Jabatan Pembangunan Kemahiran
Kementerian Sumber Manusia, Malaysia

STANDARD KEMAHIRAN PEKERJAAN KEBANGSAAN
(*NATIONAL OCCUPATIONAL SKILLS STANDARD*)

G452-003-3:2018

LIGHT VEHICLE - HVAC MAINTENANCE

LEVEL 3

Department of Skills Development (DSD)
Federal Government Administrative Centre
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Cyber 6, 63000 Cyberjaya
SELANGOR, MALAYSIA

NATIONAL OCCUPATIONAL SKILLS STANDARD

LIGHT VEHICLE - HVAC MAINTENANCE

LEVEL 3
G452-003-3:2018

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Abbreviation

1.	3R	Reduce, Reuse, and Recycle.
2.	DOE	Department of Environment.
3.	CoCU	Curriculum Of Competency Unit.
4.	CP	Competence Profile.
5.	CPC	Competence Profile Chart.
6.	CU	Competency Unit.
7.	DKM	Diploma Kemahiran Malaysia.
8.	DLKM	Diploma Lanjutan Kemahiran Malaysia.
9.	DSD	Department Of Skills Development.
10.	DOSH	Department of Occupational Safety and Health.
11.	ECU	Engine Control Unit.
12.	HVAC	Heating, Ventilation, and Air Conditioning .
13.	JPJ	Jabatan Pengangkutan Jalan.
14.	MAI	Malaysia Automotive Institute.
15.	NOSS	National Occupational Skill Standard.
16.	MOT	Ministry of Transport.
17.	OAS	Occupational Area Structure.
18.	OEM	Original Equipment Manufacturer.
19.	OSHA	Occupational Safety and Health Act.
20.	OS	Occupational Structure.
21.	PPE	Personal Protective Equipment.
22.	RTA	Road Transportation Act.
23.	SDC	Standard Development Committee.
24.	SKM	Sijil Kemahiran Malaysia.
25.	SP	Standard Practice
26.	SOP	Standard Operating Procedure.
27.	SPAD	The Land Public Transport Commission.
28.	TEM	Tools, Equipment And Materials.

Glossary

1.	Diagnostic	The definition of diagnostic is something related to the identification of a problem or disease.
2.	Inspection	An inspection is, most generally, an organized examination or formal evaluation exercise. In engineering activities inspection involves the measurements, tests, and gauges applied to certain characteristics in regard to an object or activity. The results are usually compared to specified requirements and standards for determining whether the item or activity is in line with these targets, often with a Standard Inspection Procedure in place to ensure consistent checking. Inspections are usually non-destructive.
3.	Job Order	A work order or job order is an order received by an organization from a customer or client, or an order created internally within the organization. A work order may be for products or services.
4.	Maintenance repair, and overhaul	Maintenance, repair and operations (MRO) or maintenance, repair, and overhaul involves fixing any sort of mechanical, plumbing or electrical device should it become out of order or broken (known as repair, unscheduled, or casualty maintenance). It also includes performing routine actions which keep the device in working order (known as scheduled maintenance) or prevent trouble from arising (preventive maintenance). MRO may be defined as, "All actions which have the objective of retaining or restoring an item in or to a state in which it can perform its required function. The actions include the combination of all technical and corresponding administrative, managerial, and supervision actions." MRO operations can be categorised by whether the product remains the property of the customer, i.e. a service is being offered, or whether the product is bought by the reprocessing organisation and sold to any customer wishing to make the purchase. In the former case it may be a back shop operation within a larger organization or smaller operation. The former of these represents a closed loop supply chain and usually has the scope of maintenance, repair or overhaul of the product. The latter of the categorisations is an open loop supply chain and is typified by refurbishment and remanufacture. The main characteristic of the closed loop system is that the demand for a product is matched with the supply of a used product. Neglecting asset write-offs and exceptional activities the total population of the product between the customer and the service provider remains constant.
5.	Service	A Service is a set of actions or solutions that are put in place or are performed to provide a repeatable and consistent set of outcomes, deliverables, and performance for people, organizations, and systems that represent consumers or beneficiaries of such results
6.	Workshop Manual	Workshop manuals are a series of practical repair manuals and service manuals, which are the same essential industry standard software as used by the dealerships around the world, covering repairs, service schedules, maintenance, wiring diagrams and diagnostics.

Acknowledgement

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

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

STANDARD PRACTICE

NATIONAL OCCUPATIONAL SKILLS STANDARD (NOSS) FOR:

LIGHT VEHICLE - HVAC MAINTENANCE

LEVEL 3
G452-003-3:2018

1. Introduction

1.1. Occupation Overview

1.1.1. The automotive services and spare parts industry comprises of organisations or workshops that provide spare (replacement) parts, repair and maintenance for general automotive service and Heating Ventilation Air Conditioning (HVAC) service. The demand for automotive services and replacement components largely depends on the average vehicle usage and the number of vehicles on the road. The automotive air-conditioning services and replacement components industry value chain covers system diagnostic, testing and comprehensive replacement of vehicle air-conditioning performance.

1.1.2. This NOSS will assist organisations or workshops to evaluate the necessary course of action, such as the type of repair needed to solve the problems for all light vehicle air-conditioning and the necessary maintenance and service which includes periodical servicing, inspection and test. This NOSS also gives the fundamental of the profession in service and repair of components of the light vehicle air-conditioning, performing periodical maintenance services to prevent any future damages and other holistic or completed services to ensure the functionality of automotive air-conditioning system. For the commercial vehicle there will be another NOSS that will focus more on the commercial vehicle HVAC system maintenance.

NEGERI *State*	2008	2009	2010	2011	2012	2013	2014	2015
PERLIS	56,557	59,831	63,743	66,618	68,853	71,505	74,580	77,505
KEDAH	605,125	635,959	671,989	717,393	745,237	781,143	800,867	815,521
PULAU PINANG	1,478,826	1,540,529	1,614,307	1,686,521	1,735,367	1,797,153	1,832,586	1,836,587
PERAK	1,207,765	1,255,105	1,305,640	1,361,606	1,390,851	1,429,589	1,443,940	1,438,235
SELANGOR	1,482,326	1,527,221	1,582,587	1,636,011	1,663,026	1,709,452	1,753,950	1,783,379
WILAH PERSEKUTUAN	3,331,539	3,546,433	3,785,566	4,041,587	4,290,989	4,620,264	4,748,442	4,805,029
NEGERI SEMBILAN	490,407	507,097	525,097	544,534	553,716	567,574	574,857	576,428
MELAKA	445,282	465,696	487,240	509,414	524,690	543,866	554,993	560,726
JOHOR	1,831,776	1,912,894	2,003,475	2,105,420	2,185,121	2,283,489	2,341,035	2,347,317
PAHANG	516,322	542,982	570,653	603,906	619,965	641,885	648,717	648,507
TERENGGANU	303,785	326,866	351,839	376,449	394,851	414,316	423,171	425,996
KELANTAN	409,294	440,088	473,470	505,713	526,996	554,596	569,828	574,597
SABAH	553,765	598,291	649,911	712,093	770,272	784,487	873,124	882,278
SARAWAK	865,688	912,578	968,255	1,039,390	1,100,360	1,168,915	1,214,427	1,234,249
MALAYSIA	**13,578,457**	**14,271,570**	**15,053,772**	**15,906,655**	**16,570,294**	**17,368,234**	**17,854,517**	**18,006,354**

Source: Road Transport Department

Figure 1: Number of Vehicles on the Road by State, Malaysia, 2008 - 2015

1.1.3. With the increasing numbers of vehicles year by year, based on **Figure 1**, it shows that a lot of vehicles do require maintenance and repair services. Hence, vast numbers of expertise are required to maintain and repair the vehicles, especially in HVAC maintenance for light vehicles. It is considered as a specialist skill to maintain the said work in the vehicle maintenance and repair industry.

1.1.4. The demand for qualified and experienced light vehicle HVAC service provider is important as of now, and would increase in the near future. A technician's repairing or servicing light vehicle HVAC systems for consideration must be properly trained and certified. The NOSS is essential for the industry to have certain guidelines and standards based on the level of competencies that have been set by the industry experts in this field.

1.1.5. Normal practice in Malaysia is that the automotive air conditioning service providers uses R134a, however there is also a new trend in market to go to low pollution gas such as R1234YF. There are regulations imposed by Department of Environment (DOE) and Department of Safety and Health (DOSH) that needs to be complied by automotive air conditioning servicing provider. The regulations are as below: -

<table>
<tr><th>Department of Environmental Regulation</th><th>Department of Safety and Health Regulation</th></tr>
<tr><td>ENVIRONMENTAL QUALITY ACT 1974, ENVIRONMENTAL QUALITY (REFRIGERANT MANAGEMENT) REGULATIONS 1999, (Amendment) REGULATIONS 2004</td><td>OCCUPATIONAL SAFETY AND HEALTH ACT 1994 [ACT 514]
Compliance with these regulations shall be deem to have complied with the provisions of:</td></tr>
<tr><td rowspan="3">REGULATION 3:
Application:
These regulations shall apply to a person handling a refrigerant environmentally hazardous substance in an existing or a new installation.</td><td>Sections 31 and 32 of the Factories and Machinery Act 1967</td></tr>
<tr><td>Regulation 13 of the Petroleum (Safety Measures) (Transportation of Petroleum by Pipelines) Regulations 1985</td></tr>
<tr><td>Regulation 23 of the Occupational Safety and Health (Control of Industrial Major Accident Hazards) Regulations 1996</td></tr>
<tr><td>REGULATION 4:
Prohibition on the use of refrigerant environmentally hazardous substance: - The use of refrigerant environmentally hazardous substance as a refrigerant in any new installation of a building chiller or refrigeration system, vehicle air conditioner or an air conditioning equipment is prohibited.</td><td rowspan="2">FACTORIES AND MACHINERY ACT 1967 [64 OF 1967] P.U.(A) 34/70

FACTORIES AND MACHINERY ACT 1967 [ACT 139] P.U.(A) 60/84</td></tr>
<tr><td>REGULATION 5:
Handling of refrigerant environmentally hazardous substance: -
1. No person shall handle any refrigerant environmentally hazardous substance unless he has received the approved training in the reclamation and recycling of any refrigerant environmentally hazardous substance and is in possession of an approved machine for the activity.
2. For the purpose of sub regulation (1), the Director General may, after consultation with the manufacturers of refrigeration systems, maintain a register of approved training courses for the reclamation and recycling of any refrigerant environmentally hazardous substance and approved machines for such activities.</td></tr>
</table>

REGULATION 6: Offense to vent refrigerant environmentally hazardous substance: - No person shall knowingly vent any refrigerant environmentally hazardous substance into the atmosphere, except with the prior written approval of the Director General.	

1.2. Rationale of NOSS Development

1.2.1. This NOSS document is a reviewed version from the last reviewed which was on 2012.

1.2.2. Within this new revised NOSS, there will be an updated information regarding the industry and the knowledge to be used in the training. Compared to the old document which consist of 7 Competency Units (CU), this NOSS contains 5 Competency Units that are more comprehensive for the training. Each Core CU are more focus on their own activities and because of this the trainee can easily understand the real aspect of their own work area and responsibilities

1.2.3. This NOSS is developed with the following objectives:

a) To enhance awareness and knowledge on HVAC services and repair for workshops
b) To recommend good practice to be used by local aftermarket services and repair workshops to perform relevant activities
c) To adhere to the National Automotive Policy (NAP) 2014 Strategic Thrust of safety, security and environment through the regulated and standardisation of HVAC workshop service and repair activities.
d) Malaysia are part of the United Nation Environment (UNE) committee and already created programs and standards to make sure that all the players in HVAC services and repair adhered with the current standards and regulations such as 4R2S standards and HCFC Phase-out Management Plan (HPMP Stage-1).

1.3. Rationale of Occupational Structure and Occupational Area Structure

1.3.1. In NAP 2014, there are6 roadmaps, one of it is the Malaysia Automotive Human Capital (MAHR) Roadmap which focuses on;

a) Detailing the on-going development of human capital in the automotive industry at all levels from 2014 to 2020 to realize the target set in the National Automotive Policy (NAP) 2014.
b) Improving the quality of existing Human Capital Development (HCD) programmes at all levels.
c) Outlining the implementation plan to create specialized automotive industry talents in critical areas for example hybrid components and engines transmissions.
d) Training competent workforces with various skills and ready for process automation to reduce dependency on unskilled foreign workers and help create skilled local workforces with high incomes.

1.3.2. The roadmap is centred on assessment and gap analysis of the HCD requirement by the automotive industry. Thrust areas were identified and implementation plans put forward.

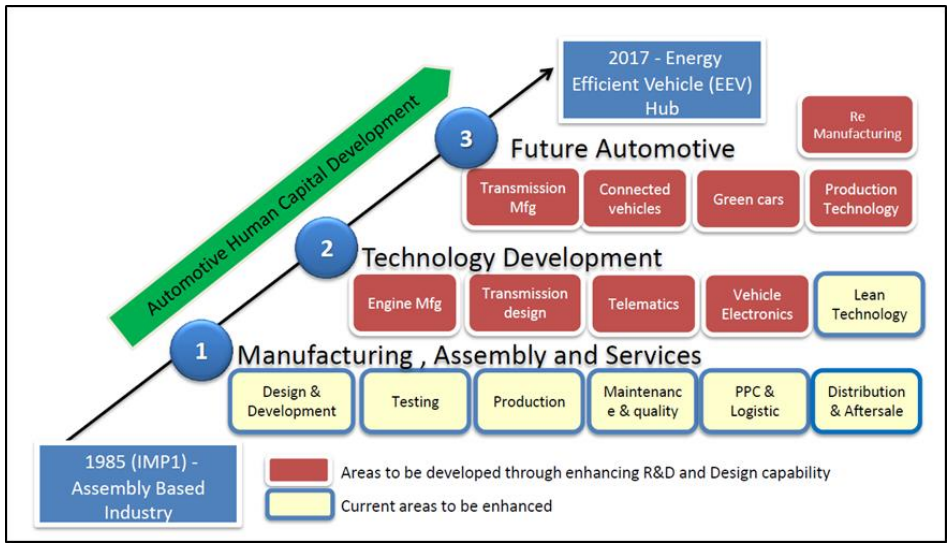

Figure 2: assessment and gap analysis

1.4. Regulatory / Statutory Body Requirements Related to Occupation

1.4.1. Ministry of Domestic Trade, Cooperatives & Consumerism (KPDNKK)

1.4.2. Department of Environment (DOE)

1.4.3. Local body of authorities

1.4.4. Consumer Protection Act 1999, Workshop Information Disclosure Regulations 2002.

1.4.5. Workshops which were found in non-compliance with the Environmental Quality (Refrigerant Management) Regulations 1999 and Environmental Quality (Refrigerant Management) (Amendment) Regulations 2004 under the

Environmental Quality Act 1974, were issued with warning notices. Failure to comply with these warning notices will result in court action as stipulated under Section 41 of the Environmental Quality Act 1974.

1.4.6. Service and Spare Parts (2S) of aftermarket motor vehicle - Code of practice. This standard prescribes industry best practices for aftermarket service provider's activities including the responsibility with regards to the requirements of 4M (Man, Method, Machine and Material). This standard is been controlled by The Ministry of Domestic Trade, Co-operatives and Consumerism (KDPNKK), Department of Environmental (DOE), Ministry of Urban Wellbeing, Housing and Local Government (KPKT) & The Road Transport Department Malaysia (JPJ).

1.5. Occupational Pre-Requisite

Generally the light vehicle HVAC maintenance technician may work with minimum supervision individually or in a team complied with Occupational Safety and Health (OSHA) requirement and Environmental Quality Act and its Regulations. It is a must that the automotive air conditioning service providers have a **valid Malaysian driving license**.

2. Occupational Structure (OS)

Section	(G) Wholesale And Retail Trade, Repair Of Motor Vehicles And Motorcycles
Group	(45201) Maintenance and repair of motor vehicles
Area	Heating Ventilation Air Conditioning (HVAC) Work
Level 5	Service / Operation Manager
Level 4	Service / Operation Executive
Level 3	Heating Ventilation Air Conditioning (HVAC) Diagnostic Technician
Level 2	Heating Ventilation Air Conditioning (HVAC) Senior Technician
Level 1	Heating Ventilation Air Conditioning (HVAC) Technician

Figure 3: Occupational Structure

3. Occupational Area Structure (OAS)

Section	(G) Wholesale And Retail Trade, Repair Of Motor Vehicles And Motorcycles
Group	(45201) Maintenance and repair of motor vehicles
Area	Heating Ventilation Air Conditioning (HVAC) Work
Level 5	After Sales – Service Management
Level 4	After Sales - Service Operation
Level 3	Light Vehicle - HVAC Maintenance
Level 2	Embedded
Level 1	Embedded

Figure 4: Occupational Area Structure

4. Definition of Competency Levels

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

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

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

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

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

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

5. Award of Certificate

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

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

6. Occupational Competencies

The Light Vehicle - HVAC Maintenance Level 3 personnel is competent in performing the following core competencies:

a. HVAC Scheduled Maintenance Work
b. HVAC System Components Replacement
c. HVAC System Diagnostic
d. HVAC Electric & Electronic Control System Replacement
e. HVAC Maintenance Supervision

7. Work Conditions

Generally they work under similar operating hours of the organisation/company. He/she may involve in outside normal working hours or work during weekends. The technician also must be comply with Department of Environmental (DOE) regulation regarding waste storage, waste handling and waste disposal.

8. Employment Prospects

The knowledge and skills gained by the Automotive Air Conditioning Servicing in handling people and the ability to work independently would be advantageous for employment in other related service industries.

Other related occupations with respect to employment opportunities are:

- Motor vehicle technician
- Service advisor

Other related industries with respect to employment opportunities are:

- Motor vehicle workshop
- Motor vehicle service centre

9. Up Skilling Opportunities

Based on the Occupational area structure, the person that is competent in level 3 can go to the aftermarket management.

10. Organisation Reference for Sources of Additional Information

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

a. Department of Environment (DOE),
Ministry of Natural Resources & Environment (NRE)
Level 1 - 4, Podium 2 & 3, Wisma Sumber Asli No.25, Persiaran Perdana, Presint 4,
Pusat Pentadbiran Kerajaan Persekutuan, 62574 Putrajaya, Malaysia.
+603-8871 2000/2200
www.nre.gov.my
aduan_k@doe.gov.my

b. Suruhanjaya Pengangkutan Awam Darat (S.P.A.D)
Block D, Platinum Sentral, Jalan Stesen Sentral 2,
Kuala Lumpur Sentral, 50470 Kuala Lumpur, Malaysia.
1-800-88-7723
www.spad.gov.my
aduan@spad.gov.my

c. PUSPAKOM Sdn. Bhd. (285985-U),
Level 3 & 4, Wisma DRB-HICOM,
No 2, Jalan Usahawan U1/8, Seksyen U1, 40150 Shah Alam,
Selangor, Malaysia
+603 2052 7474
www.puspakom.com.my
customerservice@puspakom.com.my

d. Jabatan Pengangkutan Jalan (JPJ),
Ministry Of Transport Malaysia (MOT)
Aras 3-5, No. 26,
Jalan Tun Hussien, Presint 4,
Pusat Pentadbiran Kerajaan Persekutuan,
62100 WP Putrajaya, Malaysia
+60 3 8000 8000
www.jpj.gov.my
aduantrafik@jpj.gov.my

e. SIRIM,
Ministry of Science, Technology and Innovation (MOSTI)
1, Persiaran Dato' Menteri, P.O. Box 7035,
Section 2, 40700 Shah Alam, Selangor, Malaysia.
+603-5544 6000
web@sirim.my

11. Standard Technical Evaluation Committee

NO	NAME	POSITION & ORGANISATION
1.	Mr. Cheah Wing Yew	Advisor – Technical Services & Aftersales BERMAZ motor Trading Sdn Bhd
2.	Mr. Wan Husnie Razak bin Wan Abdul Rahman	Technical Training Manager BMW Group Malaysia
3.	Mr. Mohamad Hanapiah Mat Jusop	Director Etika Motor Garage

12. Standard Development Committee

LIGHT VEHICLE – HVAC MAINTENANCE

LEVEL 3
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NO	NAME	POSITION & ORGANISATION
1.	Sharudin Bin Desa	Managing Director Shafaz Aircond
2.	Mohd Khalid Bin Abu Bakar	Senior Engineer Sanden Aircond (M) Sdn Bhd
3.	Faizal Lokman	Executive Trainer Proton Edar Sdn Bhd
4.	Tengku Hazif Tengku Mansor	Head of Aftersales Training Proton Holding Sdn Bhd
5.	Mr Syukri Bin Ismail	Head Foremen & Director Hp Auto Motorsport
6.	Wan Sarahuddin Wan Abdullah	Head Foremen & Director Grande Motorsports
7.	Suhairi bin Mohd Subali	Head Foremen & Manager Suhairi Motors Sdn Bhd
8.	Mr Hock Swee Lim	Head Instructor Bermaz Auto
10.	Mr. Cho Chee Seng	Advisor of the Aftermarket Division Malaysia Automotive Institute (MAI)
FACILITATOR		
1.	Mr. Mohd Firdaaus Mohd Munir	Executive Researcher Malaysia Automotive Institute (MAI)

STANDARD CONTENT

NATIONAL OCCUPATIONAL SKILLS STANDARD (NOSS) FOR:

LIGHT VEHICLE - HVAC MAINTENANCE

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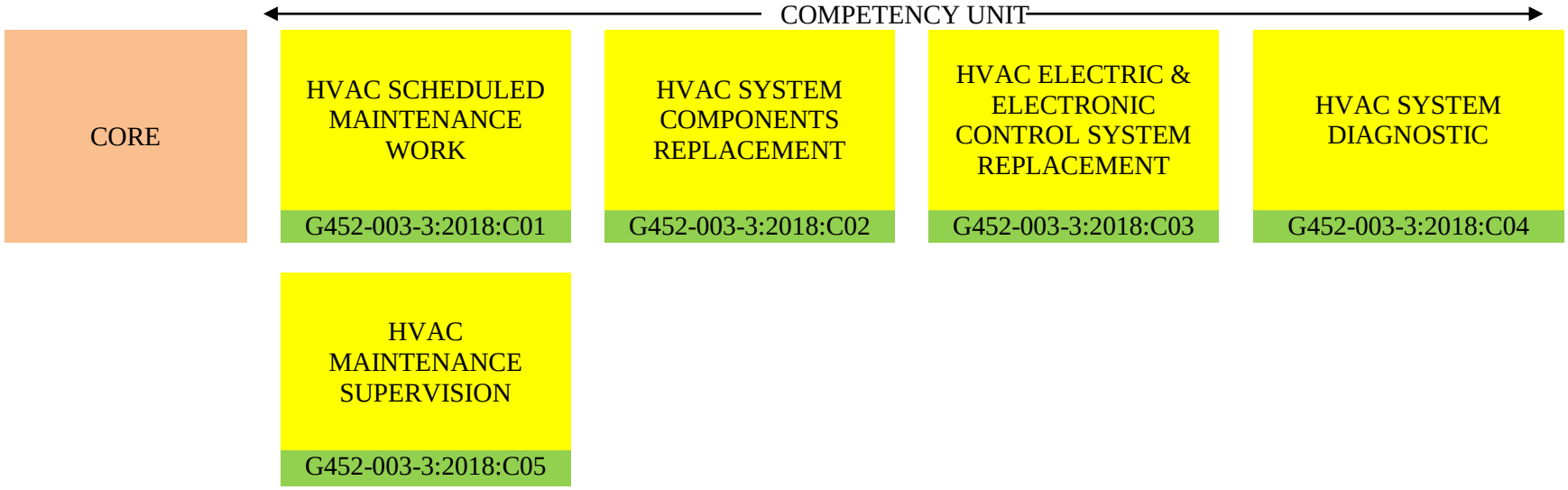
13. Competency Profile Chart (CPC)

SECTION	Wholesale And Retail Trade; Repair Of Motor Vehicles And Motorcycles (G)		
GROUP	Maintenance And Repair Of Motor Vehicles (452)		
AREA	Heating Ventilation Air Conditioning (HVAC) Work		
NOSS TITLE	Light Vehicle - HVAC Maintenance		
NOSS LEVEL	Level 3	NOSS CODE	**G452-003-3:2018**



14. Competency Profile (CP)

SECTION	Wholesale And Retail Trade; Repair Of Motor Vehicles And Motorcycles (G)		
GROUP	Maintenance And Repair Of Motor Vehicles (452)		
AREA	Heating Ventilation Air Conditioning (HVAC) Work		
NOSS TITLE	Light Vehicle - HVAC Maintenance		
NOSS LEVEL	Level 3	NOSS CODE	**G452-003-3:2018**

CU TITLE & CU CODE	CU DESCRIPTOR	WORK ACTIVITIES	PERFORMANCE CRITERIA
1. HVAC Scheduled Maintenance Work	HVAC schedule maintenance work is a competency to periodically check the automotive air conditioning system performance. The person whom is competent in HVAC schedule maintenance work must be able to replace drive belt, service cabin filter, replace receiver drier / desiccant bag, replace compressor oil and prepare HVAC scheduled maintenance work report in accordance with the workshop manual. The outcome of this competency is to provide good quality of air conditioning maintenance work to make sure the HVAC works	1. Replace Drive Belt.	1.1 Tools, equipment and materials are prepared for drive belt replacement requirement in accordance with workshop manual. 1.2 Drive belt condition inspection are performed in accordance with the workshop manual. 1.3 Drive belt are replaced in accordance with the workshop manual. 1.4 Vehicle testing is performed in accordance with the workshop manual. 1.5 Drive belt replacement checklist is prepared in accordance with the workshop manual.
		2. Service Cabin Filter	2.1 Tools, equipment and materials are prepared for air filter service requirement. 2.2 Cabin filter condition inspection are performed in accordance with the workshop manual. 2.3 Cabin filter compartment are cleaned in

	efficiently.		accordance with the workshop manual. 2.4 Cabin filter replaced in accordance with the workshop manual 2.5 Vehicle testing is performed in accordance with the workshop manual 2.6 Cabin filter service checklist is prepared in accordance with the workshop manual.
		3. Replace Receiver Drier / Desiccant Bag	3.1 Tools, equipment and materials are prepared for receiver drier / desiccant bag requirement. 3.2 Receiver drier / desiccant bag condition inspection are performed in accordance with the workshop manual. 3.3 Receiver drier / desiccant bag replaced in accordance with the workshop manual 3.4 Vehicle testing is performed in accordance with the workshop manual 3.5 Receiver drier / desiccant bag replacement checklist is prepared in accordance with the workshop manual.
		4. Replace Compressor Oil	4.1 Tools, equipment and materials are prepared for compressor oil replacement requirement. 4.2 Compressor oil condition inspection are performed in accordance with the workshop manual. 4.3 Compressor oil replacement process are performed in accordance with the workshop manual. 4.4 Vehicle testing is performed in accordance with the workshop manual 4.5 Compressor oil replacement checklist are prepared in accordance with the workshop manual.

		5. Prepare HVAC Scheduled Maintenance Work Report.	5.1 HVAC scheduled maintenance work report and checklist obtained in accordance with the company policies, & requirements. 5.2 Content HVAC scheduled maintenance work reports and checklist assessed and interpreted. 5.3 HVAC scheduled maintenance work report findings updated in accordance with the company policies, SOP & requirements. 5.4 HVAC scheduled maintenance work report documents prepared in accordance with the company policies, SOP & requirements
2. HVAC System Components Replacement	HVAC system components replacement is a competency to replace damaged or faulty air conditioning system components back to its original function. The person whom is competent in HVAC system components replacement must be able replace air conditioning expansion valve, replace air condition condenser, replace air conditioning hoses & pipes, replace air conditioning evaporator, replace air conditioning compressor and prepare HVAC system	1. Replace Air Conditioning Expansion Valve.	1.1 Tools, equipment and materials are prepared for air conditioning expansion valve replacement requirement. 1.2 Air conditioning expansion valve parts & components are identified in accordance workshop manual. 1.3 Air conditioning refrigerant recovery & recycle process are performed in accordance with the workshop manual. 1.4 Air condition expansion valve's condition inspection performed in accordance with the workshop manual. 1.5 Air conditioning expansion valve replaced in accordance with workshop manual. 1.6 Vehicle testing is performed in accordance with the workshop manual 1.7 Air conditioning expansion valve replacement checklist are prepared in accordance with the workshop manual.

	components replacement report in accordance with the workshop manual. The outcome of this competency is to provide high quality component replacement work on HVAC system to maintain air conditioning system performance.	2. Replace Air Conditioning Condenser.	2.1 Tools, equipment and materials are prepared for air conditioning condenser replacement requirement. 2.2 Air conditioning condenser parts & components are identified in accordance workshop manual. 2.3 Air conditioning condenser's condition inspection are performed in accordance with the workshop manual. 2.4 Air conditioning condenser replaced in accordance with workshop manual. 2.5 Vehicle testing is performed in accordance with the workshop manual 2.6 Air conditioning condenser replacement checklist are prepared in accordance with the workshop manual.
		3. Replace Air Conditioning Hoses & Pipes.	3.1 Tools, equipment and materials are prepared for air conditioning hoses & pipes replacement requirement. 3.2 Air conditioning hoses & pipes are identified in accordance with the workshop manual. 3.3 Air condition hoses & pipes condition inspected in accordance with the workshop manual. 3.4 Air conditioning hoses & pipes replaced in accordance with the workshop manual. 3.5 Vehicle testing is performed in accordance with the workshop manual 3.6 Air conditioning hoses & pipes replacement checklist are prepared in accordance with the workshop manual.
		4. Replace Air Conditioning Evaporator.	4.1 Tools, equipment and materials are prepared for air conditioning evaporator replacement requirement.

			4.2 Air conditioning evaporator parts & components are identified in accordance with the workshop manual. 4.3 Air condition evaporator condition inspected in accordance with the workshop manual. 4.4 Air conditioning evaporator replaced in accordance with the workshop manual. 4.5 Vehicle testing is performed in accordance with the workshop manual 4.6 Air conditioning evaporator replacement checklist are prepared in accordance with the workshop manual.
		5. Replace Air Conditioning Compressor.	5.1 Tools, equipment and materials are prepared for air conditioning compressor replacement requirement. 5.2 Air conditioning compressor parts & components are identified in accordance with the workshop manual. 5.3 Air condition compressor condition inspected in accordance with the workshop manual. 5.4 Air conditioning compressor replaced in accordance with the workshop manual. 5.5 Vehicle testing is performed in accordance with the workshop manual 5.6 Air conditioning compressor replacement checklist are prepared in accordance with the workshop manual.
		6. Prepare HVAC System Components Replacement Report.	6.1 HVAC system components replacement report and checklist obtained in accordance with the company policies, & requirements. 6.2 Content HVAC system components replacement reports and checklist assessed and interpreted.

			6.3 HVAC system components replacement report findings updated in accordance with the company policies, SOP & requirements. 6.4 HVAC system components replacement report documents prepared in accordance with the company policies, SOP & requirements
3. HVAC Electric & Electronic Control System Replacement	HVAC electric & electronic control system replacement is a competency to replace damaged or faulty vehicle's air conditioning electrical and electronic system back to its original function. The competency includes to replace air conditioning electrical circuit components, replace air conditioning condenser fan, replace air conditioning compressor magnetic clutch, replace air conditioning refrigerant pressure switch, replace air conditioning blower motor replacement, replace air conditioning thermistor, replace air selection motor actuator & air intake motor actuator, replace HVAC control panel assembly,	1. Replace Air Conditioning Electrical Circuit Components.	1.1 Tools, equipment and materials are prepared for air conditioning electrical circuit components replacement requirement. 1.2 Air condition electrical circuit components condition inspected in accordance with the workshop manual. 1.3 Air conditioning electrical circuit components replaced in accordance with the workshop manual. 1.4 Air conditioning electrical circuit components replacement checklist are prepared in accordance with the workshop manual.
		2. Replace Air Conditioning Condenser Fan.	2.1 Tools, equipment and materials are prepared for air conditioning condenser fan replacement requirement. 2.2 Air condition condenser fan condition inspected in accordance with the workshop manual. 2.3 Air conditioning condenser fan replaced in accordance with the workshop manual. 2.4 Air conditioning condenser fan replacement checklist are prepared in accordance with the workshop manual.

	replace HVAC electric & electronic sensors and prepare HVAC electric & electronic control system replacement report in accordance manual. The outcome of this competency is to provide quality replacement work on air conditioning electrical and electronic system and to maintain air conditioning performance.	3. Replace Air Conditioning Compressor Magnetic Clutch	3.1 Tools, equipment and materials are prepared for air conditioning compressor magnetic clutch replacement requirement. 3.2 Air condition compressor magnetic clutch condition inspected in accordance with the workshop manual. 3.3 Air conditioning compressor magnetic clutch replaced in accordance with the workshop manual. 3.4 Air conditioning compressor magnetic clutch replacement checklist are prepared in accordance with the workshop manual.
		4. Replace Air Conditioning Refrigerant Pressure Switch	4.1 Tools, equipment and materials are prepared for air conditioning refrigerant pressure switch replacement requirement. 4.2 Air condition refrigerant pressure switch condition inspected in accordance with the workshop manual. 4.3 Air conditioning refrigerant pressure switch replaced in accordance with the workshop manual. 4.4 Air conditioning refrigerant pressure switch replacement checklist are prepared in accordance with the workshop manual.
		5. Replace Air Conditioning Blower Motor Replacement	5.1 Tools, equipment and materials are prepared for air conditioning blower motor replacement requirement. 5.2 Air condition blower motor inspected in accordance with the workshop manual. 5.3 Air conditioning blower motor replaced in accordance with the workshop manual. 5.4 Air conditioning blower motor replacement checklist are prepared in accordance with

			the workshop manual.
		6. Replace Air Conditioning Thermistor	6.1 Tools, equipment and materials are prepared for air conditioning blower speed control switch replacement requirement. 6.2 Air condition blower speed control switch inspected in accordance with the workshop manual. 6.3 Air conditioning blower speed control switch replaced in accordance with the workshop manual. 6.4 Air conditioning blower speed control switch replacement checklist are prepared in accordance with the workshop manual.
		7. Replace Air Selection Motor Actuator & Air Intake Motor Actuator	7.1 Tools, equipment and materials are prepared for air conditioning evaporator coil thermistor and amplifier replacement requirement. 7.2 Air condition evaporator coil thermistor and amplifier inspected in accordance with the workshop manual. 7.3 Air conditioning evaporator coil thermistor and amplifier replaced in accordance with the workshop manual. 7.4 Air conditioning evaporator coil thermistor and amplifier replacement checklist are prepared in accordance with the workshop manual.
		8. Replace HVAC Control Panel Assembly	8.1 Tools, equipment and materials are prepared for air conditioning air selection module & air intake module replacement requirement. 8.2 Air condition air selection module & air intake module inspected in accordance with

			the workshop manual. 8.3 Air conditioning air selection module & air intake module replaced in accordance with the workshop manual. 8.4 Air conditioning air selection module & air intake module replacement checklist are prepared in accordance with the workshop manual.
		9. Replace HVAC Electric & Electronic Sensors	9.1 Tools, equipment and materials are prepared for HVAC electric & electronic sensor replacement requirement 9.2 Ambient sensors & interior sensors functionality are checked in accordance with the workshop manual. 9.3 ECU functionality are checked in accordance with the workshop manual. 9.4 Ambient sensors & interior sensors are replaced in accordance 9.5 ECU are replaced in accordance with the workshop manual. 9.6 ECU setting are calibrated in accordance with the workshop manual. 9.7 Ambient sensors & interior sensors setting are calibrated in accordance with the workshop manual. 9.8 Vehicle testing is performed in accordance with the workshop manual 9.9 HVAC system diagnostic status checklist are prepared.
		10. Prepare HVAC Electric & Electronic Control System Replacement Report.	10.1 HVAC electric & electronic control system replacement report and checklist obtained in accordance with the company policies, & requirements. 10.2 Content HVAC electric & electronic

			control system replacement reports and checklist assessed and interpreted. 10.3 HVAC electric & electronic control system replacement report findings updated in accordance with the company policies, SOP & requirements. 10.4 HVAC electric & electronic control system replacement report documents prepared in accordance with the company policies, SOP & requirements
4. HVAC System Diagnostic	HVAC system diagnostic is a competency to find or diagnose damaged or faulty air conditioning system components. The competency includes check refrigerant high & low pressure, operate scan tool, evaluate scan tool result and prepare HVAC system components replacement report in accordance with manufacturer specification and workshop manual. The outcome of this competency is to confirm the status of the HVAC system defect type and provide quality solution to repair it and assign the required repair job.	1. Check Refrigerant High & Low Pressure	1.1 Tools, equipment and materials are prepared for refrigerant high & low pressure level test requirement. 1.2 Refrigeration gas pressure test gauge are connected to the charging valve in accordance with workshop manual. 1.3 Refrigerant high & low pressure level test are performed in accordance with the workshop manual. 1.4 Refrigerant high & low pressure level condition are confirmed in accordance with the workshop manual. 1.5 Refrigerant high & low pressure level condition checklist are prepared in accordance with the workshop manual.
		2. Operate Scan Tool	2.1 Scan tool are prepared and setup in accordance with the HVAC system diagnostic requirement. 2.2 Scan tool procedure are adhered in accordance with the workshop manual. 2.3 Scan tool are operated in accordance with the workshop manual. 2.4 Result of the scan tool are acquired in accordance with the workshop manual.

		3. Evaluate Scan Tool Result	3.1 Scan tool result are analysed and referred to the OEM manual in accordance with HVAC system diagnostic requirement. 3.2 HVAC system test are simulated in accordance with the workshop manual. 3.3 HVAC system condition inspection checklist are prepared in accordance with the workshop manual. 3.4 Job order are assigned in accordance with the workshop manual.
		4. Prepare HVAC System Diagnostic Report.	4.1 HVAC system diagnostic reports and checklist obtained in accordance with the company policies, & requirements. 4.2 Content HVAC system diagnostic reports and checklist assessed and interpreted. 4.3 HVAC system diagnostic reports findings updated in accordance with the company policies, SOP & requirements. 4.4 HVAC system diagnostic reports documents prepared in accordance with the company policies, SOP & requirements
5. HVAC Maintenance Supervision	HVAC maintenance supervision is to administer and supervise the whole work process in work place. The person who is competent in HVAC maintenance supervision activities shall be able to prepare work schedule, conduct briefing session, prepare sectional operation budget information, monitor staff performance,	1. Prepare Work Schedule	1.1 Manpower capacity and resources identified 1.2 Manpower requirements determined in accordance with job requirements 1.3 Work schedule analysed in accordance with job requirements 1.4 Work schedule prepared in accordance with job requirements
		2. Conduct Briefing Session	2.1 Staff briefing requirements determined in accordance with company standard practice 2.2 Items to brief identified in accordance with briefing session requirements 2.3 Staff briefing conducted in accordance with

	coordinate staff training, monitor workshop safety and monitor clean work place environment in accordance with workshop manual. The outcome of this competency is to provide supervisory skills so that the workshop is administered professionally in accordance with company requirements		company operating procedure 2.4 Information delivered and explained clearly 2.5 Delivered information interpreted and acted upon by subordinates in accordance with job requirements
		3. Prepare Sectional Operation Budget Information	3.1 Previous year sectional operation budget analysed in accordance with budget preparation requirements 3.2 Yearly manpower requirement determined in accordance with company annual planning 3.3 Forecasted expenditure determined in accordance with company budget requirements 3.4 Sectional operation budget prepared in accordance with section operation plan
		4. Monitor Staff Performance	4.1 Standard performance guidelines identified in accordance with appraisal requirements 4.2 Method of monitoring staff performance identified 4.3 Actual staff performance observed 4.4 Previous year personnel appraisal analysed in accordance with human resource guidelines 4.5 Personnel appraisal session coordinated in accordance with human resource guidelines 4.6 Personnel appraisal recommendation carried out in accordance with company operating procedures 4.7 Personnel appraisal report prepared and presented in accordance with human resource guidelines

		5. Coordinate Staff Training	5.1 Training Need Analysis (TNA) conducted as per company requirements 5.2 Training Need Identify (TNI) conducted as per company requirements 5.3 Training requirements determined in accordance with TNA and TNI finding 5.4 Logistic of training coordinated in accordance with company SOP 5.5 Staff training coordinated in accordance with the training need
		6. Monitor Workshop Safety	6.1 Workshop safety requirements determined in accordance with company SOP 6.2 Workshop safety compliance monitored in accordance with company regulations 6.3 Workshop safety measures enforced in accordance with occupational safety & health act 1994 (Act 514) and regulations compliance
		7. Monitor Clean Air Environment	7.1 Clean air environment requirements determined in accordance with relevant authority regulations 7.2 Clean air environment compliance monitored in accordance with company requirements 7.3 Clean air environment measure enforced in accordance with environmental quality (clean air) regulation 1978

CURRICULUM OF COMPETENCY UNIT

NATIONAL OCCUPATIONAL SKILLS STANDARD (NOSS) FOR:

LIGHT VEHICLE - HVAC MAINTENANCE

LEVEL 3
G452-003-3:2018

15. Curriculum of Competency Unit

15.1. HVAC Scheduled Maintenance Work

SECTION	Wholesale And Retail Trade; Repair Of Motor Vehicles And Motorcycles (G)		
GROUP	Maintenance And Repair Of Motor Vehicles (452)		
AREA	Heating Ventilation Air Conditioning (HVAC) Work		
NOSS TITLE	Light Vehicle - HVAC Maintenance		
COMPETENCY UNIT TITLE	HVAC Scheduled Maintenance Work		
LEARNING OUTCOMES	The outcome of this competency is to provide good quality of air conditioning maintenance work. Upon completion of this competency unit, trainees shall be able to: 1. Replace Drive Belt. 2. Service Cabin Filter 3. Replace Receiver Drier / Desiccant Bag 4. Replace Compressor Oil 5. Prepare HVAC Scheduled Maintenance Work Report.		
TRAINING PRE-REQUISITE			
CU CODE	**G452-003-3:2018:C01**	NOSS LEVEL	L3

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
1. Replace Drive Belt.	1.1 Job order • Printed or manual 1.2 Fundamental of vehicle • Vehicle framework & structure • Vehicle testing procedure • Vehicle operations and functions 1.3 Fundamentals of Drive Belt • Type • Function • Usage	1.1 Interpret job order. 1.2 Identify part, tools, and materials. 1.3 Prepare part, tools, and materials. 1.4 Inspect drive belt condition. 1.5 Replace drive belt. 1.6 Perform vehicle testing for drive belt abnormalities. 1.7 Update drive belt replacement status	<u>ATTITUDE</u> • Systematic in organising work activities. <u>SAFETY</u> • Adhere to company safety and policy. • Occupational safety & health act 514 1994 <u>ENVIRONMENT</u> • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality	1.1 Job order / worksheet are obtained, presented and explained. 1.2 Tools, equipment and materials for air conditioning drive belt replacement are acquired and prepared in working place. 1.3 Drive belt abnormalities condition are visually and physically inspected in compliance with workshop manual. 1.4 New drive belt indicated by part numbers is installed in

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Layout • Parts number 1.4 Fundamentals of common tool • Function • Usage 1.5 Fundamentals of Service Special Tool (SST) • Function • Usage 1.6 Fundamentals of material • Consumables item • Sundry 1.7 Drive belt abnormalities • Crack • Slippage 1.8 Drive belt replacement process 1.9 Workshop manual • Type (printed, electronics) • Function • Usage 1.10 Checklist: • Format such as computerised or manual • Content / information • Submission procedure	checklist.	act 127 1974	compliance with the workshop manual. 1.5 Vehicle testing for any drive belt defects are performed and ascertained. 1.6 Drive belt replacement status checklist are completed and printed

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
2. Service Cabin Filter	2.1 Job order • Printed or manual 2.2 Fundamental of vehicle • Vehicle framework & structure • Vehicle testing procedure • Vehicle operations and functions 2.3 Fundamentals of Cabin Filter • Type (serviceable, non-serviceable) • Function • Usage • Layout • Parts number 2.4 Fundamentals of common tool • Function • Usage 2.5 Fundamentals of material • Consumables item • Sundry 2.6 Cabin Filter abnormalities • Contaminated • Clogs 2.7 Cabin Filter service process 2.8 Workshop manual • Type (printed,	2.1 Interpret job order. 2.2 Identify part, tools, and materials. 2.3 Prepare part, tools, and materials. 2.4 Inspect cabin filter condition. 2.5 Clean cabin filter. 2.6 Replace cabin filter. 2.7 Perform vehicle testing for cabin filter defect. 2.8 Update cabin filter replacement status checklist.	ATTITUDE • Systematic in organising work activities. SAFETY • Adhere to company safety and policy. • Occupational safety & health act 514 1994 ENVIRONMENT • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality act 127 1974	2.1 Job order / worksheet are obtained, presented and explained. 2.2 Tools, equipment and materials for air conditioning expansion valve replacement are acquired and prepared in working place. 2.3 Cabin filter abnormalities condition are visually and physically inspected in compliance with workshop manual. 2.4 New cabin filter indicated by part numbers or cleaned cabin filter is installed in compliance with the workshop manual. 2.5 Vehicle testing for any cabin filter defects are performed and ascertained. 2.6 Cabin filter replacement status checklist are completed and printed

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	electronics) • Function • Usage 2.9 Checklist: • Format such as computerised or manual • Content / information • Submission procedure			
3. Replace Receiver Drier / Desiccant Bag	3.1 Job order • Printed or manual 3.2 Fundamental of vehicle • Vehicle framework & structure • Vehicle testing procedure • Vehicle operations and functions 3.3 Fundamentals of receiver drier / desiccant bag • Function • Usage • Construction • Part numbers / names 3.4 Fundamentals of common tool • Function • Usage	3.1 Interpret job order. 3.2 Identify part, tools, equipment and materials. 3.3 Prepare part, tools, equipment and materials. 3.4 Inspect receiver drier / desiccant bag condition. 3.5 Recover refrigerant. 3.6 Remove receiver drier / desiccant bag 3.7 Inspect O-ring condition 3.8 Replace O-ring 3.9 Replace receiver drier / desiccant bag. 3.10 Recharge refrigerant. 3.11 Perform vehicle testing for receiver drier / desiccant bag defect.	<u>ATTITUDE</u> • Systematic in organising work activities. <u>SAFETY</u> • Adhere to company safety and policy. • Occupational safety & health act 514 1994 <u>ENVIRONMENT</u> • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality act 127 1974	3.1 Job order / worksheet are obtained, presented and explained. 3.2 Tools, equipment and materials for air conditioning receiver drier / desiccant bag replacement are acquired and prepared in working place. 3.3 Receiver drier / desiccant bag abnormalities condition are visually and physically inspected in compliance with workshop manual. 3.4 Refrigerant are safely recovered using recovery / recycle machine in compliance with the workshop manual. 3.5 Faulty receiver drier / desiccant bag is dismantled from the air conditioning system. 3.6 Damaged O-ring are visually confirmed and new O-ring installed.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	3.5 Fundamentals of Service Special Tool (SST) • Function • Usage 3.6 Fundamentals of material • Consumables item • Sundry 3.7 Fundamental of Air-Conditioning refrigerant • Types • Usage 3.8 Fundamentals of air conditioning recovery machine • Function • Usage • Type 3.9 Expansion receiver drier / desiccant bag abnormalities condition • Leaking • Blockage 3.10 Refrigerant recovery and recycle process 3.11 Receiver drier / desiccant bag replacement process 3.12 Workshop manual • Type (printed, electronics)	3.12 Update receiver drier / desiccant bag replacement status checklist.		3.7 New receiver drier / desiccant bag parts indicated by part numbers is installed in compliance with the workshop manual. 3.8 Charged refrigerant to the system in compliance with the workshop manual. 3.9 Vehicle testing for any receiver drier / desiccant bag defects are performed and ascertained. 3.10 Receiver drier / desiccant bag replacement status checklist are completed and printed

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Function • Usage 3.13 Checklist: • Format such as computerised or manual • Content / information • Submission procedure			
4 Replace Compressor Oil	4.1 Job order • Printed or manual 4.2 Fundamental of vehicle • Vehicle framework & structure • Vehicle testing procedure • Vehicle operations and functions 4.3 Fundamentals of compressor oil • Function • Usage • Layout • System flow 4.4 Fundamentals of common tool • Function • Usage 4.5 Fundamentals of Service Special Tool (SST) • Function • Usage	4.1 Interpret job order. 4.2 Identify part, tools, equipment and materials. 4.3 Prepare part, tools, equipment and materials. 4.4 Recover refrigerant 4.5 Evacuate air conditioning system 4.6 Charge refrigerant. 4.7 Replace compressor oil 4.8 Perform vehicle testing for HVAC functionality. 4.9 Update air conditioning system charging status checklist.	<u>ATTITUDE</u> • Systematic in organising work activities. <u>SAFETY</u> • Adhere to company safety and policy. • Occupational safety & health act 514 1994 <u>ENVIRONMENT</u> • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality act 127 1974	4.1 Job order / worksheet are obtained, presented and explained. 4.2 Tools, equipment and materials for compressor oil replacement are acquired and prepared in working place. 4.3 Refrigerant are safely recovered using recovery / recycle machine in compliance with the workshop manual. 4.4 Air conditioning system are evacuated and free from moisture and air. 4.5 Charged refrigerant to the system in compliance with the workshop manual. 4.6 New compressor oil are refilled into the compressor in compliance with the workshop manual. 4.7 Vehicle testing for functionality of the HVAC are performed and ascertained.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	4.6 Fundamentals of material • Consumables item • Sundry 4.7 Compressor oil replacement process 4.8 Fundamental of Air-Conditioning refrigerant • Types • Usage 4.9 Refrigerant recovery and charging process 4.10 Workshop manual • Type (printed, electronics) • Function • Usage 4.11 Checklist: • Format such as computerised or manual • Content / information • Submission procedure			4.8 Receiver drier / desiccant bag replacement status checklist are completed and printed
5 Prepare HVAC Scheduled Maintenance Work Report.	5.1 Source of report / checklist 5.2 Report information content: • Job details • Servicing information 5.3 Performance compliance:	5.1 Obtain HVAC scheduled maintenance reports and checklist. 5.2 Interpret content HVAC scheduled maintenance reports. 5.3 Update HVAC scheduled maintenance report findings.	<u>ATTITUDE</u> • Systematic in organising work activities. <u>SAFETY</u> • Adhere to company safety and policy. • Occupational safety & health act 514 1994	5.1 HVAC Scheduled Maintenance reports and checklist acquired and confirmed. 5.2 Content HVAC Scheduled Maintenance report assessed and identified. 5.3 HVAC Scheduled Maintenance report updated, generated and submitted.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Safety regulations 5.4 HVAC Scheduled Maintenance report writing : • Type of report • Content / information • Submission procedure	5.4 Prepare HVAC scheduled maintenance final report documents.	ENVIRONMENT • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality act 127 1974	

Employability Skills

Core Abilities

- Please refer NCS- Core Abilities latest edition.

Social Values & Social Skills

- Please refer Handbook on Social Skills and Social Values in Technical Education and Vocational Training.

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3 Anon (Author). Air Conditioning Manual. ISBN-10: 1785213598. J H Haynes & Co Ltd (June 27, 2016).

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15.2. HVAC System Components Replacement

SECTION	Wholesale And Retail Trade; Repair Of Motor Vehicles And Motorcycles (G)		
GROUP	Maintenance And Repair Of Motor Vehicles (452)		
AREA	Heating Ventilation Air Conditioning (HVAC) Work		
NOSS TITLE	Light Vehicle - HVAC Maintenance		
COMPETENCY UNIT TITLE	HVAC System Components Replacement		
LEARNING OUTCOMES	The outcome of this competency is to provide high quality component replacement work on HVAC system to maintain air conditioning system performance. Upon completion of this competency unit, trainees shall be able to: 1. Replace Air Conditioning Expansion Valve. 2. Replace Air Conditioning Condenser. 3. Replace Air Conditioning Hoses & Pipes. 4. Replace Air Conditioning Evaporator. 5. Replace Air Conditioning Compressor. 6. Prepare HVAC System Components Replacement Report.		
TRAINING PRE-REQUISITE			
CU CODE	**G452-003-3:2018:C02**	NOSS LEVEL	L3

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
1. Replace Air Conditioning Expansion Valve	1.1 Job order • Printed or manual 1.2 Fundamental of vehicle • Vehicle framework & structure • Vehicle testing procedure • Vehicle operations and functions 1.3 Fundamentals of expansion valve • Function • Usage	1.1 Receive job order / worksheet 1.2 Interpret job order. 1.3 Identify part, tools, equipment and materials. 1.4 Prepare part, tools, equipment and materials at working area. 1.5 Inspect expansion valve's condition. 1.6 Recover refrigerant.	<u>ATTITUDE</u> • Systematic in organising work activities. <u>SAFETY</u> • Adhere to company safety and policy. • Occupational safety & health act 514 1994 <u>ENVIRONMENT</u> • Practice Reuse, Recycle and Reduce (3R).	1.1 Job order / worksheet are obtained, presented and explained. 1.2 Tools, equipment and materials for air conditioning expansion valve replacement are acquired and prepared in working place. 1.3 Abnormalities condition are visually and physically inspected in compliance with workshop manual. 1.4 Refrigerant are safely

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Parts and components • Construction • Part numbers / names 1.4 Fundamentals of common tool • Function • Usage 1.5 Fundamentals of Service Special Tool (SST) • Function • Usage 1.6 Fundamentals of air conditioning recovery machine • Function • Usage • Type 1.7 Expansion valve abnormalities condition • Leaking • Blockage • Noise, Vibration & Harshness (NVH) 1.8 Fundamental of Air-Conditioning refrigerant • Types • Usage 1.9 Refrigerant recovery and recycle process 1.10 Expansion valve replacement process	1.7 Remove expansion valve 1.8 Inspect O-ring condition 1.9 Replace O-ring 1.10 Replace expansion valve. 1.11 Recharge refrigerant. 1.12 Perform vehicle testing for expansion valve functionality. 1.13 Update expansion valve replacement status checklist.	• Environmental Quality act 127 1974	recovered using recovery / recycle machine in compliance with the workshop manual. 1.5 Faulty expansion valve is dismantled from the piping system. 1.6 Damaged O-ring are visually confirmed and new O-ring installed. 1.7 New expansion valve parts indicated by part numbers is installed in compliance with the workshop manual. 1.8 Charged refrigerant to the system in compliance with the workshop manual. 1.9 Vehicle testing for functionality of expansion valve are performed and ascertained. 1.10 Expansion valve replacement status checklist are completed and printed

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	1.11 Workshop manual • Type (printed, electronics) • Function • Usage 1.12 Checklist: • Format such as computerised or manual • Content / information • Submission procedure			
2. Replace Air Conditioning Condenser.	2.1 Job order • Printed or manual 2.2 Fundamental of vehicle • Vehicle framework & structure • Vehicle testing procedure • Vehicle operations and functions 2.3 Fundamental of Air-Conditioning refrigerant • Types • Usage 2.4 Fundamentals of Condenser • Types • Function • Usage • Parts and components	2.1 Identify part, tools, equipment and materials. 2.2 Prepare part, tools, equipment and materials at working area. 2.3 Inspect condenser condition 2.4 Recover refrigerant 2.5 Remove Condenser 2.6 Inspect O-ring condition 2.7 Replace O-ring 2.8 Replace condenser. 2.9 Recharge refrigerant. 2.10 Perform vehicle testing for air conditioning condenser functionality.	<u>ATTITUDE</u> • Systematic in organising work activities. <u>SAFETY</u> • Adhere to company safety and policy. • Occupational safety & health act 514 1994 <u>ENVIRONMENT</u> • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality act 127 1974	2.1 Job order / worksheet are obtained, presented and explained. 2.2 Tools, equipment and materials for air conditioning condenser replacement are acquired and prepared in working place. 2.3 Abnormalities condition are visually and physically inspected in compliance with workshop manual. 2.4 Refrigerant are safely recovered using recovery / recycle machine in compliance with the workshop manual. 2.5 Faulty condenser is dismantled from the piping system. 2.6 Damaged O -ring are visually confirmed and new O -ring installed. 2.7 New condenser parts indicated

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Construction • Abnormalities • Part numbers / names 2.5 Fundamentals of common tool • Function • Usage 2.6 Fundamentals of Service Special Tool (SST) • Function • Usage 2.7 Condenser abnormalities condition • Leaking • Blockage • Vibration • Bend 2.8 Condenser replacement process 2.9 Workshop manual • Type (printed, electronics) • Function • Usage • Service Specification 2.10 Checklist: • Format such as computerised or manual • Content / information	2.11 Update air conditioning condenser replacement status checklist.		by part numbers is installed in compliance with the workshop manual. 2.8 Charged refrigerant to the system in compliance with the workshop manual. 2.9 Vehicle testing for functionality of air conditioning condenser are performed and ascertained. 2.10 Condenser replacement status checklist are completed and printed

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Submission procedure			
3 Replace Air Conditioning Hoses & Pipes.	3.1 Job order • Printed or manual 3.2 Fundamental of vehicle • Vehicle framework & structure • Vehicle testing procedure • Vehicle operations and functions 3.3 Fundamentals of hoses & pipes • Function • Usage • Parts and components • Construction & Layout • Abnormalities • Part numbers / names 3.4 Fundamentals of common tool • Function • Usage 3.5 Fundamentals of Service Special Tool (SST) • Function • Usage 3.6 Fundamentals of air conditioning recovery / recycle machine	3.1 Identify part, tools, equipment and materials. 3.2 Prepare part, tools, equipment and materials at working area. 3.3 Inspect air condition hoses & pipes condition. 3.4 Recover refrigerant 3.5 Remove hoses & pipes 3.6 Inspect O-ring condition 3.7 Replace O-ring 3.8 Replace hoses & pipes. 3.9 Recharge refrigerant 3.10 Perform vehicle testing for leaking. 3.11 Update air conditioning hoses & pipes replacement status checklist.	<u>ATTITUDE</u> • Systematic in organising work activities. <u>SAFETY</u> • Adhere to company safety and policy. • Occupational safety & health act 514 1994 <u>ENVIRONMENT</u> • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality act 127 1974	3.1 Job order / worksheet are obtained, presented and explained. 3.2 Tools, equipment and materials for air conditioning hoses & pipes replacement are acquired and prepared in working place. 3.3 Abnormalities condition are visually and physically inspected in compliance with workshop manual. 3.4 Refrigerant are safely recovered using recovery / recycle machine in compliance with the workshop manual. 3.5 Faulty hoses & pipes is dismantled from the piping system. 3.6 Damaged O -ring are visually confirmed and new O -ring installed. 3.7 New hoses & pipes parts indicated by part numbers is installed in compliance with the workshop manual. 3.8 Charged refrigerant to the system in compliance with the workshop manual. 3.9 Vehicle testing for leaking of air conditioning hoses & pipes are performed and ascertained. 3.10 Hoses & pipes replacement

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Function • Usage • Type 3.7 Hoses & pipes abnormalities condition • Leakage • Blockage • Vibration • Noise • Bend 3.8 Leak Detection method • Visual leak detection • Soap solution • Electronic leak detector 3.9 Fundamental of Air-Conditioning refrigerant • Types • Usage 3.10 Refrigerant recovery and recycle process 3.11 Hoses & pipes replacement process 3.12 Workshop manual • Type (printed, electronics) • Function • Usage • Service Specification 3.13 Checklist: • Format such as			status checklist are completed and printed

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	computerised or manual • Content / information • Submission procedure			
4 Replace Air Conditioning Evaporator.	4.1 Job order / worksheet • Printed or manual 4.2 Fundamental of vehicle • Vehicle framework & structure • Vehicle testing procedure • Vehicle operations and functions 4.3 Fundamentals of evaporator • Types • Function • Usage • Parts and components • Construction • Abnormalities • Part numbers / names 4.4 Fundamentals of common tool • Function • Usage 4.5 Fundamentals of Service Special Tool (SST) • Function	4.1 Identify part, tools, equipment and materials. 4.2 Prepare part, tools, equipment and materials at working area. 4.3 Inspect evaporator condition. 4.4 Recover refrigerant 4.5 Remove evaporator 4.6 Inspect O-ring condition 4.7 Replace O-ring 4.8 Replace evaporator. 4.9 Recharge refrigerant 4.10 Perform vehicle testing for air conditioning evaporator functionality. 4.11 Update evaporator replacement status checklist.	<u>ATTITUDE</u> • Systematic in organising work activities. <u>SAFETY</u> • Adhere to company safety and policy. • Occupational safety & health act 514 1994 <u>ENVIRONMENT</u> • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality act 127 1974	4.1 Job order / worksheet are obtained, presented and explained. 4.2 Tools, equipment and materials for air conditioning condenser replacement are acquired and prepared in working place. 4.3 Abnormalities condition are visually and physically inspected in compliance with workshop manual. 4.4 Refrigerant are safely recovered using recovery / recycle machine in compliance with the workshop manual. 4.5 Faulty evaporator is dismantled from the piping system. 4.6 Damaged O-ring are visually confirmed and new O-ring installed. 4.7 New evaporator parts indicated by part numbers is installed in compliance with the workshop manual. 4.8 Charged refrigerant to the system in compliance with the workshop manual. 4.9 Vehicle testing for functionality

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Usage 4.6 Evaporator abnormalities condition • Leaking • Blockage • Vibration 4.7 Evaporator replacement process 4.8 Fundamental of Air-Conditioning refrigerant • Types • Usage 4.9 Refrigerant recovery and recycle process 4.10 Workshop manual • Type (printed, electronics) • Function • Usage • Service Specification 4.11 Checklist: • Format such as computerised or manual • Content / information • Submission procedure			of air conditioning evaporator are performed and ascertained 4.10 Evaporator replacement status checklist are completed and printed
5 Replace Air Conditioning Compressor.	5.1 Job order / worksheet • Printed or manual 5.2 Fundamental of vehicle • Vehicle framework	5.1 Identify part, tools, equipment and materials. 5.2 Prepare part, tools, equipment and	<u>ATTITUDE</u> • Systematic in organising work activities.	5.1 Job order / worksheet are obtained, presented and explained. 5.2 Tools, equipment and materials for air conditioning compressor

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	& structure • Vehicle testing procedure • Vehicle operations and functions 5.3 Fundamentals of compressor • Types • Function • Usage • Parts and components • Construction • Abnormalities • Part numbers / names 5.4 Fundamentals of common tool • Function • Usage 5.5 Fundamentals of Service Special Tool (SST) • Function • Usage 5.6 Compressor abnormalities condition • Leaking • Blockage • Vibration 5.7 Fundamentals of air conditioning system flushing • Flushing procedure	materials at working area. 5.3 Inspect compressor condition. 5.4 Recover refrigerant 5.5 Remove compressor 5.6 Inspect O-ring condition 5.7 Replace O-ring 5.8 Replace air conditioning compressor. 5.9 Flush contaminated air conditioning system 5.10 Recharge refrigerant. 5.11 Perform vehicle testing for air conditioning compressor functionality. 5.12 Update air conditioning compressor replacement status checklist.	<u>SAFETY</u> • Adhere to company safety and policy. • Occupational safety & health act 514 1994 <u>ENVIRONMENT</u> • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality act 127 1974	replacement are acquired and prepared in working place. 5.3 Abnormalities condition are visually and physically inspected in compliance with workshop manual. 5.4 Refrigerant are safely recovered using recovery / recycle machine in compliance with the workshop manual. 5.5 Faulty compressor is dismantled from the piping system. 5.6 Damaged O -ring are visually confirmed and new O -ring installed. 5.7 New compressor parts indicated by part numbers is installed in compliance with the workshop manual. 5.8 Air conditioning system flushing activities perform in compliance with workshop manual. 5.9 Charged refrigerant to the system in compliance with the workshop manual. 5.10 Vehicle testing for functionality of air conditioning compressor are performed and ascertained 5.11 Compressor replacement status checklist are completed and printed

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Flushing method • Equipment • Recommended flushing agent 5.8 Compressor replacement process 5.9 Fundamental of Air-Conditioning refrigerant • Types • Usage 5.10 Refrigerant recovery and recycle process 5.11 Workshop manual • Type (printed, electronics) • Function • Usage • Service Specification 5.12 Checklist: • Format such as computerised or manual • Content / information • Submission procedure			
6 Prepare HVAC System Components Replacement Report.	6.1 Source of report / checklist 6.2 Report information content: • Job details • Servicing	6.1 Obtain HVAC system components service & repair reports and checklist. 6.2 Interpret content HVAC system components service & repair reports.	<u>ATTITUDE</u> • Systematic in organising work activities. <u>SAFETY</u> • Adhere to company	6.1 HVAC system components service & repair reports and checklist acquired and confirmed. 6.2 Content HVAC system components service & repair report assessed and identified.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	information 6.3 Performance compliance: • Safety regulations 6.4 HVAC system components service & repair report writing : • Type of report • Content / information • Submission procedure	6.3 Update HVAC system components service & repair report findings. 6.4 Prepare HVAC system components service & repair final report documents.	safety and policy. • Occupational safety & health act 514 1994 <u>ENVIRONMENT</u> • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality act 127 1974	6.3 HVAC system components service & repair report updated, generated and submitted.

Employability Skills

Core Abilities

- Please refer NCS- Core Abilities latest edition.

Social Values & Social Skills

- Please refer Handbook on Social Skills and Social Values in Technical Education and Vocational Training.

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1 Quansheng Zhang (Author), Shengbo Eben Li (Author), Kun Deng (Author). Automotive Air Conditioning: Optimization, Control and Diagnosis 1st ed. ISBN-13: 978-3319335896. Springer; 1st ed. 2016 edition (August 11, 2016).

2 Graham Stoakes (Author). Principles of Light Vehicle Air Conditioning. ISBN-10: 0992949246.

3 Anon (Author). Air Conditioning Manual. ISBN-10: 1785213598. J H Haynes & Co Ltd (June 27, 2016).

4 Chris Johanson (Author). Auto Heating and Air Conditioning. ISBN-10: 1619607638. Goodheart-Willcox; 4 edition (September 12, 2014)

15.3. HVAC Electric & Electronic Control System Replacement

SECTION	Wholesale And Retail Trade; Repair Of Motor Vehicles And Motorcycles (G)		
GROUP	Maintenance And Repair Of Motor Vehicles (452)		
AREA	Heating Ventilation Air Conditioning (HVAC) Work		
NOSS TITLE	Light Vehicle - HVAC Maintenance		
COMPETENCY UNIT TITLE	HVAC Electric & Electronic Control System Replacement		
LEARNING OUTCOMES	The outcome of this competency is to provide quality replacement work on air conditioning electrical and electronic system and to maintain air conditioning performance. Upon completion of this competency unit, trainees shall be able to: 1. Replace Air Conditioning Electrical Circuit Components 2. Replace Air Conditioning Condenser Fan 3. Replace Air Conditioning Compressor Magnetic Clutch 4. Replace Air Conditioning Refrigerant Pressure Switch 5. Replace Air Conditioning Blower Motor Replacement 6. Replace Air Conditioning Thermistor 7. Replace Air Selection Motor Actuator & Air Intake Motor Actuator 8. Replace HVAC Control Panel Assembly 9. Replace HVAC Electric & Electronic Sensors 10. Prepare HVAC Electric & Electronic Control System Replacement Report.		
TRAINING PRE-REQUISITE			
CU CODE	**G452-003-3:2018:C03**	NOSS LEVEL	L3

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
1. Replace Air Conditioning Electrical Circuit Components	1.1 Job order • Printed or manual 1.2 Fundamentals of air conditioning electrical circuit components • Type (relay, fuse, switches, connectors) • Function	1.1 Receive job order / worksheet. 1.2 Interpret job order. 1.3 Identify part, tools, equipment and materials. 1.4 Identify type air conditioning electrical circuit components.	ATTITUDE • Systematic in organising work activities. SAFETY • Adhere to company safety and policy. • Occupational safety & health act 514 1994	1.1 Job order / worksheet are obtained, presented and explained. 1.2 Tools, equipment and materials for air conditioning electrical circuit components replacement are acquired and prepared in working place. 1.3 Electrical circuit components

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Usage • Schematic Diagram 1.3 Fundamentals of common tools • Function • Usage 1.4 Fundamentals of material • Consumables item • Sundry 1.5 Fundamentals of measuring equipment • Multimeter • LED Test lamp 1.6 Fundamentals of Service Special Tool (SST) • Function • Usage 1.7 Electrical circuit components faulty condition • Poor contact • Burnt • Continuity 1.8 Electrical circuit components replacement process • Fuse • Relay • Switches • Connectors 1.9 Workshop manual • Type (printed,	1.5 Check electrical circuit components contact continuity. 1.6 Inspect electrical circuit components physical condition. 1.7 Check electrical circuit components power supply / ground. 1.8 Replace electrical circuit components 1.9 Update relay replacement status checklist.	<u>ENVIRONMENT</u> • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality act 127 1974	contact continuity, physical condition and power supply / ground are physically checked according to the workshop manual. 1.4 New electrical circuit components assembly indicated by part numbers is installed in compliance with the workshop manual. 1.5 Electrical Circuit Components replacement status checklist are completed and printed

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	electronics) • Function • Usage 1.10 Checklist: • Format such as computerised or manual • Content / information • Submission procedure			
2. Replace Air Conditioning Condenser Fan Assembly	2.1 Job order • Printed or manual 2.2 Fundamentals of condenser fan assembly • Function • Usage • Parts and components • Construction • Part numbers / names 2.3 Fundamentals of common tool • Function • Usage 2.4 Fundamentals of material • Consumables item • Sundry 2.5 Fundamentals of Service Special Tool (SST) • Function	2.1 Receive job order / worksheet. 2.2 Interpret job order. 2.3 Identify part, tools, and materials. 2.4 Inspect condenser motor condition. 2.5 Inspect condenser fan blade condition. 2.6 Inspect condenser fan cover condition. 2.7 Replace condenser motor. 2.8 Replace condenser fan blade. 2.9 Replace condenser fan cover. 2.10 Update condenser fan assembly replacement status checklist.	<u>ATTITUDE</u> • Systematic in organising work activities. <u>SAFETY</u> • Adhere to company safety and policy. • Occupational safety & health act 514 1994 <u>ENVIRONMENT</u> • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality act 127 1974	2.1 Job order / worksheet are obtained, presented and explained. 2.2 Tools and materials for air conditioning condenser fan assembly replacement are acquired and prepared in working place. 2.3 Condenser fan assembly abnormalities condition are visually and physically inspected in compliance with workshop manual. 2.4 New condenser fan assembly indicated by part numbers is installed in compliance with the workshop manual. 2.5 Condenser fan assembly replacement status checklist are completed and printed.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Usage 2.6 Condenser fan assembly abnormalities condition • Malfunction • Inadequate air flow • Deform • Noise, Vibration & Harshness (NVH) 2.7 Condenser fan assembly replacement process 2.8 Workshop manual • Type (printed, electronics) • Function • Usage 2.9 Checklist: • Format such as computerised or manual • Content / information • Submission procedure			
3. Replace Air Conditioning Compressor Magnetic Clutch	3.1 Job order • Printed or manual 3.2 Fundamentals of magnetic clutch • Function • Usage • Parts and components • Construction • Part numbers /	3.1 Receive job order / worksheet. 3.2 Interpret job order. 3.3 Identify part, tools, equipment and materials. 3.4 Inspect air condition compressor magnetic clutch condition. 3.5 Replace compressor magnetic clutch.	<u>ATTITUDE</u> • Systematic in organising work activities. <u>SAFETY</u> • Adhere to company safety and policy. • Occupational safety & health act 514 1994	3.1 Job order / worksheet are obtained, presented and explained. 3.2 Tools and materials for air conditioning magnetic clutch replacement are acquired and prepared in working place. 3.3 Magnetic clutch abnormalities condition are visually and physically inspected in compliance with workshop

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	names 3.3 Fundamentals of common tool • Function • Usage 3.4 Fundamentals of measuring equipment • Multimeter • LED Test lamp 3.5 Fundamentals of material • Consumables item • Sundry 3.6 Fundamentals of Service Special Tool (SST) • Function • Usage 3.7 Magnetic clutch abnormalities condition • Malfunction • Noise, Vibration & Harshness (NVH) 3.8 Magnetic clutch replacement process 3.9 Workshop manual • Type (printed, electronics) • Function • Usage 3.10 Checklist: • Format such as computerised or manual	3.6 Update compressor magnetic clutch replacement status checklist.	<u>ENVIRONMENT</u> • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality act 127 1974	manual. 3.4 New magnetic clutch indicated by part numbers is installed in compliance with the workshop manual. 3.5 Magnetic clutch replacement status checklist are completed and printed.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Content / information • Submission procedure			
4. Replace Air Conditioning Refrigerant Pressure Switch	4.1 Job order • Printed or manual 4.2 Fundamentals of pressure switch • Function • Usage • Parts and components • Construction • Part numbers / names 4.3 Fundamentals of common tool • Function • Usage 4.4 Fundamentals of Service Special Tool (SST) • Function • Usage 4.5 Fundamentals of air conditioning recovery machine • Function • Usage • Type 4.6 Pressure switch abnormalities condition • Malfunction • Leaking	4.1 Receive job order / worksheet. 4.2 Interpret job order. 4.3 Identify part, tools, equipment and materials. 4.4 Inspect pressure switch condition. 4.5 Recover refrigerant 4.6 Remove pressure switch 4.7 Inspect O-ring condition 4.8 Replace O-ring 4.9 Replace pressure switch. 4.10 Recharge refrigerant 4.11 Update pressure switch replacement status checklist.	<u>ATTITUDE</u> • Systematic in organising work activities. <u>SAFETY</u> • Adhere to company safety and policy. • Occupational safety & health act 514 1994 <u>ENVIRONMENT</u> • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality act 127 1974	4.1 Job order / worksheet are obtained, presented and explained. 4.2 Tools, equipment and materials for air conditioning pressure switch replacement are acquired and prepared in working place. 4.3 Pressure switch abnormalities condition are visually and physically inspected in compliance with workshop manual. 4.4 Refrigerant are safely recovered using recovery / recycle machine in compliance with the workshop manual. 4.5 Faulty pressure switch is dismantled from the piping system. 4.6 Damaged O -ring are visually confirmed and new O -ring installed. 4.7 New pressure switch parts indicated by part numbers is installed in compliance with the workshop manual. 4.8 Charged refrigerant to the system in compliance with the workshop manual. 4.9 Pressure switch replacement

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Blockage • Short circuit 4.7 Pressure switch replacement process 4.8 Workshop manual • Type (printed, electronics) • Function • Usage 4.9 Checklist: • Format such as computerised or manual • Content / information • Submission procedure			status checklist are completed and printed
5. Replace Air Conditioning Blower Motor	5.1 Job order • Printed or manual 5.2 Fundamentals of blower motor • Function • Usage • Parts and components • Construction • Part numbers / names 5.3 Fundamentals of common tool • Function • Usage 5.4 Fundamentals of Service	5.1 Receive job order / worksheet. 5.2 Interpret job order. 5.3 Identify part, tools, equipment and materials. 5.4 Prepare part, tools, equipment and materials. 5.5 Inspect blower motor condition. 5.6 Replace blower motor. 5.7 Update blower motor replacement status checklist.	<u>ATTITUDE</u> • Systematic in organising work activities. <u>SAFETY</u> • Adhere to company safety and policy. • Occupational safety & health act 514 1994 <u>ENVIRONMENT</u> • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality act 127 1974	5.1 Job order / worksheet are obtained, presented and explained. 5.2 Tools and materials for air conditioning blower motor replacement are acquired and prepared in working place. 5.3 Blower motor abnormalities condition are visually and physically inspected in compliance with workshop manual. 5.4 New blower motor indicated by part numbers is installed in compliance with the workshop manual.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	Special Tool (SST) • Function • Usage 5.5 Fundamentals of material • Consumables item • Sundry 5.6 Blower motor abnormalities condition • Malfunction • Deform • Noise, Vibration & Harshness (NVH) 5.7 Blower motor replacement process 5.8 Workshop manual • Type (printed, electronics) • Function • Usage 5.9 Checklist: • Format such as computerised or manual • Content / information • Submission procedure			5.5 Blower motor replacement status checklist are completed and printed.
6. Replace Air Conditioning Thermistor	6.1 Job order • Printed or manual 6.2 Fundamentals of thermistor • Function	6.1 Receive job order / worksheet. 6.2 Interpret job order. 6.3 Identify part, tools, equipment and materials.	<u>ATTITUDE</u> • Systematic in organising work activities. <u>SAFETY</u>	6.1 Job order / worksheet are obtained, presented and explained. 6.2 Tools and materials for air conditioning thermistor replacement are acquired and

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Usage • Parts and components • Construction • Part numbers / names 6.3 Fundamentals of common tool • Function • Usage 6.4 Fundamentals of Service Special Tool (SST) • Function • Usage 6.5 Fundamentals of material • Consumables item • Sundry 6.6 Thermistor abnormalities condition • Malfunction • Detached 6.7 Thermistor replacement process 6.8 Workshop manual • Type (printed, electronics) • Function • Usage 6.9 Checklist: • Format such as computerised or manual	6.4 Check cooling temperature. 6.5 Remove evaporator assembly from vehicle. 6.6 Inspect thermistor condition. 6.7 Replace thermistor. 6.8 install evaporator assembly to vehicle 6.9 Update thermistor replacement status checklist.	• Adhere to company safety and policy. • Occupational safety & health act 514 1994 <u>ENVIRONMENT</u> • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality act 127 1974	prepared in working place. 6.3 Thermistor abnormalities condition are visually and physically inspected in compliance with workshop manual. 6.4 New thermistor indicated by part numbers is installed in compliance with the workshop manual. 6.5 Thermistor replacement status checklist are completed and printed.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Content / information • Submission procedure			
7. Replace Air Selection Motor Actuator & Air Intake Motor Actuator	7.1 Job order • Printed or manual 7.2 Fundamentals of Air Selection Motor Actuator & Air Intake Motor Actuator • Function • Usage • Parts and components • Construction • Part numbers / names 7.3 Fundamentals of common tool • Function • Usage 7.4 Fundamentals of Service Special Tool (SST) • Function • Usage 7.5 Fundamentals of material • Consumables item • Sundry 7.6 Air Selection Motor Actuator & Air Intake Motor Actuator abnormalities condition	7.1 Receive job order / worksheet. 7.2 Interpret job order. 7.3 Identify part, tools, equipment and materials. 7.4 Inspect air selection motor actuator 7.5 Inspect air intake motor actuator condition. 7.6 Replace air selection motor actuator 7.7 Replace air intake motor actuator. 7.8 Update air selection motor actuator & air intake motor actuator replacement status checklist.	<u>ATTITUDE</u> • Systematic in organising work activities. <u>SAFETY</u> • Adhere to company safety and policy. • Occupational safety & health act 514 1994 <u>ENVIRONMENT</u> • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality act 127 1974	7.1 Job order / worksheet are obtained, presented and explained. 7.2 Tools and materials for air conditioning air selection motor actuator & air intake motor actuator replacement are acquired and prepared in working place. 7.3 Air selection motor actuator & air intake motor actuator abnormalities condition are visually and physically inspected in compliance with workshop manual. 7.4 New air selection motor actuator & air intake motor actuator parts & components indicated by part numbers is installed in compliance with the workshop manual. 7.5 Air selection motor actuator & air intake motor actuator replacement status checklist are completed and printed.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	• Malfunction • Short circuit 7.7 Air Selection Motor Actuator replacement process 7.8 Air Intake Motor Actuator replacement process 7.9 Workshop manual • Type (printed, electronics) • Function • Usage 7.10 Checklist: • Format such as computerised or manual • Content / information • Submission procedure			
8. Replace HVAC Control Panel Assembly	8.1 Job order • Printed or manual 8.2 Fundamentals of HVAC control panel assembly • Function • Usage • Parts and components • Construction • Part numbers / names 8.3 Fundamentals of	8.1 Receive job order / worksheet. 8.2 Interpret job order. 8.3 Identify part, tools, equipment and materials. 8.4 Inspect blower speed control switch functionality. 8.5 Inspect temperature control switch functionality 8.6 Inspect refresh /	<u>ATTITUDE</u> • Systematic in organising work activities. <u>SAFETY</u> • Adhere to company safety and policy. • Occupational safety & health act 514 1994 <u>ENVIRONMENT</u> • Practice Reuse, Recycle and Reduce (3R).	8.1 Job order / worksheet are obtained, presented and explained. 8.2 Tools and materials for air conditioning HVAC control assembly replacement are acquired and prepared in working place. 8.3 HVAC control panel assembly functionality condition are visually and physically inspected in compliance with workshop manual.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	common tool • Function • Usage 8.4 Fundamentals of Service Special Tool (SST) • Function • Usage 8.5 Fundamentals of material • Consumables item • Sundry 8.6 HVAC control panel assembly abnormalities condition • Malfunction • Stuck / loose • Short circuit 8.7 HVAC control panel assembly replacement process 8.8 Workshop manual • Type (printed, electronics) • Function • Usage 8.9 Checklist: • Format such as computerised or manual • Content / information • Submission procedure	recycle switch functionality 8.7 Inspect selection mode switch 8.8 Inspect On / Off A/C switch functionality 8.9 Replace HVAC control panel assembly. 8.10 Update HVAC control assembly replacement status checklist.	• Environmental Quality act 127 1974	8.4 New HVAC control panel assembly indicated by part numbers is installed in compliance with the workshop manual. 8.5 HVAC control assembly panel replacement status checklist are completed and printed.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
9. Replace HVAC Electric & Electronic Sensors	9.1 Job order • Printed or manual 9.2 Fundamental of vehicle • Vehicle framework & structure • Vehicle testing procedure 9.3 Vehicle operations and functions 9.4 Fundamentals of HVAC sensors • Type • Function • Usage • Schematic Diagram • Replacement process 9.5 Fundamentals of ECU • Type • Function • Usage • Schematic Diagram • Replacement process 9.6 HVAC system calibration process 9.7 Workshop manual • Type (printed, electronics) • Function • Usage 9.8 Checklist: • Format such as	9.1 Receive job order / worksheet 9.2 Interpret job order. 9.3 Identify part, tools, and equipment. 9.4 Prepare part, tools, and equipment at working area. 9.5 Check ambient sensors functionality 9.6 Check Interior sensors functionality 9.7 Check ECU functionality 9.8 Replace ambient sensors 9.9 Replace Interior sensors 9.10 Replace ECU 9.11 Calibrate ambient sensors setting 9.12 Calibrate interior sensors setting 9.13 Calibrate ECU setting 9.14 Perform vehicle testing for electric & electronic sensors functionality. 9.15 Update HVAC system diagnostic status checklist	<u>ATTITUDE</u> • Systematic in organising work activities. <u>SAFETY</u> • Adhere to company safety and policy. • Occupational safety & health act 514 1994 <u>ENVIRONMENT</u> • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality act 127 1974	9.1 Job order / worksheet are obtained, presented and explained. 9.2 Tools, equipment and materials for air conditioning expansion valve replacement are acquired and prepared in working place. 9.3 Ambient sensors & interior sensors functionality are confirmed in compliance with the workshop manual. 9.4 ECU functionality are confirmed in compliance with the workshop manual. 9.5 New Ambient sensors & interior sensors indicated by part numbers is installed in compliance with the workshop manual. 9.6 New ECU indicated by part numbers is installed in compliance with the workshop manual. 9.7 ECU, ambient sensors & interior sensors settings are calibrated according to OEM requirement using scan tool. 9.8 Vehicle testing to find electric & electronic sensor defects are performed and ascertained. 9.9 HVAC Electric & Electronic Sensors status checklist are prepared

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	computerised or manual • Content / information • Submission procedure			
10. Prepare HVAC Electric & Electronic Control System Replacement Report.	10.1 Source of report / checklist 10.2 Report information content: • Job details • Servicing information 10.3 Performance compliance: • Safety regulations 10.4 HVAC electric & electronic control system replacement report writing : • Type of report • Content / information • Submission procedure	10.1 Obtain HVAC electric & electronic control system replacement reports and checklist. 10.2 Interpret content HVAC electric & electronic control system replacement reports. 10.3 Update HVAC electric & electronic control system replacement report findings. 10.4 Prepare HVAC electric & electronic control system replacement final report documents.	ATTITUDE • Systematic in organising work activities. SAFETY • Adhere to company safety and policy. • Occupational safety & health act 514 1994 ENVIRONMENT • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality act 127 1974	10.1 HVAC electric & electronic control system replacement reports and checklist acquired and confirmed. 10.2 Content HVAC electric & electronic control system replacement report assessed and identified. 10.3 HVAC electric & electronic control system replacement report updated, generated and submitted.

Employability Skills

Core Abilities

- Please refer NCS- Core Abilities latest edition.

Social Values & Social Skills

- Please refer Handbook on Social Skills and Social Values in Technical Education and Vocational Training.

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2 Graham Stoakes (Author). Principles of Light Vehicle Air Conditioning. ISBN-10: 0992949246.

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4 Chris Johanson (Author). Auto Heating and Air Conditioning. ISBN-10: 1619607638. Goodheart-Willcox; 4 edition (September 12, 2014)

15.4. HVAC System Diagnostic

SECTION	Wholesale And Retail Trade; Repair Of Motor Vehicles And Motorcycles (G)		
GROUP	Maintenance And Repair Of Motor Vehicles (452)		
AREA	Heating Ventilation Air Conditioning (HVAC) Work		
NOSS TITLE	Light Vehicle - HVAC Maintenance		
COMPETENCY UNIT TITLE	HVAC System Diagnostic		
LEARNING OUTCOMES	The outcome of this competency is to confirm the status of the HVAC system defect type and provide quality solution to repair it and assign the required repair job. Upon completion of this competency unit, trainees shall be able to: 1. Check Refrigerant High & Low Pressure 2. Operate Scan Tool 3. Evaluate Scan Tool Result 4. Prepare HVAC System Diagnostic Report.		
TRAINING PRE-REQUISITE			
CU CODE	**G452-003-3:2018:C04**	NOSS LEVEL	Level 3

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
1. Check Refrigerant High & Low Pressure	1.1 Job order • Printed or manual 1.2 Fundamental of vehicle 1.3 Fundamentals of refrigerant high & low pressure • Function • Usage • Layout • System flow 1.4 Fundamentals of common tool • Function • Usage 1.5 Fundamentals of Service	1.1 Interpret job order. 1.2 Identify part, tools, equipment and materials. 1.3 Prepare part, tools, equipment and materials. 1.4 Connect manifold pressure gauge. 1.5 Operate manifold pressure gauge 1.6 Determine refrigerant high & low pressure reading abnormalities. 1.7 Update refrigerant high	<u>ATTITUDE</u> • Systematic in organising work activities. <u>SAFETY</u> • Adhere to company safety and policy. • Occupational safety & health act 514 1994 <u>ENVIRONMENT</u> • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality act 127 1974	1.1 Job order / worksheet are obtained, presented and explained. 1.2 Tools, equipment and materials for air conditioning receiver drier / desiccant bag replacement are acquired and prepared in working place. 1.3 Manifold pressure gauge are connected to the air conditioning system service valve. 1.4 Manifold pressure gauge are activated in compliance with the workshop manual. 1.5 Refrigerant high & low pressure

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	Special Tool (SST) • Function • Usage 1.6 Fundamentals of material • Consumables item • Sundry 1.7 Refrigerant high & low pressure abnormalities condition • Over pressure • Under pressure 1.8 Refrigerant high & low pressure inspection process 1.9 Workshop manual • Type (printed, electronics) • Function • Usage 1.10 Checklist: • Format such as computerised or manual • Content / information • Submission procedure	& low pressure status checklist.		reading abnormalities condition are confirmed in compliance with workshop manual. 1.6 Refrigerant high & low pressure status checklist are completed and printed.
2. Operate Scan Tool	2.1 Job order • Printed or manual 2.2 Fundamental of vehicle 2.3 Fundamentals of HVAC • Type (ECU, sensors,	2.1 Interpret job order. 2.2 Prepare Scan tool. 2.3 Follow procedure of scan tool setup. 2.4 Connect scan tool. 2.5 Operate scan tool.	<u>ATTITUDE</u> • Systematic in organising work activities. <u>SAFETY</u>	2.1 Job order / worksheet are obtained, presented and explained. 2.2 Scan tool are prepared and setup in the working area. 2.3 Scan tool are connected to the

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	switch, actuator) • Function • Usage • Schematic Diagram 2.4 Fundamentals of scan tools • Operational process • Special Function • Actuator / Simulation test 2.5 Workshop manual • Type (printed, electronics) • Function • Usage	2.6 Obtain result of the scan tool.	• Adhere to company safety and policy. • Occupational safety & health act 514 1994 <u>ENVIRONMENT</u> • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality act 127 1974	vehicle and switch on. 2.4 Scan tool are operated following the OEM procedure. 2.5 Result of the scan tool are printed according to the workshop manual.
3. Evaluate Scan Tool Result.	3.1 Scan tool result evaluation process • Diagnostic Trouble Code (DTC) • Data List • Actuator / Simulation test • Reset Trouble code 3.2 Checklist: • Format such as computerised or manual • Content / information • Submission procedure	3.1 Determine Diagnostic Trouble Code (DTC). 3.2 Analyse Diagnostic Trouble Code (DTC). 3.3 Analyse sensors data list. 3.4 Erase Diagnostic Trouble Code (DTC). 3.5 Simulate HVAC system test 3.6 Update HVAC system diagnostic status checklist. 3.7 Assign job order	<u>ATTITUDE</u> • Systematic in organising work activities. <u>SAFETY</u> • Adhere to company safety and policy. • Occupational safety & health act 514 1994 <u>ENVIRONMENT</u> • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality act 127 1974	3.1 Diagnostic Trouble Code (DTC) and sensors data list are interpreted and referred to the OEM manual. 3.2 Diagnostic Trouble Code (DTC) are erased using scan tool in according to the OEM manual. 3.3 HVAC system test are simulated according to the OEM manual. 3.4 HVAC system condition inspection status checklist are prepared. 3.5 Job order list are prepared and assigned.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
4. Prepare HVAC System Diagnostic Report.	4.1 Source of report / checklist 4.2 Report information content: • Job details • Servicing information 4.3 Performance compliance: • Safety regulations 4.4 HVAC system components replacement report writing : • Type of report • Content / information • Submission procedure	4.1 Obtain HVAC system diagnostic report and checklist. 4.2 Interpret content HVAC system diagnostic report. 4.3 Update HVAC system diagnostic report findings. 4.4 Prepare HVAC system diagnostic report final report documents.	ATTITUDE • Systematic in organising work activities. SAFETY • Adhere to company safety and policy. • Occupational safety & health act 514 1994 ENVIRONMENT • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality act 127 1974	4.1 HVAC system diagnostic reports and checklist acquired and confirmed. 4.2 Content HVAC system diagnostic report assessed and identified. 4.3 HVAC system diagnostic report updated, generated and submitted.

Employability Skills

Core Abilities

- Please refer NCS- Core Abilities latest edition.

Social Values & Social Skills

- Please refer Handbook on Social Skills and Social Values in Technical Education and Vocational Training.

References for Learning Material Development

1 Quansheng Zhang (Author), Shengbo Eben Li (Author), Kun Deng (Author). Automotive Air Conditioning: Optimization, Control and Diagnosis 1st ed. ISBN-13: 978-3319335896. Springer; 1st ed. 2016 edition (August 11, 2016).

2 Graham Stoakes (Author). Principles of Light Vehicle Air Conditioning. ISBN-10: 0992949246.

3 Anon (Author). Air Conditioning Manual. ISBN-10: 1785213598. J H Haynes & Co Ltd (June 27, 2016).

4 Chris Johanson (Author). Auto Heating and Air Conditioning. ISBN-10: 1619607638. Goodheart-Willcox; 4 edition (September 12, 2014)

15.5. HVAC Maintenance Supervision

SECTION	Wholesale And Retail Trade; Repair Of Motor Vehicles And Motorcycles (G)		
GROUP	Maintenance And Repair Of Motor Vehicles (452)		
AREA	Heating Ventilation Air Conditioning (HVAC) Work		
NOSS TITLE	Light Vehicle - HVAC Maintenance		
COMPETENCY UNIT TITLE	HVAC Maintenance Supervision		
LEARNING OUTCOMES	The outcome of this competency is to provide supervisory skills so that the workshop is administered professionally in accordance with company requirements. Upon completion of this competency unit, trainees shall be able to: 1. Prepare Work Schedule 2. Conduct Briefing Session 3. Prepare Sectional Operation Budget Information 4. Monitor Staff Performance 5. Coordinate Staff Training 6. Monitor Workshop Safety 7. Monitor Clean Work Place Environment		
TRAINING PRE-REQUISITE			
CU CODE	**G452-003-3:2018:C05**	NOSS LEVEL	Level 3

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
1. Prepare Work Schedule.	1.1 Work schedule format 1.2 Scheduling technique such as: • Part time scheduling • Flexi time scheduling • Full time • Scheduling 1.3 Manpower capacity and resources. 1.4 Job order record.	1.1 Identify manpower capacity and resources. 1.2 Determine manpower requirements. 1.3 Analyse work schedule. 1.4 Prepare work schedule.	<u>ATTITUDE:</u> • Systematic in organising work activities. <u>SAFETY:</u> • Adhere to safety precaution in preparing work schedule. • Adhere to company safety and policy. • Use relevant Personal Protective Equipment	1.1 Manpower capacity and resources analysed and checklist prepared. 1.2 Work schedule completed and distributed. 1.3 Work schedule updated.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
			(PPE). • Occupational Safety & Health Act 1994 (Act 514). *ENVIRONMENTAL:* • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality Act 1974 (Act 127).	
2. Conduct Briefing Session.	2.1 Briefing detail • Daily • Monthly • Weekly 2.2 Briefing issue/ topic according to current operational requirement 2.3 Root cause of problem, action and solution. 2.4 Consumer Protection Act 1999 (Act 599)	2.1 Determine staff briefing requirements 2.2 Identify items to be briefed 2.3 Carry out staff briefing 2.4 Deliver and explain information clearly 2.5 Interpret delivered information	ATTITUDE: • Systematic in organising work activities. SAFETY: • Adhere to safety precaution in conducting briefing session. • Adhere to company safety and policy. • Use relevant Personal Protective Equipment (PPE). • Occupational Safety & Health Act 1994 (Act 514). *ENVIRONMENTAL:* • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality Act 1974 (Act 127).	2.1 Staff briefing requirement prepared and understood. 2.2 Items to brief prepared and listed 2.3 Staff briefing performed with the staff 2.4 Information clearly explained and understood 2.5 Delivered information elaborated with Q&A session

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
3. Prepare Sectional Operation Budget Information.	3.1 Previous year section budget. 3.2 Capital expenditure forecast. 3.3 Yearly manpower requirement. 3.4 Presentation technique. 3.5 Section budget expenses.	3.1 Analyse previous year's sectional operation budget. 3.2 Determine yearly manpower requirement. 3.3 Determine forecasted expenditure. 3.4 Prepare sectional operation budget.	ATTITUDE: • Systematic in organising work activities. SAFETY: • Adhere to company safety and policy. • Use relevant Personal Protective Equipment (PPE). • Occupational Safety & Health Act 1994 (Act 514). *ENVIRONMENTAL:* • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality Act 1974 (Act 127).	3.1 Previous year's sectional operation budget understand and analysed 3.2 Yearly manpower requirement understood and identified 3.3 Forecast expenditure report prepared 3.4 Sectional operation budget explained in checklist performed
4. Monitor Staff Performance	4.1 Standard performance guidelines for staff appraisal. 4.2 Technique of conducting appraisal such as: • Question & answer • Probing • Counselling • Suggesting & recommending 4.3 Staff performance report format. 4.4 Employment Act 1955 (Act 265).	4.1 Identify standard performance guidelines. 4.2 Identify method of monitoring staff performance. 4.3 Observe actual staff performance. 4.4 Analyse previous year personnel appraisal. 4.5 Carry out personnel appraisal session. 4.6 Carry out personnel appraisal recommendation. 4.7 Prepare personnel	ATTITUDE: • Systematic in organising work activities. SAFETY: • Adhere to safety precaution in monitoring staff performance. • Adhere to company safety and policy. • Use relevant Personal Protective Equipment (PPE). • Occupational Safety & Health Act 1994 (Act	4.1 Standard performance guidelines checklist performed. 4.2 Method of monitoring staff performance determined and applied to the staff. 4.3 Actual staff performance evaluation checklist performed. 4.4 Previous year personnel appraisal evaluated and understood. 4.5 Personnel appraisal session one on one with staff performed. 4.6 Personnel appraisal recommendation checklist completed. 4.7 Personnel appraisal report

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
		appraisal report.	514). *ENVIRONMENTAL:* • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality Act 1974 (Act 127).	checklist completed.
5. Coordinate Staff Training.	5.1 Training Need Analysis (TNA). 5.2 Training Need Identification (TNI). 5.3 Training schedule 5.4 Arrangement of training facilities and requirements such as: • Training room • Training materials • Audio visual aid 5.5 Trainer's coordination of staff training.	5.1 Conduct Training Need Analysis (TNA). 5.2 Conduct Training Need Identification (TNI) 5.3 Determine training requirements. 5.4 Prepare training logistic. 5.5 Coordinate staff training.	ATTITUDE: • Systematic in organising work activities. SAFETY: • Adhere to safety precaution in coordinating staff training. • Adhere to company safety and policy. • Use relevant Personal Protective Equipment (PPE). • Occupational Safety & Health Act 1994 (Act 514). *ENVIRONMENTAL:* • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality Act 1974 (Act 127).	5.1 Training Need Analysis (TNA) and Training Need Identification (TNI) on staff performed. 5.2 Training requirements for each staff identified. 5.3 Training room, materials and visual aid prepared and ready to use. 5.4 Staff training program for the staff performed.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
6. Monitor Workshop Safety.	6.1 OSHA & FMA act and regulation • HIRARC • Chemical Safety • Data Sheet • (CSDS) 6.2 Health & safety equipment. 6.3 Workplace safety & health regulations.	6.1 Determine workshop safety requirements. 6.2 Monitor workshop safety compliance. 6.3 Enforce workshop safety measures.	ATTITUDE: • Systematic in organising work activities. SAFETY: • Adhere to safety precaution in monitoring workshop safety. • Adhere to company safety and policy. • Use relevant Personal Protective Equipment (PPE). • Occupational Safety & Health Act 1994 (Act 514). *ENVIRONMENTAL:* • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality Act 1974 (Act 127).	6.1 Workshop safety requirements understood and applied. 6.2 Workshop safety compliance checklist performed. 6.3 Workshop safety measures enforced to the staff.
7. Monitor Workshop Environment Cleanliness.	7.1 Workplace environment procedures & regulations. 7.2 Local environmental law & regulations at workplace. 7.3 Hazardous material storage area requirement. 7.4 Flammable material storage area requirement.	7.1 Determine clean air environment. 7.2 Monitor clean air environment compliance. 7.3 Enforce clean air environment measure.	ATTITUDE: • Systematic in organising work activities. SAFETY: • Adhere to safety precaution in monitoring clean work place environment. • Adhere to company safety and policy. • Use relevant Personal	7.1 Clean air environment assured with air ventilation in workshop 7.2 Clean air environment compliance checklist performed 7.3 Clean air environment measure enforced to the staff.

WORK ACTIVITIES	RELATED KNOWLEDGE	RELATED SKILLS	ATTITUDE/ SAFETY/ ENVIRONMENT	ASSESSMENT CRITERIA
	7.5 Recovery and recycling refrigerant machine operation manual. 7.6 Schedule waste requirement.		Protective Equipment (PPE). • Occupational Safety & Health Act 1994 (Act 514). *ENVIRONMENTAL:* • Practice Reuse, Recycle and Reduce (3R). • Environmental Quality Act 1974 (Act 127).	

Employability Skills

Core Abilities

- Please refer NCS- Core Abilities latest edition.

Social Values & Social Skills

- Please refer Handbook on Social Skills and Social Values in Technical Education and Vocational Training.

References for Learning Material Development

1 Rezin, Andrew A. Ph.D. 2012/05. Automotive Service Management: Principles into Practice (2nd). ISBN 9780132725408. Pearson College Div

2 Schneider, Mitch. 2003/01. Managing Dollars with Sense (Automotive Service Management Series). ISBN 9781401826635. Delmar Pub (US).

3 Schneider, Mitch. 2003/06. Safety Communication (Automotive Service Management Series). ISBN 9781401826628. Delmar Pub (US).

4 Mosley, Donald, Jr. / Pietri, Paul H. 2010/02. Supervisory Management -- Paperback (International 8th ed.). ISBN 9780538472050. South-Western College Pub (JP)

5 Leonard, Edwin C., Jr., Ph.D. / Trusty, Kelly A., Ph.D. 2015/01. Supervision: Concepts and Practices of Management (13th). ISBN 9781285866376. South-Western Pub (US).

16. Delivery Mode

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

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

17. Tools, Equipment and Materials (TEM)

LIGHT VEHICLE - HVAC MAINTENANCE

LEVEL 3

CU No.	CU CODE	COMPETENCY UNIT TITLE
CU1	**G452-003-3:2018:C01**	HVAC Scheduled Maintenance Work
CU2	**G452-003-3:2018:C02**	HVAC System Components Replacement
CU3	**G452-003-3:2018:C03**	HVAC System Diagnostic
CU4	**G452-003-3:2018:C04**	HVAC Electric & Electronic Control System Replacement
CU5	**G452-003-3:2018:C05**	HVAC Maintenance Supervision

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

No	ITEM*	RATIO (TEM : Trainees)	CU1	CU2	CU3	CU4	CU5
A. Tools			**Tick (√) where relevant**				
1	Gauge manifolds	1:5	√	√	√		
2	Manifold hoses	1:5	√	√	√		
3	Temperature gauges	1:5		√	√		
4	Leak detectors	1:5	√	√	√		
5	Test light	1:5	√	√	√		
6	Multimeters	1:5			√	√	
7	Ohmmeter	1:5			√	√	
8	Oscilloscopes	1:5	√	√	√		
9	Belt tension gauge	1:2	√	√			
10	Vacuum pump & gauge	1:5		√	√		
11	Scan Tool / Diagnostic Tool	1:5				√	
12	Recovery/recycling Machine	1:5	√	√	√		
13	Evacuation pumps	1:5		√	√		
14	Pressure tester	1:5		√	√		
15	Antifreeze tester	1:5		√	√	√	
16	Service manual	1:1	√	√	√	√	√
17	Workshop Manual	1:1	√	√	√	√	√

18	OEM Service Manual	1:1	√	√	√	√	√
19	Sample Report	1:1	√	√	√	√	√
20	Sample Checklist	1:1	√	√	√	√	√
21	Vehicle	1:5	√	√	√	√	√
22	Special tools	1:1	√	√	√	√	√
23	General tools	1:1	√	√	√	√	√
24	Sample of workshop housekeeping manual	1:1	√	√	√	√	√
25	Workshop housekeeping tools, equipment and materials	1:1	√	√	√	√	√
26	Cleaning materials	1:1		√	√	√	√
27	Stationary	1:1	√	√	√	√	√
28	Gauge manifolds	1:5	√	√	√		
29	Manifold hoses	1:5	√	√	√		
B. Equipment		**Tick (Ö) where relevant**					
1	Personnel Protective Equipment (PPE)	1:1	√	√	√	√	√
2	Computer peripheral	1:2	√	√	√	√	√
C. Materials		**Tick (Ö) where relevant**					
1	Soap solution	1:1	√	√	√	√	
2	Test strips	1:1	√	√	√	√	
3	Air-Conditioning Refrigerant	1:5	√	√			
4	Safety and security protecting materials	1:1	√	√	√	√	

18. Training Hour Summary

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

LIGHT VEHICLE - HVAC MAINTENANCE
LEVEL 3
G452-003-3:2018

CU CODE	COMPETENCY UNIT TITLE	WORK ACTIVITIES	RELATED KNOWLEDGE (HOURS)	RELATED SKILLS (HOURS)	TRAINING DURATION (HOURS)	SKILLS CREDIT
G452-003-3:2018:C01	HVAC Scheduled Maintenance Work	Replace Drive Belt.	18	40	243	30
		Service Cabin Filter	15	30		
		Replace Receiver Drier / Desiccant Bag	18	40		
		Replace Compressor Oil	18	40		
		Prepare HVAC Scheduled Maintenance Work Report	8	16		
G452-003-3:2018:C02	HVAC System Components Replacement	Replace Air Conditioning Expansion Valve.	19	40	320	32
		Replace Air Conditioning Condenser.	19	40		
		Replace Air Conditioning Hoses & Pipes.	19	40		
		Replace Air Conditioning Evaporator.	19	40		
		Replace Air Conditioning Compressor.	19	40		
		Prepare HVAC System Components Replacement Report.	9	16		
G452-003-3:2018:C03	HVAC Electric & Electronic Control System Replacement	Replace Air Conditioning Electrical Circuit Components	19	40	606	61
		Replace Air Conditioning Condenser Fan	19	40		
		Replace Air Conditioning Compressor Magnetic Clutch	19	40		
		Replace Air Conditioning Refrigerant Pressure Switch	19	40		
		Replace Air Conditioning Blower Motor Replacement	19	40		
		Replace Air Conditioning Thermistor	19	40		
		Replace Air Selection Motor Actuator & Air Intake Motor Actuator	19	40		
		Replace HVAC Control Panel Assembly	19	40		
		Replace HVAC Electric & Electronic Sensors	32	64		
		Prepare HVAC Electric & Electronic Control System Replacement Report.	12	26		

G452-003-3:2018:C04	HVAC System Diagnostic	Check Refrigerant High & Low Pressure	18	40	192	20
		Operate Scan Tool	16	32		
		Evaluate Scan Tool Result	16	32		
		Prepare HVAC System Diagnostic Report.	12	26		
G452-003-3:2018:C05	HVAC Maintenance Supervision	Prepare Work Schedule	9	26	239	24
		Conduct Briefing Session	9	25		
		Prepare Sectional Operation Budget Information	9	25		
		Monitor Staff Performance	9	25		
		Coordinate Staff Training	9	25		
		Monitor Workshop Safety	9	25		
		Monitor Clean Work Place Environment	9	25		
TOTAL HOURS (CORE COMPETENCY)			502	1098	1600	