Safety/Environment: i. Adhere to workplace housekeeping practice when preparing tools, equipment and materials.			
2. Repair compressor magnetic clutch	i. Type and function of magnetic clutch components and parts • Magnetic clutch unit • Magnetic clutch pulley • Magnetic clutch pulley bearing • Field coil (electrical part) ii. Magnetic clutch unit removing and replacing procedure iii. Magnetic clutch pulley bearing removing and replacing procedure iv. Magnetic clutch centre bolt tightening procedure			15 hours	Lecture	i. Type and function of magnetic clutch components described ii. Magnetic clutch unit removed and replaced according to service manual iii. Magnetic clutch pulley bearing removed and replaced according to service manual iv. Magnetic clutch air gap adjusted according to manufacturer's specification v. Magnetic clutch

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	v. Magnetic clutch air gap adjustment technique vi. Tightening torque specification					centre bolt torque according to manufacturer's specification
		i. Remove and replace magnetic clutch unit ii. Remove and replace magnetic clutch pulley bearing iii. Adjust magnetic clutch air gap iv. Torque magnetic clutch canter bolt	*Attitude:* i. Accurate when measure and adjusting magnetic clutch air gap ii. Detail when executing repair work *Safety/Environment:* i. Concern to safety requirement when performing	45 hours	Demonstration Practical or Project	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			compressor magnetic clutch repair ii. Adhere to Workshop Practice work area ergonomics practice when executing job			
3. Overhaul air conditioning compressor unit	i. Type and function of air conditioning compressor parts: • Compressor Valve Plate • Piston • Crankshaft • Connecting Rod • Bore Block • Shaft Seal • Low Pressure and High Pressure Service Valve ii. Torque tightening procedure and specification			15 hours	Lecture & Group discussion	i. Type of air conditioning compressor described ii. High and low pressure service valve removed and replaced according to repair manual iii. Compressor valve plate removed and replaced according to repair manual iv. Piston removed

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	iii. Compressor Service Valve removing and replacing procedure iv. Compressor valve plate removing and replacing procedure v. Shaft seal removing and replacing procedure vi. Piston removing and replacing procedure vii. Connecting rod removing and replacing procedure viii. Crankshaft removing and replacing procedure ix. Bore block removing and replacing procedure x. Compressor oil refilling procedure xi. Compressor leak testing procedure					and replaced according to repair manual v. Connecting rod removed and replaced according to repair manual vi. Crankshaft removed, rectified and replaced according to repair manual vii. Bore block removed, rectified and replaced according to repair manual viii. Shaft seal removed and replaced according to service manual ix. Compressor oil refilled in according with manufacturer's specification x. Compressor leakage tested
		i. Remove and replace high and low pressure service valve ii. Remove and replace compressor valve		45 hours	Demonstration Practical or project	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
		plate iii. Remove and replace piston iv. Remove and replace connecting rod v. Remove, rectify and replace crankshaft vi. Remove, rectify or replace bore block vii. Remove and replace shaft seal viii. Refill compressor oil ix. Conduct compressor leakage test	*Attitude:* i. Careful when performing air conditioning compressor unit overhaul ii. Thorough when conducting compressor leak test			in according with service manual

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			Safety/Environment: i. Concern to safety requirement when perform air conditioning compressor unit overhaul ii. Adhere to Workshop Practice work area ergonomics practice when executing job			
4. Repair Evaporator Assembly	i. Type and function of air conditioning evaporator assembly's components: • Evaporator blower motor • Evaporator air filter • Evaporator coils • Thermal expansion valve • Liquid line solenoid valve • Drain port / hose			15 hours	Lecture & Group discussion	i. Evaporator filter inspected, cleaned or replaced in according to service manual ii. System "pump down" activities performed according to service manual iii. Evaporator coil removed, and replaced according to repair manual

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	ii. Removing, cleaning or replacing evaporator air filter procedure iii. System “pump down” procedure iv. Removing and replacing evaporator coil procedure v. Removing and replacing thermal expansion valve vi. Removing and replacing liquid line solenoid valve procedure vii. Removing and replacing drain port / hose procedure viii. Evaporating unit leakage testing procedure					iv. Thermal expansion valve removed and replaced according to repair manual v. Liquid line solenoid valve removed and replaced according to repair manual vi. Drain port / hose replaced in according to service manual vii. Evaporating unit leakage tested in according to service manual
		i. Remove, clean or replace evaporator air filter ii. Perform system “pump down” activities iii. Remove and replace evaporator coils iv. Remove and replace		45 hours	Demonstration Practical or project	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
		thermal expansion valve v. Remove and replace liquid line solenoid valve vi. Remove and replace drain port / hose vii. Perform evaporating unit leakage test	*Attitude:* i. Careful when remove and replace cooling unit parts ii. Detail when rectifying cooling unit system components abnormalities *Safety/Environment:* i. Concern to safety requirement when perform cooling unit repair			

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
5. Repair condenser unit assembly	i. Types of condensing unit assembly components : • Condenser coil • Condenser fan Motor • Ambient air switch • Filter-drier • Refrigerant receiver tank ii. System “pump down” procedure iii. Removing and replacing condenser coils procedure iv. Removing and replacing filter-drier procedure v. Removing and replacing refrigerant receiver tank procedure vi. Condensing unit leakage testing procedure			15 hours	Lecture & Group discussion	i. System “pump down” activities performed in according with service manual ii. Condenser coil removed, and replaced in according with service manual iii. Filter-drier removed and replaced according to service manual iv. Refrigerant receiver tank removed and replaced according to service manual v. Condensing unit leakage tested according service manual

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
		i. Perform system "pump down" activities ii. Remove and replace condenser coils iii. Remove and replace filter-drier iv. Remove and replace refrigerant receiver tank v. Conduct condensing unit leakage test	*Attitude:* i. Careful when remove and replace condensing unit parts ii. Detail when carry out condensing unit repair iii. Analytical mind and accurate when rectifying condensing unit system abnormalities	45 hours	Demonstration Practical or project	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			Safety/Environment: i. Concern to safety requirement when perform condenser unit repair ii. Adhere to Workshop Practice work area ergonomics practice when executing job			
6. Repair air conditioning refrigerant cycle system	i. Types and function of air conditioning refrigerant cycle system components and parts • Suction and discharge pipes and hoses • O-ring • High and low pressure service valve ii. System "pump down' procedure iii. Suction pipe and discharge pipe leak testing procedure iv. Suction and			15 hours	Lecture & Group discussion	i. Types and function of air conditioning refrigerant cycle system components described ii. Suction and discharge pipe and hoses leakage tested in according with service manual iii. System "pump down" activities perform in according with service manual

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	discharge pipes removing and replacing procedure v. High and low pressure service valve removing and replacing procedure					iv. Suction and discharge pipes and hoses removed and replaced in according with service manual v. Suction and discharge piping and hoses leakage tested in according with service manual
		i. Conduct suction pipe and discharge pipe leakage test ii. Perform system "pump down" activities iii. Remove and replace suction and discharge pipes and hoses iv. Perform suction and discharge piping and hoses leakage test	*Attitude:* i. Careful when conducting leak test ii. Detail in when carrying out air conditioning refrigerant cycle system repair works	45 hours	Demonstration & project	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			Safety/Environment: i. Concern to safety requirement when perform air conditioning refrigerant cycle system repair ii. Adhere to Workshop Practice work area ergonomics practice when executing job			
7. Carry out air conditioning mechanical components performance test	i. Compressor pulley belting tension adjusting procedure ii. Compressor abnormal noise iii. Cabin cooling temperature testing procedure iv. Manifold gauge set operating procedure v. Air conditioning refrigerant pressure tasting procedure			8 hours	Lecture & Group discussion	i. Compressor pulley belting tension adjusted in according with service manual ii. Compressor noise level check in according with service manual iii. Cabin cooling temperature tested in according with

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
		i. Conduct Condenser and evaporator unit blower motor air flow testing activities ii. Conduct cabin cooling temperature testing activities iii. Conduct Refrigerant Pressure Test	*Attitude:* i. Careful when conducting performance test ii. Accurate in interpreting test result *Safety/Environment:* i. Concern to safety requirement when perform air conditioning mechanical performance test ii. Adhere to Workshop Practice work area ergonomics practice when executing job	22 hours	Demonstration & project	manufacturer's specification iv. Air conditioning refrigerant pressure level tested in according with manufacturer's specification

Employability Skills

Core Abilities	Social Skills
01.01 Identify and gather information 01.02 Document information, procedures or processes. 01.03 Utilize basic IT applications 01.04 Analyze information 01.05 Utilize the internet to locate and gather information 01.06 Utilize word processor to process information 01.07 Utilize database applications to locate and process information 01.08 Utilize spreadsheets applications to locate and process information 01.09 Utilize business graphic application to process information 01.10 Apply a variety of mathematical techniques 01.11 Apply thinking skills and creativity 02.01 Interpret and follow manuals, instructions and SOP's 02.02 Follow telephone/telecommunication procedures 02.03 Communicate clearly 02.04 Prepare brief reports and checklists using standard forms 02.05 Read / interpret flowcharts and pictorial information 02.06 Write memos and letters 02.07 Utilize local area network (LAN) Internet to exchange information 02.08 Prepare pictorial and graphic information. 02.09 Prepare flowcharts 02.10 Prepare reports and instructions 02.11 Convey information and ideas to people 03.01 Apply cultural requirements to the workplace. 03.02 Demonstrate integrity and apply ethical practices. 03.03 Accept responsibility for own work and work area. 03.04 Seek and act constructively upon feedback about performance 03.05 Demonstrate safety skills 03.06 Respond appropriately to people and situations 03.07 Resolve interpersonal conflicts 03.08 Develop and maintain a cooperation within work group	1. Communication skills 2. Conceptual skills 3. Interpersonal skills 4. Learning skills 5. Leadership skills 6. Multitasking and prioritizing 7. Self-discipline 8. Teamwork

03.09 Manage and improve performance of individuals 03.10 Provide consultation and counselling 03.11 Monitor and evaluate performance of human resources 03.12 Provide coaching/on-the job training 03.13 Develop and maintain team harmony and resolve conflicts 03.14 Facilitate and coordinate teams and ideas 03.15 Liaise to achieve identified outcomes 03.16 Identify and assess client / customer needs 03.17 Identify staff training needs and facilitate access to training 04.01 Organize own work activities 04.02 Set and revise own objectives and goals 04.03 Organize and maintain own workplace 04.04 Apply problem-solving strategies 04.05 Demonstrate initiative and flexibility 04.06 Allocate work	

Tools, Equipment and Materials (TEM)

ITEMS	RATIO (TEM: Trainees)
1. Air conditioning compressor magnetic clutch repair - Pulley - Magnetic clutch Bearing - Stator coil/ rotor	1:4
2. Air conditioning compressor unit - Valve plate - Piston - Crankshaft - Connecting rod - Bore block - Shaft seal	1:4
3. Air conditioning cooling unit - Blower motor wheels - Blower motor carbon brush - Blower motor bearing - Blower motor armature - Return air filter - Evaporator - Drain port/ hose - Expansion valve	1:4
4. Air conditioning condenser unit - Condenser - Condenser fan motor	1:4

- Condenser fan motor blade - Condenser fan motor carbon brush - Condenser fan motor armature - Condenser fan motor bearing - Dryer Tank	
5. Air conditioning refrigerant cycle system - Suction hose - Discharge hose - Suction pipe - Discharge pipe - O-ring - Low pressure switch - High pressure switch	1:4
6. Installation Manual	1:1
7. Personal Protective Equipment (PPE)	1:1
8. Mechanical repair tools (Wire Crimping, Wire striper, Wire cutter, Soldering iron set, Multi meter, Ampere meter)	1:4
9. Recovery machine	1:4
10. Sample of mechanical component repair work plan	1:1
11. Sample of electrical circuit diagram	1:1
12. Sample of company SOP	1:1
13. Mechanical repair materials (Wire tape, Wire, Spiral conduit, Cable tie)	As per required
14. Wire (Heat resistant wire, Command wire)	As per required

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CURRICULUM of COMPETENCY UNIT (CoCU)

Sub Sector	**AFTER SALES SERVICES**						
Job Area	**COMMERCIAL VEHICLE AIR CONDITIONING**						
NOSS Title	**COMMERCIAL VEHICLE AIR CONDITIONING INSTALLATION AND MAINTENANCE**						
Competency Unit Title	**COMMERCIAL VEHICLE AIR CONDITIONING ELECTRICAL COMPONENTS REPAIR**						
Learning Outcomes	The outcome of this competency is to provide effective, timely, and satisfactory repair / replacements works of the air conditioning electrical components according to service manual / repair manual and regulatory body regulation to ensure customer satisfaction guaranteed. Upon completion of this competency unit, trainees will be able to: • Carry out air conditioning electrical components troubleshooting • Carry out air conditioning electrical components rectification works • Perform air conditioning electrical components functionality test						
Competency Unit ID	**TP-122-3:2013-C06**	**Level**	3	**Training Duration**	230	**Credit Hours**	23

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
1 Carry out air conditioning electrical components troubleshooting	i. Introduction of Electrical wiring diagram and symbol ii. Electrical circuit diagram of Commercial vehicle air conditioning system iii. Fundamental of electricity • Electron flow • Ohm Law • Kirchhoff Law			15 hours	Lecture & Group discussion	i. Electrical circuit and wiring diagram interpreted ii. Fundamental of electricity described iii. Required tools and equipment for troubleshooting and repair work selected

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	• Series and parallel circuit • AC current and DC current iv. Types and function of Semiconductor parts • Diode • Resistor • Transistor • Capacitor • Integrated Circuit (IC) • Power Circuit Board (PCB) • Roof unit amplifier v. Type, size, colour code and length of wire specification vi. Type and function of tools and equipment for electrical parts troubleshooting and repair works • Wire Crimping • Wire striper • Wire cutter • Soldering iron					iv. Climate control panel Diagnose Trouble Code (DTC) interpreted according to repair manual v. Climate control panel functionality tested according to repair manual vi. Relay functionality tested according to repair manual vii. Roof Unit Amplifier functionality tested according to repair manual viii. Magnetic Clutch Stator Coil functionality tested according to repair manual ix. Condenser Fan and cooling unit Motor functionality tested according to repair manual

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	set • Multi meter • Ampere meter vii. Climate control panel Diagnose Trouble Code (DTC) viii. Climate control panel troubleshooting procedure ix. Relay troubleshooting procedure x. Roof top unit amplifier troubleshooting procedure xi. Magnetic clutch field coil troubleshooting procedure xii. Condenser and cooling blower fan motor troubleshooting procedure xiii. Liquid line solenoid valve troubleshooting procedure xiv. Pressure switch troubleshooting					x. High and low pressure switch functionality tested according to repair manual xi. Temperature Sensor functionality tested according to repair manual xii. Electrical components failure symptom identified xiii. Electrical components problem route cause identified

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	procedure xv. Temperature sensors troubleshooting procedure					
		i. Interpret air conditioning electrical wiring diagram ii. Select tools and equipment for troubleshooting work iii. Interpret climate control panel Diagnose Trouble Code (DTC) iv. Carry out relay functionality test v. Roof top Unit amplifier functionality test vi. Magnetic clutch field Coil functionality test vii. Condenser and cooling unit fan blower motor functionality test viii. Liquid line solenoid valve functionality test		25 hours	Demonstration Practical & Group Discussion	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
		ix. High and low pressure switches functionality test x. Temperature sensors functionality test	*Attitude:* i. Accuracy in interpreting climate control panel Diagnose Trouble Code (DTC ii. Detail in determining types of tools, equipment for repair work. iii. Analytical when interpreting troubleshooting result and identifying problem root cause *Safety/Environment*: i. Adhere to safety procedure when carry out air conditioning electrical components			

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			troubleshoot ii. Adhere to workshop Practice			
2 Carry out air conditioning electrical components rectification works	i. Fuse removing and replacing procedure ii. Relay removing and replacing procedure iii. Roof unit amplifier removing and replacing procedure iv. Magnetic clutch field coil removing and replacing procedure v. Condenser fan motor and evaporator blower motor rectification procedure vi. High and low pressure switch removing and replacing procedure vii. Temperature Sensors removing and replacing procedure viii. Climate control panel removing and replacing procedure			35 hours	Lecture & Group discussion	i. Electrical component's fuse replaced in according with service manual and specification ii. Electrical component's relay replaced in according with service manual and specification iii. Roof top unit amplifier tested and replaced in according with service manual and specification iv. Magnetic clutch filed coil tested and replaced in according with service manual and specification v. Condenser fan

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
						motor and evaporator blower motor tested, rectified or replaced in according with service manual vi. Pressure switches tested and replaced in according with service manual and specification vii. Temperature sensors tested and replaced in according with service manual and specification viii. Ambient temperature sensor tested and replaced in according with service manual and specification ix. Climate control panel tested and rectified or replaced in according with service manual
		i. Remove and replace fuses ii. Remove and replace s relays iii. Remove and replace roof top unit amplifier iv. Remove and replace magnetic clutch field coil v. Remove, repair or replace condenser and cooling unit fan motor vi. Remove and replace liquid line coil assembly vii. Remove and replace high and low Pressure Switches viii. Remove and replace temperature sensor ix. Removed and replace climate control Panel		105 hours	Demonstration & Practical	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			Attitude: i. Meticulous and detail in interpreting service manual when carrying out repair job ii. Careful when carry out air conditioning electrical components repair works *Safety/Environment*: i. Adhere to safety procedure when carry out air conditioning electrical components repair ii. Adhere to Workshop Practice work area ergonomics practice when executing job			

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
3 Perform air conditioning electrical components functionality check	i. Climate control panel functionality test procedure ii. Cooling unit blower motor air flow test procedure iii. Magnetic clutch load test procedure iv. Condenser fan motor air flow test procedure			10 hours	Lecture	i. Condenser fan and evaporator blower motor functionality tested in according with service manual ii. Condenser fan motor and evaporator blower motor air flow tested in according with manufacturer's specification iii. Climate control panel functionality tested in according with service manual iv. Magnetic clutch functionality tested in according with service manual
		i. Carry out condenser fan and evaporator blower motor functionality tested i ii. Carry out condenser fan motor and evaporator blower motor air flow tested iii. Conduct climate control panel functionality test iv. Conduct magnetic clutch load test	*Attitude:* i. Meticulous in conducting electrical components functionality test	40 hours	Demonstration & Practical	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			ii. Analytical mind and detail when interpreting test result <u>*Safety/Environment*</u>: i. Adhere to safety procedure when carry out air conditioning electrical components functionality test ii. Adhere to Workshop Practice work area ergonomics practice when executing job			

Employability Skills

Core Abilities	Social Skills
01.01 Identify and gather information 01.02 Document information, procedures or processes. 01.03 Utilize basic IT applications 01.04 Analyze information 01.05 Utilize the internet to locate and gather information 01.06 Utilize word processor to process information 01.07 Utilize database applications to locate and process information 01.08 Utilize spreadsheets applications to locate and process information 01.09 Utilize business graphic application to process information 01.10 Apply a variety of mathematical techniques 01.11 Apply thinking skills and creativity 02.01 Interpret and follow manuals, instructions and SOP's 02.02 Follow telephone/telecommunication procedures 02.03 Communicate clearly 02.04 Prepare brief reports and checklists using standard forms 02.05 Read / interpret flowcharts and pictorial information 02.06 Write memos and letters 02.07 Utilize local area network (LAN) Internet to exchange information 02.08 Prepare pictorial and graphic information. 02.09 Prepare flowcharts 02.10 Prepare reports and instructions 02.11 Convey information and ideas to people 03.01 Apply cultural requirements to the workplace. 03.02 Demonstrate integrity and apply ethical practices. 03.03 Accept responsibility for own work and work area. 03.04 Seek and act constructively upon feedback about performance 03.05 Demonstrate safety skills 03.06 Respond appropriately to people and situations 03.07 Resolve interpersonal conflicts 03.08 Develop and maintain a cooperation within work group	1. Communication skills 2. Conceptual skills 3. Interpersonal skills 4. Learning skills 5. Leadership skills 6. Multitasking and prioritizing 7. Self-discipline 8. Teamwork

03.09 Manage and improve performance of individuals 03.10 Provide consultation and counselling 03.11 Monitor and evaluate performance of human resources 03.12 Provide coaching/on-the job training 03.13 Develop and maintain team harmony and resolve conflicts 03.14 Facilitate and coordinate teams and ideas 03.15 Liaise to achieve identified outcomes 03.16 Identify and assess client / customer needs 03.17 Identify staff training needs and facilitate access to training 04.01 Organize own work activities 04.02 Set and revise own objectives and goals 04.03 Organize and maintain own workplace 04.04 Apply problem-solving strategies 04.05 Demonstrate initiative and flexibility 04.06 Allocate work	

Tools, Equipment and Materials (TEM)

ITEMS	RATIO (TEM: Trainees)
1. Air conditioning Semiconductor parts - Ambient temperature sensor - Capacitor - Diode - Integrated Circuit (IC) - Power Circuit Board (PCB) - Pressure switch - Resistor - Roof unit amplifier - Temperature sensor - Transistor	1:4
2. Air conditioning electrical components: - Alternator - Connector - Fuse - Relay - Roof unit amplifier - Socket - Wire - Wire harness	1:4
3. Electrical repair materials (Wire tape, Wire, Spiral conduit, Cable tie)	As per required
4. Manufacturer Installation Manual	1:4
5. Personal Protective Equipment (PPE)	1:1

6. Electrical repair tools (Wire Crimping, Wire striper, Wire cutter, Soldering iron set, Multi meter, Ampere meter) 7. Sample of electrical component repair work plan 8. Sample of electrical circuit diagram 9. Sample of company SOP 10. Sample of sub electrical component repair test checklist 11. Tools for Electrical part repair works - Wire Crimping, Wire striper, Wire cutter, Soldering iron set, Multi meter, Ampere meter 12. Wire (Heat resistant wire, Command wire)	1:1 1:1 1:1 1:1 1:1 1:1 As per required As per required

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CURRICULUM of COMPETENCY UNIT (CoCU)

Sub Sector	**AFTER SALES SERVICES**						
Job Area	**COMMERCIAL VEHICLE AIR CONDITIONING**						
NOSS Title	**COMMERCIAL VEHICLE AIR CONDITIONING INSTALLATION AND MAINTENANCE**						
Competency Unit Title	**COMMERCIAL VEHICLE AIR CONDITIONING WORKSHOP ADMINISTRATION AND SUPERVISION**						
Learning Outcomes	The outcome of this competency is to administer and supervise team members through job monitoring and delegation, staff development programmes, proper problem solving approach and workplace safety, health and environment practice that contribute to workshop productivity enhancement. Upon completion of this competency unit, trainees will be able to: • Carry out customer service related activities • Supervise subordinate • Monitor workplace safety, health and environment practices						
Competency Unit ID	**TP-122-3:2013-C07**	**Level**	3	**Training Duration**	130	**Credit Hours**	13

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
1. Carry out customer service related activities	i. Introduction of customer service ii. Company's customer Service Standard Operating Procedure iii. Customers need and expectation iv. Customer database contents • Customer detail • Vehicles database • Customer			20 hours	Lecture & Group discussion	i. Customers' Services perform in according with Company customer's service Standard operating Procedure. ii. Customer request

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	complaint v. Communication skills vi. Interpersonal skills vii. Presentation skills viii. Negotiation skills ix. Social etiquette and protocol x. Understanding cultural differences					attended in according with company standard operating procedure iii. Customer's service satisfaction achieve in according with company target
		~~i.~~ Perform customers' service Standard Operating Procedure ii. Attend to customer requests	*Attitude:* i. Accurate in interpreting customer information ii. Hospitable and courteous when attending workshop customer iii. Detail when interpret previous maintenance	20 hours	Demonstration Group Discussion Practical	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			servicing record <u>*Safety/Environment*</u>: i. Cautions to workshop customer safety			
2. Supervise subordinate work activities	i. Subordinate duties and job scope ii. Subordinate competency information i. Subordinate performance appraisal procedure ii. Coaching procedure iii. Counselling procedure iv. Problem solving procedure v. Skill gap assessment method			20 hours	Lecture & Group discussion	i. Briefing related to job task conducted ii. Subordinate work performance monitored in according with company policy iii. Workplace crisis solved in according with Human Resource guideline

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
		i. Assign work task to subordinate ii. Conduct briefing related to job tasks iii. Monitor subordinate work performance iv. Appraise subordinate job performance v. Handle workplace crisis related to job vi. Guide and coach subordinate in executing job vii. Identify required training programme for subordinate viii. Monitor tools and equipment maintenance activities	*Attitude:* i. Systematic when giving briefing to subordinate related to job tasks ii. Creative when handling workplace crisis related to job	25 hours	Demonstration & Project	iv. Subordinate coached and guided in according with Human Resource guideline v. Training programme proposed in according with subordinates' skills and competencies enhancement

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			iii. Rational when appraise subordinate *Safety/Environment*: i. Adhere to safety procedure ii. Adhere to Workshop Practice and work area ergonomics practice when executing job			
3. Monitor workplace safety, health and environment practices	i. Occupational Safety and Health Act (OSHA) ii. Company safety and health procedures iii. Type and usage of Personal Protective Equipment (PPE) iv. First Aid Kits contents v. Types and usage of fire extinguisher vi. 5 S procedure vii. Scheduled Waste Handling procedure viii. Safety and health awareness programmes			20 hours	Lecture & Group discussion	i. Company safety and health procedures described ii. Usage of Personal Protective Equipment (PPE) implemented iii. First Aid Kits contents fully equipped iv. Types of fire extinguisher listed out and function

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
						described v. Handling procedure of fire extinguishers demonstrated vi. 5S implemented vii. Scheduled Waste disposal arranged viii. Safety and health awareness courses conducted
		i. Determine workplace safety, health and environment requirements. ii. Carry out company safety and health procedures iii. Implement usage of Personal Protective Equipment (PPE). iv. Ensure First Aids Kits contents fully provided v. Arrange scheduled waste materials disposal vi. Conduct Safety and Health awareness courses	*enforce*	25 hours	Demonstration & project	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			Attitude: i. Analytical mind when determine workplace safety, health and environment requirements ii. Efficient when monitoring safety and health practises iii. Pro-active when arranging scheduled waste materials disposal *Safety/Environment*: i. Safety caution when using electric cutting tool			

Employability Skills

Core Abilities	Social Skills
01.01 Identify and gather information 01.02 Document information, procedures or processes. 01.03 Utilize basic IT applications 01.04 Analyze information 01.05 Utilize the internet to locate and gather information 01.06 Utilize word processor to process information 01.07 Utilize database applications to locate and process information 01.08 Utilize spreadsheets applications to locate and process information 01.09 Utilize business graphic application to process information 01.10 Apply a variety of mathematical techniques 01.11 Apply thinking skills and creativity 02.01 Interpret and follow manuals, instructions and SOP's 02.02 Follow telephone/telecommunication procedures 02.03 Communicate clearly 02.04 Prepare brief reports and checklists using standard forms 02.05 Read / interpret flowcharts and pictorial information 02.06 Write memos and letters 02.07 Utilize local area network (LAN) Internet to exchange information 02.08 Prepare pictorial and graphic information. 02.09 Prepare flowcharts 02.10 Prepare reports and instructions 02.11 Convey information and ideas to people 03.01 Apply cultural requirements to the workplace. 03.02 Demonstrate integrity and apply ethical practices. 03.03 Accept responsibility for own work and work area. 03.04 Seek and act constructively upon feedback about performance 03.05 Demonstrate safety skills 03.06 Respond appropriately to people and situations 03.07 Resolve interpersonal conflicts 03.08 Develop and maintain a cooperation within work group 03.09 Manage and improve performance of individuals	1. Communication skills 2. Conceptual skills 3. Interpersonal skills 4. Learning skills 5. Leadership skills 6. Multitasking and prioritizing 7. Self-discipline 8. Teamwork

03.10 Provide consultation and counselling 03.11 Monitor and evaluate performance of human resources 03.12 Provide coaching/on-the job training 03.13 Develop and maintain team harmony and resolve conflicts 03.14 Facilitate and coordinate teams and ideas 03.15 Liaise to achieve identified outcomes 03.16 Identify and assess client / customer needs 03.17 Identify staff training needs and facilitate access to training 04.01 Organize own work activities 04.02 Set and revise own objectives and goals 04.03 Organize and maintain own workplace 04.04 Apply problem-solving strategies 04.05 Demonstrate initiative and flexibility 04.06 Allocate work	

Tools, Equipment and Materials (TEM)

ITEMS	RATIO (TEM: Trainees)
1. Occupational Safety and Health Act (OSHA)	1:1
2. Environmental Quality Act 1974 (EQA)	1:1
3. Sample of Flat Rate Time (FRT)	1:1
4. Sample of Air conditioning installation and maintenance checklist	1:1
5. Sample of Job card	1:1
6. Sample of Customer acknowledgement form	1:1
7. Sample of Requisition order	1:1
8. Sample of Customer satisfaction feedback form	1:1
9. Sample of Documentation procedure	1:1

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2. David Evans. 2006. 5th Edition. *Supervisory Management*. Thomson Learning. ISBN-13: 978-0-82645-733-2
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CURRICULUM of COMPETENCY UNIT (CoCU)

Sub Sector	**AFTER SALES SERVICES**
Job Area	**COMMERCIAL VEHICLE AIR CONDITIONING**
NOSS Title	**COMMERCIAL VEHICLE AIR CONDITIONING INSTALLATION AND MAINTENANCE**
Competency Unit Title	**COMMERCIAL VEHICLE AIR-CONDITIONING SUB-ENGINE SEVICING**
Learning Outcomes	The outcome of this competency is to produce excellent condition of the sub-engine in term of performance and functionality to power the air conditioning unit. The ultimate goal is to provide cold and comfort environment to passengers. Upon completion of this competency unit, trainees will be able to: • Prepare sub-engine servicing tools, equipment and materials • Service sub-engine lubrication • Service sub-engine cooling system • Service sub-engine fuel system components • Service sub-engine electrical components

Competency Unit ID	**TP-122-3:2013-E01**	**Level**	3	**Training Duration**	220	**Credit Hours**	22

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
1. Prepare sub-engine servicing tools, equipment and materials	i. Types and function of sub-engine parts to be serviced • Sub-engine lubrication system • Sub-engine cooling system • Sub-engine fuel system • Sub-engine electrical			7 hours	Lecture & Group discussion	i. Servicing tools and equipment listed out and describe ii. Service parts prepared in according with Job order iii. Materials and consumable prepared in

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	components ii. Vehicle data and maintenance record iii. Sub-engine periodical servicing schedule iv. Types and operation of tools and equipment for sub-engine servicing work • Common hand tools • Stroboscopic instrument • Radiator pressure tester • Ampere meter • Multi meter • Injector tester • Thermometer • Volt meter v. Types of consumable items for sub-engine servicing work • Engine oil • Oil filter					according with job scope
		i. Interpret sub-engine servicing job order contents		12 hours	Demonstration Group Discussion & Practical	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
		ii. Select tools and equipment for sub-engine servicing works iii. Prepare sub-engine parts to for servicing work iv. Prepare required materials and consumable items for sub-engine servicing works	*Attitude:* i. Detail when interpret job order contents ii. Precise when identify servicing tools, equipment and materials *Safety/Environment:* i. Adhere to workplace housekeeping practice when preparing tools, equipment and materials			

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
2. Sub-engine lubrication service	i. Types and grade of lubrication oil ii. Procedure to replace engine oil iii. Procedure to remove and replace oil filter iv. Procedure to remove and replace air filter v. Procedure to remove and replace diesel filter vi. Procedure of bleeding fuel system vii. Scheduled waste disposal procedure			7 hours	Lecture & Group discussion	i. Types of sub-engine lubrication oil described ii. Engine oil replaced in according with service manual iii. Oil filter removed and replaced in according with service manual iv. Air filter removed and replaced in according with service manual v. Diesel filter removed and replaced in according with service manual vi. Diesel fuel system bleed in according with service manual
		i. Replace engine oil ii. Remove and replace oil filter iii. Clean or replace air filter iv. Remove and replace diesel filter v. Carry out diesel fuel system bleeding	<u>*Attitude:*</u> i. Systematic when replace engine oil and radiator coolant ii. Careful when	23 hours	Demonstration & Project	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			executing servicing work <u>*Safety/Environment*</u>: i. Safety cautions when carry out engine lubrication service ii. Adhere to workshop Practice and work area ergonomics practice when executing job			
3. Service sub-engine cooling system	i. Introduction to Sub-Engine cooling system ii. Types of sub-engine cooling system components and parts: • Radiator • Radiator hose • Thermostat • Radiator fan • Radiator cap • Water jacket			15 hours	Lecture & Group discussion	i. Types of sub-engine cooling system components and parts listed out and described ii. Radiator removed, repaired or replaced in according with service manual iii. Radiator hose removed and

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	• Radiator spare tank • Water pump iii. Procedure to remove, repair and replace Radiator iv. Procedure to remove and replace Radiator hose v. Procedure to remove and replace Thermostat vi. Procedure to remove and replace Radiator fan vii. Procedure to remove and replace Radiator cap viii. Procedure to remove and replace Water jacket ix. Procedure to remove and replace Radiator spare tank x. Procedure to remove and replace Water pump xi. Radiator Cooling pressure test procedure					replaced in according with service manual iv. Thermostat removed and replaced in according twithservice manual v. Radiator fan removed and replaced in according with service manual vi. Radiator cap removed and replaced in according with service manual vii. Water jacket removed and replaced in according with service manual viii. Radiator spare tank removed and replaced in according with service manual ix. Water pump removed and replaced in

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
		i. Remove, repair and replace Radiator ii. Remove and replace Radiator hose iii. Remove and replace Thermostat iv. Remove and replace Radiator fan v. Remove and replace Radiator cap vi. Remove and replace Water jacket vii. Remove and replace Radiator spare tank viii. Remove and replace Water pump ix. Conduct Radiator Cooling pressure test	*Attitude:* i. Systematic when servicing sub-engine cooling system ii. Detail when conducting Radiator Cooling pressure test *Safety/Environment*:	35 hours	Demonstration & Project	according with service manual x. Radiator cooling system pressure tested in according with service manual

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			i. Safety caution when carry out sub-engine cooling system servicing ii. Adhere to workshop Practice			
4. Service sub-engine fuel system components	i. Types of diesel injection system • In line pump • Distributor type ii. Types of diesel injection system components: • Injection pump • Fuel injector • High and low pressure pipe • Diesel filter • Diesel feed pump iii. Injection pump service procedure iv. Fuel injector service procedure v. High and low pressure pipe service procedure vi. Diesel filter service			15 hours	Lecture & Group discussion	i. Types of diesel injection system described ii. Diesel injection system components listed out and described iii. Injection pump removed and replaced in according with service manual iv. Fuel injector removed, service or replaced in according with service manual v. High and low pressure pipe removed and replaced in according with

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	procedure vii. Fuel feed pump service procedure viii. Diesel fuel system bleeding procedure					service manual vi. Diesel filter removed and replaced in according with service manual
		i. Inspect sub-engine fuel system components ii. Remove and replace injection pump iii. Calibrate injection pump iv. Remove and replace fuel injector v. Calibrate fuel injection vi. Remove and replace high and low pressure pipe vii. Remove and replace diesel filter viii. Remove and replace fuel feed pump ix. Carry out diesel fuel system bleeding	*Attitude:*	45 hours	Demonstration Practical or project	vii. Fuel feed pump removed and replaced in according with service manual viii. Diesel fuel system bleed in according with service manual

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			i. Analytical mind when carrying out inspection works ii. Detail when calibrate fuel injection and injection pump iii. Careful when performing diesel fuel system bleeding <u>*Safety/Environment*</u>: i. Safety caution when performing Sub-Engine Fuel System Components Servicing ii. Adhere to workshop Practice			
5. Service sub-engine electrical components	i. Types of diesel engine electrical system components and parts: • Ignition system - Ignition key			15 hours	Lecture & Group discussion	i. Types of diesel engine electrical system components and parts listed out and

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
	- Glow plug - Battery • Starter motor - Starter motor relay - Solenoid switch - Carbon brush - Armature - Comutator - Field coil - Over run gear • Alternator - Carbon brush - Rotor - Field coil - Rectifier - Integrated circuit regulator - Bearing ii. Ignition system service procedure iii. Starter motor components service procedure iv. Alternator components service procedure					described ii. Charging system wiring condition checked iii. Ignition system components removed and replaced in according with service manual iv. Starter motor components removed, repair or replaced in according with service manual v. Alternator components removed, repair or replaced in according with service manual
		i. Inspect charging system wiring		45 hours	Demonstration	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
		condition ii. Inspect sub-engine engine electrical components iii. Remove and replace ignition system components iv. Remove and replace starter motor components v. Test starter motor relay functionality vi. Remove and replace Alternator components vii. Test alternator functionality	*Attitude:* i. Analytical mind when carrying out inspection works ii. Detail and follow instruction when executing servicing work		Practical or project	

Work Activities	Related Knowledge	Related Skills	Attitude / Safety / Environment	Training Hours	Delivery Mode	Assessment Criteria
			iii. Precise when carrying out starter motor relay and alternator functionality test <u>*Safety/Environment*</u>: i. Safety caution when performing Sub-Engine Electrical Components Servicing ii. Adhere to workshop Practice			

Employability Skills

Core Abilities	Social Skills
01.01 Identify and gather information 01.02 Document information, procedures or processes. 01.03 Utilize basic IT applications 01.04 Analyze information 01.05 Utilize the internet to locate and gather information 01.06 Utilize word processor to process information 01.07 Utilize database applications to locate and process information 01.08 Utilize spreadsheets applications to locate and process information 01.09 Utilize business graphic application to process information 01.10 Apply a variety of mathematical techniques 01.11 Apply thinking skills and creativity 02.01 Interpret and follow manuals, instructions and SOP's 02.02 Follow telephone/telecommunication procedures 02.03 Communicate clearly 02.04 Prepare brief reports and checklists using standard forms 02.05 Read / interpret flowcharts and pictorial information 02.06 Write memos and letters 02.07 Utilize local area network (LAN) Internet to exchange information 02.08 Prepare pictorial and graphic information. 02.09 Prepare flowcharts 02.10 Prepare reports and instructions 02.11 Convey information and ideas to people 03.01 Apply cultural requirements to the workplace. 03.02 Demonstrate integrity and apply ethical practices. 03.03 Accept responsibility for own work and work area. 03.04 Seek and act constructively upon feedback about performance 03.05 Demonstrate safety skills 03.06 Respond appropriately to people and situations 03.07 Resolve interpersonal conflicts 03.08 Develop and maintain a cooperation within work group	1. Communication skills 2. Conceptual skills 3. Interpersonal skills 4. Learning skills 5. Leadership skills 6. Multitasking and prioritizing 7. Self-discipline 8. Teamwork

03.09 Manage and improve performance of individuals 03.10 Provide consultation and counselling 03.11 Monitor and evaluate performance of human resources 03.12 Provide coaching/on-the job training 03.13 Develop and maintain team harmony and resolve conflicts 03.14 Facilitate and coordinate teams and ideas 03.15 Liaise to achieve identified outcomes 03.16 Identify and assess client / customer needs 03.17 Identify staff training needs and facilitate access to training 04.01 Organize own work activities 04.02 Set and revise own objectives and goals 04.03 Organize and maintain own workplace 04.04 Apply problem-solving strategies 04.05 Demonstrate initiative and flexibility 04.06 Allocate work	

Tools, Equipment and Materials (TEM)

ITEMS	RATIO (TEM: Trainees)
1. Commercial vehicle air conditioning Sub-Engine unit	1:5
2. Commercial vehicle air conditioning Sub-Engine cooling system components - Radiator , Radiator hose, Thermostat, Radiator fan, Radiator cap, Water jacket, Water gallery, Radiator spare tank, Water pump	1:5
3. Consumable items for air conditioning Sub-engine servicing - Engine oil, Oil filter	As required
4. Diesel injection system components - Injection pump, Fuel injector, High and low pressure pipe, Diesel filter, Diesel feed pump	1:5
5. Diesel engine electrical system - Ignition system components: Ignition key, Glow plug, Battery - Starter motor components: Starter motor relay, Solenoid switch, Carbon brush, Armature, Comutator, Field coil, Over run gear - Alternator components: Carbon brush, Armature, Comutator, Field coil, Rectifier, Integrated circuit regulator, Bearing	1:5
6. Tools and equipment for air conditioning Sub-engine servicing - Common hand tools, Stroboscopic instrument, Radiator pressure tester, Ampere meter, Multi meter, Injector tester , Radiator pressure tester, Spectrometer, Thermometer , Volt meter, High rate discharge tester, Hydrometer	1:5
7. Manufacturer Service Manual	1:5
8. Sample of job order	1:1
9. Sample of company SOP	1:1

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ABBREVIATIONS

BTU:	British Thermal Unit
COCU	Curriculum of Competency Unit
CP	Competency Profile
CPC	Competency Chart Profile
CU	Competency Unit
DOE:	Department of Environment
DSD:	Department of Skill Development
FRT:	Flat Rate Time
HSE	Health Safety and Environment
ISO	International Organization of Standardizon
MIS:	Maintenance Instruction Sheet
NOSS	National Occupational Skills Standard
OSHA	Occupational Safety and Health Act
PPE:	Personal Protective Equipment
PMSS:	Preventive Maintenance Service Schedule
Rpm:	Revolution Per Minute
SKM	Sijil Kemahiran Malaysia
SOP:	Standard Operating Procedure
SST:	Service Special Tools

SUMMARY OF TRAINING DURATION

TP-122-3-2013 (COMMERCIAL VEHICLE AIR CONDITIONING INSTALLATION AND MAINTENANCE)

NO.	COMPETENCY UNIT TITLE	WORK ACTIVITIES	RELATED KNOWLEDGE	APPLIED SKILLS	HOURS	TOTAL (Hours)
1	**COMMERCIAL VEHICLE AIR-CONDITIONING FITTING PARTS FABRICATION**	1. Organize air conditioning fitting parts fabrication tools, equipment and materials	10	20	30	230
		2. Fabricate air conditioning compressor bracket	15	45	60	
		3. Fabricate air conditioning ducting	20	60	80	
		4. Fabricate air conditioning piping	15	45	60	
2	**COMMERCIAL VEHICLE AIR-CONDITIONING SUB-WIRE HARNESS FABRICATION**	1. Organize sub-wire harness fabrication tools and materials	10	20	30	180
		2. Fabricate air conditioning sub-wire harness	35	85	120	
		3. Carry out air conditioning sub-wire harness 'pre-installation' functionality test	10	20	30	
3	**COMMERCIAL VEHICLE AIR-CONDITIONING UNIT INSTALLATION**	1. Organize air conditioning unit installation tools, equipment and materials	10	30	40	335
		2. Install air conditioning unit mechanical parts	40	110	150	
		3. Install air conditioning sub-wire harness and electrical parts	75	5	80	
		4. Perform air conditioning refrigerant system charging	15	10	25	

		5. Carry out air conditioning unit testing and commissioning	10	30	40	
4	**COMMERCIAL VEHICLE AIR-CONDITIONING MAINTENANCE**	1. Organise commercial vehicle air conditioning maintenance	7	23	30	220
		2. Carry out "Compressor *Drive System*" (CDS) maintenance	10	40	50	
		3. Carry out cooling unit system maintenance	10	40	50	
		4. Carry out condensing unit system maintenance	10	40	50	
		5. Carry out air conditioning refrigerant cycle system maintenance	10	30	40	
5	**COMMERCIAL VEHICLE AIR CONDITIONING MECHANICAL COMPONENTS REPAIR**	1. Perform commercial vehicle air conditioning troubleshooting	7	3	10	340
		2. Repair compressor magnetic clutch	15	45	60	
		3. Overhaul air conditioning compressor unit	15	45	60	
		4. Repair cooling unit	15	45	60	
		5. Repair condenser unit	15	45	60	
		6. Repair air conditioning refrigerant cycle system	15	45	60	
		7. Carry out conditioning mechanical performance test	8	22	30	

6	**COMMERCIAL VEHICLE AIR CONDITIONING ELECTRICAL COMPONENTS REPAIR**	1. Carry out air conditioning electrical components troubleshooting	15	25	40	230
		2. Carry out air conditioning electrical components rectification works	35	105	140	
		3. Perform air conditioning electrical components functionality test	10	40	50	
7	**COMMERCIAL VEHICLE AIR CONDITIONING WORKSHOP ADMINISTRATION AND SUPERVISION**	1. Carry out customer service related activities	20	20	40	130
		2. Supervise subordinate	20	25	45	
		3. Monitor workplace safety, health and environment practices	20	25	45	
TOTAL HOURS (CORE Competencies)			**522**	**1143**	**1665**	

1	**COMMERCIAL VEHICLE AIR-CONDITIONING SUB-ENGINE SEVICING**	1. Prepare sub-engine servicing tools, equipment and materials	7	12	19	219
		2. Service sub-engine lubrication	7	23	30	
		3. Service sub-engine cooling system	15	35	50	
		4. Service sub-engine fuel system components	15	45	60	
		5. Service sub-engine electrical components	15	45	60	
TOTAL HOURS (ELECTIVE Competencies)			**59**	**160**	**219**	
TOTAL HOURS (CORE & ELECTIVE Competencies)			**581**	**1303**	**1884**	