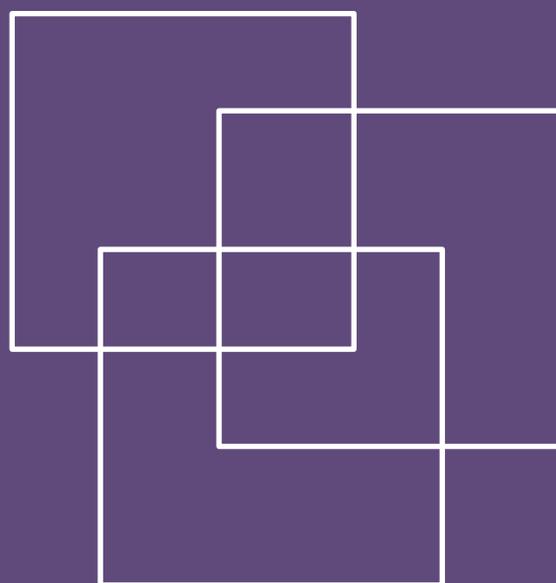




International  
Labour  
Organization

# Regional Model Competency Standards: Mechanical services



Regional Model Competency Standards:  
Mechanical services

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# Preface

Mechanical services work encompasses a wide range of job specialties - from small automotive garages, domestic repairs and installations to building sites, industrial construction and facilities and shipbuilding. Skills in mechanical services, in particular in the automotive and engineering fields are in demand as new technologies are introduced and as some enterprises develop and expand. Requirements for air conditioning technicians are also high, given Asia is the global leader in construction, and is forecasted to remain so for some time. The skills development and recognition of workers in mechanical services plays an important part in meeting the challenges of meeting demand for skilled labour.

The need to improve the quality and effectiveness of training systems remains a major challenge for many countries in the Asia-Pacific region. The skills of workers are a critical source of enterprises' productivity and competitiveness, as well as of workers' employability. Much effort has been made to improve the relevance of training systems, to ensure that the skills that workers possess meet the needs of the workplace.

The establishment of the ASEAN Economic Community, with the goal of creating economic integration, a single market production base and a freer flow of skilled labour in the region, has increased the importance to sending and receiving countries of being able to recognize the skills of migrant workers.

To help accelerate the improvement of training systems and the mutual recognition of skills, the ILO has developed, in consultation with employers, governments and workers, the Regional Model Competency Standards (RMCS). These have been developed in identified priority areas and are in a simplified format.

Competency standards are a set of benchmarks that define the skills, knowledge and attributes people need to perform a work role. They are developed in consultation with industry, in order to ensure they reflect the needs of the workplace. These standards are primarily used to develop and implement training, to assess the outcomes of training, and to assess the level of a person's existing skills and competencies.

The RMCS are intended to be a regional reference for developing competency standards for those countries that are in the process of creating standards, or reviewing existing national standards. The RMCS can provide the basis for developing national competency standards in countries so they can avoid developing standards from scratch. By providing a regional reference for competency standards, I also hope that the RMCS can assist ASEAN regional integration by facilitating the mutual recognition of skills of workers across borders.



Tomoko Nishimoto  
Assistant Director-General and  
Regional Director for Asia and the Pacific



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# Acknowledgements

The Regional Model Competency Standards (RMCS) for mechanical services was produced as a result of a collaborative effort between a number of dedicated individuals who contributed their time and expertise through a consultative process.

These standards were developed following a benchmarking process, in which national competency standards from several countries were researched and similarities noted. The RMCS for Mechanical Services have largely been modeled on Standards owned by the Commonwealth of Australia; namely those developed for:

- Automotive industry by Auto Skills Australia – *AUR12 The Automotive Industry Retail, Service and Repair Training Package*; and
- Electrotechnology industry by the Electrocomms and Energy Utilities Industry Skills Council, E-Oz Training Standards, *UEE11- Electrotechnology Training Package*.

Ms Carmela Torres, ILO Senior Specialist on Skills and Employability, provided overall technical supervision of the RMCS. Mr Andre Lewis of Andre Lewis and Associates Pty Ltd developed the basic sets of competencies. Ms Wendy Wyatt of W R Wyatt and Associates, provided expert contents and editing on the final draft. Moreover, Ms Alin Sirisaksopit and Ms Suttida Chaikitsakol provided assistance throughout the revisions of the RMCS. Ms Wilawan Wiseschinda, Ms Ruttiya Bhula-or and Ms Onpreeya Chitpakdee formatted and finalized this publication.



# Glossary

## **Competency**

The ability to perform particular tasks and duties to the standard of performance expected in the workplace, applying all relevant skills, knowledge and attitudes consistently over time in the required workplace situations.

## **Unit of competency**

An agreed statement of the skills and knowledge required for effective performance of a particular job or job function.

## **Competency standards**

Competency standards are made up of a number of units of competency each of which describes a key function or role in a particular job function or occupation.

## **Attainment of Competency**

Competencies may be gained in a number of ways including through:

- Formal or informal education and training
- Experiences in the workplace
- General life experience, and/or
- Any combination of the above.

## **Attribute**

A quality or characteristic.

## **Unit details**

A short title that summarises the main job function covered by the unit, accompanied by an alphanumeric code that follows ILO guidelines.

## **Unit descriptor**

A short statement giving a more detailed description of the job function covered by the unit.

## **Element of competency**

The major functions and tasks that make up the competency.

## **Performance criteria**

The performance standard or tasks that are involved in each of the relevant job functions. Critical terms or phrases may be written in bold italics and then defined in Range statement, in the order of their appearance in the performance criteria.

## **Critical skills and essential knowledge**

Brief statements that outline key skills and required knowledge for the job function covered by this unit. Knowledge identifies what a person needs to know to perform the work in an informed and effective manner. Skills describe how the knowledge is converted to a workplace outcome.

**Evidence guide**

The Evidence guide information to the assessor about how the competency may be demonstrated, such as conditions and context of assessment, suitable methods of assessment and resource implications.

**Range statement**

Brief statements that clarify the scope and range of performance, including clarification on contexts, operations and equipment referred to in the performance criteria. As applicable, the meanings of key terms used in the performance criteria are also explained in the Range statement.

# Introduction

National competency standards play an important and increasing role in skills development and recognition in the Asia-Pacific region as they do in many other parts of the world. They are a guide to the scope of skills and knowledge required for an industry and can be flexibly combined into jobs and occupations. Competency standards are the common basis for training programmes, skills assessment and certification in many countries.

Competency standards, when recognized nationally, or across a cluster of nations, can form a key component in assisting the mobility of skilled labour. As part of a quality assured system, the assessment of a person's skills against accepted benchmarks means those skills can be applied in other similar work. Potential employers can feel confident in the level of competencies workers claim to have. Workers returning from employment in other countries can have the skills they gained working there formally recognized.

## Labour mobility and the need for skills recognition

The labour market in Asia is characterised by a high level of worker migration, within the region and to external countries. Asia accounted for 31 per cent of the global international migrant stock (UN, 2013)<sup>1</sup>. Many developing countries have come to rely heavily on remittances sent from individuals working abroad to their families at home. Remittances in the 2010s are now nearly three times the size of official development assistance and larger than private debt and portfolio equity flows to developing countries. The importance of remittances as a source of foreign currency earnings is increasing, particularly in South Asia (World Bank, 2013)<sup>2</sup>.

Many migrants do have skills that were acquired in their home country but not all of their skills are necessarily formally certified. This reduces their prospect for employment and better working conditions that correspond with their skills. Upon their return, there is little opportunity to have their newly acquired skills and work experience formally acknowledged. These are missed opportunities in capitalizing on the wealth of new learning and skills the workers bring back. This scenario impacts negatively on the individual worker's future employment prospects both within the region and outside. It also impedes their country's capacity to build a skilled and qualified workforce.

## Training systems and the need for improvement

Training systems in the Asia-Pacific region are often criticized on the basis that there is a mismatch between the skills offered and the needs of workers and employers. This means that some people are learning skills that are not needed by industry and training organizations are wasting their limited resources providing training that is not used. This is a serious problem for any country, as it holds back development and growth in productivity and employment.

The RMCS were developed in a simplified format so that they could be used in discussions between stakeholders to reduce this mismatch. The competencies are designed so that they can be modified to meet the specific requirements of an employer, job or workplace. Some competency elements will need

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<sup>1</sup> United Nations, Department of Economic and Social Affairs: *Trends in international migrant stock: The 2013 Revision*. <http://esa.un.org/unmigration/TIMSA2013/migrantstocks2013.htm> [accessed 7 Oct. 2014].

<sup>2</sup> World Bank: *Migration and Development Brief 22*. Migration and Remittances Team, Development Prospects Group. April 2014 <http://www.worldbank.org/prospects/migrationandremittances> [accessed 7 Oct. 2014].

to be added or deleted depending on the local requirements. This review process must take place to ensure the relevancy of any learning, training or assessment strategy based on the standards

## **Mechanical services industry**

Research has found that CEOs from around the world consider skills gaps to be one of their top five pressing concerns. Skills gaps constrain companies' ability to grow, innovate, deliver products and services on time, meet quality standards and meet environmental and social requirements in countries where they operate.

Asia is experiencing a significant skills gap in the mechanical services industry. Mechanical services relate to many roles, including automotive skills, where skills shortages are very high<sup>3</sup>, and also to air conditioning specialists. The need for air conditioning specialists is growing in line with the boom in the Asian construction market, where residential and infrastructure construction are anticipated to expand significantly.<sup>4</sup>

Mechanical services work encompasses a wide range of job specialties, and in a range of settings, including small automotive garages, domestic repairs and installations, building sites, industrial constructions, and facilities and shipbuilding.

The specialist occupational areas selected for inclusion in these RMCS were selected for two reasons. Firstly, they are identified as being the largest skills gaps areas. Secondly, these are the occupational areas at the lower, entry level of the mechanical services industry. For example, the automotive repair occupations included in this document focus on servicing two-wheel drive cars, and motorcycles, rather than the more complex area of servicing heavy machinery. Air conditioning service and repair occupations focus on domestic applications, rather than the more complex industrial refrigeration skills and knowledge requirements.

## **Purpose of the RMCS**

These competency standards were developed as a basis for identifying skills needed in the workplace, so that training and assessment resources can be developed and individuals tested against the standards. Training resources may include: a curriculum, test projects, learner guides, texts, references, teaching strategies, group activities and an assessment system that can be used to determine competence in each unit of competency.

The standards can be also be used in many other ways as a reference material, for example, for recruitment and the development of job descriptions. The complete sets of competency standards included in these RMCS, however, do not represent a common job description or expectation of the work performance of every mechanical worker. Each job of a mechanical worker should be negotiated as part of their employment contract and different levels and complexities of tasks and responsibilities should be reflected in working conditions including wages.

Different countries will have different customs and any training provided should reflect these different customs and expectations. Similarly, there will be different legislation and government regulations that apply in different countries and regions and these also must be taken into account in designing training programmes. It is therefore important that the effort for developing and updating national competency standards form not only a part of skills development initiatives for mechanical workers, but also a part of broader national effort for promoting their decent work.

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<sup>3</sup> M. Aring: *Youth and skills: Putting education to work - Report on Skills Gaps, Background paper prepared for the Education for All Global Monitoring Report*, 2012

<sup>4</sup> AECOM: *Asia Construction Outlook 2014*, <http://www.aecom.com/Where+We+Are/Asia/news/Asia+Construction+Outlook+2014> [accessed 1 July 2014].

## **Content**

The RMCS are grouped functionally and not along the line of jobs or occupations. This enables the users of the RMCS to tailor make their own ‘competency standards for mechanical services workers’ by selecting and grouping the units of competencies from the RMCS to better fit their national and local understanding and situations.

The standards define a general framework for the critical skills, knowledge and attitudes that equip and/or certify workers to undertake construction work.

However, these RMCS should not be seen as complete sets of competencies needed for an industry. They are meant to be a starting point for discussions and should be modified to meet the specific requirements of a particular employer, job, workplace or country’s education and training system. Additional performance elements could be added or deleted to match the local requirements. Similarly, any special “performance standards” can be modified or added to match enterprise requirements or government regulations that apply in different countries and regions.

The RMCS for mechanical services workers include both generic competencies (Functional Area A: Core Competencies) and vocational and technical competencies (Functional Areas B-H).

### **Assumed content for assessment of technical units**

To avoid repetition and reduce the complexity, the technical units of competency, requirements relating to ‘work safely’, ‘in an environmentally responsible manner’ and some core skills have been extracted and included in the following tables. These are to be included in the competency assessment of the technical units, i.e. units MS-B to MS-G.

**Table 1: Essential skills and knowledge: Work safely**

---

**Precautions applicable to:**

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Emergency procedures including for

- Accident and first aid
- Explosion
- Fire

Hazard identification and control, including policies and procedures relating to

- Blocked exits
- Broken or damaged equipment
- Damaged packing material or containers
- Electrical safety
- Flammable materials and fire hazards
- Glue guns/burns
- Hazardous substances
- Ladders
- Lifting practices
- Manual lifting and shifting
- Sharp cutting tooling and instruments
- Spillages
- Toxic substances
- Trolleys
- Vehicular movement
- Waste and debris especially on floors (trip hazards)

Personal safety policies, procedures and requirements including

- First aid
- Handling of material
- Hazard control and hazardous materials and substances
- Protective clothing and equipment
- Safe manual handling
- Safe use of tools and equipment
- Use of fire-fighting equipment

**Table 2: Essential skills and knowledge: Environmental safety**

---

**Precautions applicable to:**

---

Clean-up management and correct handling disposal of hazardous materials

Control of chemical residues, contaminants, wastes and pollution

Disposal of waste material to ensure minimal environmental impact

Efficient energy and water use

Efficient use and recycling of material

Minimising noise, dust, or odour emissions

Undertaking environmental hazard identification, risk assessment and control

## **Templates for RMCS**

The template used follows the model of unit description used in various countries in Asia and Pacific as well as the other RMCS developed by the ILO. Each unit of competency describes the skills a

worker applies when performing the identified task or role, as well as the underpinning skills, knowledge and attitudes the worker needs to perform the task effectively.

Individual units define the competency outcomes necessary for a particular area of work. It is the combination of a number of units that describes a whole job role. The combining of units also captures the need to manage different tasks simultaneously and to adapt to different workplace environments and situations.

These RMCS have been divided into nine functional areas, which are comprised of 49 Units of Competency. These are summarised in the following table (Table 1)

**Table 3: Units of competency by functional areas**

<b>Functional area</b>	<b>Code</b>	<b>Unit title</b>
A Mechanical services core competencies	MS-A1	Communicate
	MS-A2	Work safely
	MS-A3	Plan for mechanical services work
B Common tasks	MS-B1	Identify vehicle problems
	MS-B2	Select parts for service or repair
	MS-B3	Remove and tag components
	MS-B4	Use mechanical tools and equipment
	MS-B5	Weld gas metal arc
	MS-B6	Weld gas tungsten arc
C Engine transmissions service and repair	MS-C1	Remove and install vehicle engines
	MS-C2	Inspect and service vehicle engines
	MS-C3	Repair vehicle cooling systems
	MS-C4	Service and adjust vehicle petrol and diesel fuel systems
	MS-C5	Service vehicle manual transmissions
	MS-C6	Service automotive transmissions
	MS-C7	Service vehicle clutch assemblies
D Brake driveline and exhaust repair	MS-D1	Service and repair anti-lock braking and traction control systems
	MS-D2	Remove steering, suspension and brake system components
	MS-D3	Repair exhaust system components
	MS-D4	Inspect and service braking systems
	MS-D5	Remove and refit driveline components
	MS-D6	Inspect and service steering systems
	MS-D7	Inspect and service suspension systems
	MS-D8	Repair motorcycle steering and suspension systems
E Car and motorcycle body and trim repair	MS-E1	Prepare vehicles for body repair
	MS-E2	Body trim and repair (cars and motorcycles)
	MS-E3	Realign and repair major vehicle body components
	MS-E4	Replace major welded vehicle panels

		MS-E5	Remove paint from vehicles
		MS-E6	Repair vehicle body panels
		MS-E7	Replace and align new vehicle panels, sections and fittings
		MS-E8	Repair and align motorcycle frames
		MS-E9	Finish vehicle body panels for painting
		MS-E10	Mask vehicles for painting
		MS-E11	Apply solid acrylic enamel refinishing
		MS-E12	Use vehicle paint finishing techniques
F	Electrical electronic systems service and repair	MS-F1	Vehicle charging systems
		MS-F2	Remove and replace electrical/electronic components
		MS-F3	Service, maintain and replace batteries
		MS-F4	Repair vehicle low voltage single electrical circuits
		MS-F5	Repair vehicle wiring harness/looms
		MS-F6	Repair vehicle instruments and warning systems
		MS-F7	Repair vehicle ignition systems
		MS-F8	Identify motorcycle electrical/electronic system faults
G	Refrigeration, air conditioning, install, service and repair	MS-G1	Install refrigeration systems
		MS-G2	Service and repair refrigeration systems
		MS-G3	Install domestic air conditioning systems
		MS-G4	Service air conditioning systems
		MS-G5	Repair air conditioning systems

# Functional area A – Core mechanical services competencies

## MS-A1 Communicate in the mechanical services workplace

---

### Unit details

Functional area A	Core mechanical services competencies
Unit title	Communicate in the mechanical services industry
Unit code	MS-A1

### Description

This unit describes the skills and knowledge required to communicate effectively with other workers, supervisors and the public in a mechanical services workplace.

Element of competency	Performance criteria
1. Write routine texts	1.1 Routine texts of one or more sentences are composed to meet workplace requirements for completing workplace records. 1.2 Routine forms are completed in accordance with workplace requirements.
2. Read routine documents	2.1 <b>Non-verbal information</b> relevant to the work task, are understood and described. 2.2 Clarification is sought where written instructions are unclear or not understood. 2.3 Work safety signs are understood and correctly followed.
3. Communicate with customers effectively	3.1 Customer requirements are obtained and confirmed. 3.2 Clear information is provided to customers about work requirements, costs and time needed.
4. Contribute to workplace communications	4.1 Verbal instructions are followed with correct actions. 4.2 Questions are used to gain additional information and to clarify understanding and to avoid repeated problems. 4.3 Instructions are conveyed to others accurately, using appropriate <b>modes of communication</b> . 4.4 Requests for information from colleagues are met. 4.5 Clear and accurate verbal reports are provided where required. 4.6 Assistance is provided to colleagues in the workplace to foster common understanding. 4.7 The correct process for meetings is identified and followed.

## **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. The candidate must be able to transfer competency to different circumstances in the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

## **Critical skills and essential knowledge**

The ability to:

- follow drawings and specifications from a variety of sources (e.g. manufacturer manuals);
- follow simple spoken and written instructions;
- interpret and convey workplace information accurately;
- maintain workplace communications;
- read, interpret and apply routine texts in the workplace;
- use questioning and listening skills to identify, clarify and confirm requirements; and
- write short routine texts for records purposes.

Knowledge of:

- Communication technology relevant to the candidate's work role
- Effective communication in a work team
- Effective communication, including the role of body language
- Workplace communication procedures and systems
- Workplace documentation requirements

## **Range statement**

**Non-verbal communication** may include

- written instructions
- signage
- email
- facsimile
- internet
- hand signals

**Communication modes** may include

- one to one communication
- small group e.g. work team
- telephone
- two-way radios

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report.

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-A2 Work safely in the mechanical services industry

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### Unit details

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Functional area A	<b>Core mechanical services competencies</b>
Unit title	<b>Work safely in the mechanical services industry</b>
Unit code	<b>MS-A2</b>

### Description

This unit describes the skills and knowledge required to contribute to a safe working environment for self and others.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Apply basic safety procedures	1.1 <b>Policies and procedures</b> to achieve a safe working environment are followed.
	1.2 All unsafe situations are recognised and reported according to worksite procedures.
	1.3 All machinery and equipment breakdowns are reported to supervisor or nominated persons.
	1.4 Fire and safety <b>hazards</b> are identified and precautions are taken or reported according to worksite policy and procedures.
	1.5 Dangerous goods and substances are identified, handled and stored according to worksite policy and procedures and safety requirements and environmental considerations.
	1.6 Worksite policy regarding manual handling practice is followed.
2. Apply emergency procedures	2.1 Safety alarms are identified.
	2.2 Appropriate persons are contacted in the event of accident.
	2.3 Accident or injury details are documented according to worksite procedures.
	2.4 Worksite evacuation procedures are identified and applied.

### Evidence guide

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements.

## **Critical skills and essential knowledge**

The ability to:

- apply safe manual handling practices;
- follow worksite evacuation procedures;
- operate fire-fighting equipment;
- plan and organise activities which follow standard safety procedures;
- recognise and report hazardous situations;
- safely handle and store dangerous and/or hazardous goods and substances; and
- safely operate and use workplace equipment and materials

Knowledge of:

- Dangerous goods and hazardous chemicals handling processes
- Emergency procedures
- Hazard reporting procedures.
- Procedures for the use of personal protective clothing and equipment
- Types and layout of service/repair manuals (hard copy and electronic)
- Use of fire-fighting equipment
- Workplace policies and procedures, including quality requirements, reporting and recording procedures
- Workplace safety policies and procedures

## **Range statement**

Workplace **policies and procedures** may include:

- Emergency procedures
- Fire and accident procedures
- Hazard policies and procedures
- Personal safety procedures
- Procedures for the use of personal protective clothing and equipment
- Use of motor vehicles
- Work instructions

**Hazards** and unsafe situations may include:

- Broken or damaged equipment
- Damaged packing material or containers
- Electricity and water
- Flammable materials and fire hazards
- Glue guns/burns
- Ladders
- Lifting practices
- Sharp cutting tooling and instruments
- Spillages
- Toxic substances
- Trolleys
- Waste and debris especially on floors

Personal protective equipment may include:

- Head covering
- Ear protection
- Eye protection
- Gloves
- Heavy duty enclosed shoes/boots
- Mask

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-A3 Plan for mechanical services work tasks

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### Unit details

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Functional area A	<b>Core mechanical services competencies</b>
Unit title	<b>Plan for mechanical services work tasks</b>
Unit code	<b>MS-A3</b>

### Description

This unit describes the skills and knowledge required to plan and organise work and follow workplace reporting requirements.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Plan	<p>1.1 Tasks are confirmed with supervisor to ensure correct interpretation of requirements.</p> <p>1.2 Steps are taken to ensure efficient conduct of work tasks.</p> <p>1.3 Work steps are planned and prioritized in conjunction with others.</p>
2. Complete and review	<p>2.1 All required documentation related to job planning and work progress is completed in accordance with workplace requirements.</p> <p>2.2 Planning and organizing of work activities is reviewed regularly, to check effectiveness and identify improvements.</p> <p>2.3 Any ideas for improvement to work planning procedures are suggested.</p>

### Evidence guide

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. The candidate must be able to transfer competency to different circumstances in the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances.

### Critical skills and essential knowledge

The ability to:

- communicate with others, including questioning to ensure understanding and clarify any ambiguities;
- establish effective work layout to minimize reworking and avoid wastage;
- plan and prioritize work steps in collaboration with others; and
- work effectively as a member of a team.

Knowledge of:

- Work organization and planning processes
- Workplace policies and procedures.
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

**Range statement**

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

# Functional area B – Mechanical services common tasks

## MS-B1 Identify common vehicle problems

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### Unit details

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Functional area B	<b>Mechanical services common tasks</b>
Unit title	<b>Work safely in the mechanical services industry</b>
Unit code	<b>MS-B1</b>

### Description

This unit describes the skills and knowledge required to identify common automotive faults or problems based on evidence provided by customers.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Identify nature of the fault or problem	1.1 Customer is made to feel valued.
	1.2 Questioning techniques are used to determine the nature of the customer's enquiry.
	1.3 Available information relating to the <b>fault or problem</b> is gathered, documented and confirmed with the customer.
2. Apply basic identification processes	2.1 Faulty system and/or component is identified.
	2.2 Basic identification techniques are used to determine the likely cause of the fault or problem.
	2.3 Advice is sought from the workplace product/system specialist, where available.
	2.4 Customer is advised of the likely cause and possible solutions to the fault or problem.

### Evidence guide

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. The candidate must be able to transfer competency to different circumstances in the critical aspects of:

- Communicating effectively with customers and others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

## **Critical skills and essential knowledge**

The ability to:

- collect, organise and understand information related to identifying basic vehicle problems;
- identify automotive systems and components;
- questioning and active listening skills, e.g. when obtaining factual information from customers;
- use basic diagnostic skills and troubleshooting techniques to determine possible causes of faults or problems; and
- use workplace technology related identifying basic vehicle problems.

Knowledge of:

- Basic troubleshooting techniques/processes
- Function of **major components of common vehicles.**
- Types, layout and location of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

## **Range statement**

Common **faults or problems** may include:

- Excessive exhaust smoke or noise
- Excessive play or vibration through steering
- Failure of lighting systems/components
- Failure to achieve fuel flow
- Failure to achieve ignition/power
- Loss of coolant
- Slow response or excessive pedal travel when braking
- Unusual engine noises or vibrations

**Major components of common vehicles** may include:

- Braking systems
- Cooling systems
- Electrical systems
- Engine systems
- Exhaust systems
- Fuel systems
- Steering and suspension systems
- Transmissions/drive trains

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-B2 Select mechanical/electrical parts for service or repair

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### Unit details

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Functional area B	<b>Mechanical services common tasks</b>
Unit title	<b>Select mechanical/electrical parts for service or repair</b>
Unit code	<b>MS-B2</b>

### Description

This unit describes the skills and knowledge required to determine, match and obtain specified vehicle parts or products.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Obtain parts	<p>1.1 All required parts and materials for system to be <b>repaired or serviced</b> are checked and listed from relevant <b>specifications</b>.</p> <p>1.2 Requirements are matched product descriptions and part numbers accessed from part/product manufacturer's manual or computerized cataloguing system.</p> <p>1.3 Required parts are obtained or ordered, and checked to ensure they are as required.</p>
2 Store parts	<p>2.1 Parts are stored or provided to the servicing/repair area or job-site for use.</p> <p>2.2 Workplace documentation is completed as required.</p>

### Evidence guide

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. The candidate must be able to transfer competency to different circumstances in the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

### Critical skills and essential knowledge

The ability to:

- correctly identify, obtain and store parts and materials needed for repair or service;
- list required parts and materials as needed;
- literacy skills to use and interpret manufacturers materials, diagrams and other specifications; and
- use communication skills to liaise on part requirements and obtain materials needed.

Knowledge of:

- Parts and systems

- Types, layout and location of service/repair manuals (hard copy and electronic)
- Workplace procedures for obtaining and ordering parts and completing required documentation

**Range statement**

Systems for **repair or service** may include: mechanical/electrical equipment for:

- Air-conditioning
- Refrigeration
- Vehicles

**Specifications** may include:

- Diagrams
- Physical and visual evidence
- Sketches
- Specifications
- Technical documentation
- Verbal descriptions

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-B3 Remove and tag components for servicing or repair

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### Unit details

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Functional area B	<b>Mechanical services common tasks</b>
Unit title	<b>Remove and tag components for servicing or repair</b>
Unit code	<b>MS-B3</b>

### Description

This unit describes the skills and knowledge required to remove all components; and tag each with appropriate information.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare for removing and tagging	<p>1.1 Work requirements is confirmed with supervisor.</p> <p>1.2 Required tools and equipment are obtained.</p> <p>1.3 Disassembly methods are analyzed and most appropriate option to meet work requirements is selected.</p> <p>1.4 <b>Components for removal</b> are identified.</p>
2. Remove and tag components	<p>2.1 Components are removed without damage and inspected for wear and/or damage.</p> <p>2.2 Each component is tagged correctly by title and application and laid out without damage, in preparation for cleaning, servicing, repair or replacement.</p>
3. Clean and store equipment and complete documentation	<p>3.1 <b>Tools and equipment</b> are cleaned and inspected and faults identified and tagged in accordance with workplace requirements.</p> <p>3.2 Documentation is completed as required to workplace standards.</p>

### Evidence guide

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

## **Critical skills and essential knowledge**

The ability to:

- accurately tag and set out of items for reassembly;
- remove component items without damage;
- select appropriate methods and techniques; and
- work in a systematic manner.

Knowledge of:

- Disassembly methods for systems
- Identification of work or broken components
- Naming of components
- Types, layout and location of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

## **Range statement**

**Components for removal** may include:

- Electrical, mechanical or body components
- Refrigeration or air-conditioning equipment
- Vehicle parts

**Components for removal** may be from:

- A vehicle
- Air-conditioning equipment
- Electrical components or systems
- Mechanical refrigeration

**Tools and equipment** may include:

- Hand and power tools
- Workshop manuals.

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-B4 Use mechanical tools and equipment

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### Unit details

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Functional area B	<b>Mechanical services common tasks</b>
Unit title	<b>Use mechanical tools and equipment</b>
Unit code	<b>MS-B4</b>

### Description

This unit describes the skills and knowledge required to use, maintain and store a range of common mechanical hand and power tools in a safe and effective manner.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Select and use correct tools and equipment	1.1 <b>Hand and power tools</b> are selected appropriate for the task and according to workplace policies and procedures.
	1.2 Hand and power tools are used to produce desired outcomes to <b>job specifications</b> .
	1.3 All safety requirements and environmental considerations are followed.
2. Maintain and store workplace tools and equipment	2.1 <b>Routine maintenance</b> is performed on tools, as required.
	2.2 Faulty tools and equipment are tagged and reported, in accordance with workplace procedures.
	2.3 Tools are safely stored, according to workplace procedures and manufacturers' recommendations.

### Evidence guide

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances.

### Critical skills and essential knowledge

The ability to:

- maintain tools in good order through identifying faults, performing maintenance and storing correctly; and
- select and use tools for specified job safely and correctly.

Knowledge of:

- Basic maintenance procedures for tools and equipment
- Tool and equipment operating procedures

- Types, characteristics, uses and limitations of tools and workplace equipment
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

**Range statement**

**Hand tools** may include:

- Belt tensioners
- Files of all cross-sectional shapes and types
- Hacksaws
- Hammers
- Jigs and fixtures
- Multigrips
- Screwdrivers
- Sockets
- Spanners
- Vices and clamps
- Wrenches (hand and torque)

**Power tools** may include:

- Cutting saws
- Electric or pneumatic/hydraulic drills or pedestal drills
- Grinders
- Jacking devices
- Sanders

**Job specifications** may include:

- Assembly
- Component removal
- Finishing
- Shaping
- Sizing
- Tensioning

**Routine maintenance** of tools may include:

- Adjustment
- Cleaning
- Lubricating
- Sharpening
- Simple repair
- Tightening

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-B5 Weld using gas metal arc process (GMAW)

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### Unit details

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Functional area B	<b>Mechanical services common tasks</b>
Unit title	<b>Weld using gas metal arc process (GMAW)</b>
Unit code	<b>MS-B5</b>

### Description

This unit describes the skills and knowledge required to weld effectively using gas metal arc welding (GMAW).

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare materials for gas metal arc welding (GMAW)	1.1 <b>Weld</b> requirements are identified from specifications and/or drawings.
	1.2 <b>Materials</b> are assembled/aligned to specification, where required.
	1.3 Safety requirements and environmental are observed throughout the work.
	1.4 Tools and equipment are identified and checked for safe use.
	1.5 Products are determined to minimize waste material.
2. Set up welding equipment and apply distortion measures	2.1 Welding machine settings, accessories and consumables are identified and selected.
	2.2 Welding <b>equipment</b> is assembled and set up.
	2.3 Appropriate distortion prevention measures are selected and applied and <b>distortion</b> is <b>rectified</b> .
3. Weld to job specification and ensure weld conformance	3.1 Weld deposit is made to specifications.
	3.2 Joints are cleaned to specifications.
	3.3 Weld joints are visually inspected for conformance to specifications.
	3.4 <b>Defects</b> are removed with minimum loss of sound metal, using correct and appropriate techniques and tools.
4. Clean up work area and maintain equipment	4.1 Material that can be reused is collected and stored and waste removed following workplace procedures.
	4.2 Equipment and work area is cleaned and inspected for serviceable condition.
	4.3 Unserviceable and faulty equipment is tagged and identified in accordance with workplace requirements.

- 4.4 Tools and equipment are stored in accordance with workplace procedures.
- 4.5 Weld records are completed as required.

### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

### **Critical skills and essential knowledge**

The ability to:

- apply techniques to prevent and rectify distortion;
- clean welds;
- control distortion of materials;
- inspect and identify defects in welds;
- make measurements relating to joint preparation and GMAW;
- operate welding equipment to manufacturers specifications;
- prepare materials, select and set up the welding equipment;
- read and interpret information on sketches, drawings, written job instructions, specifications and standard operating procedures; and
- record information related to GMAW welds onto standard workplace forms.

Knowledge of:

- Causes of distortion for materials
- Correct welding machine, leads, hand pieces and electrodes
- Electrode classification
- Joint preparations
- Material preparation
- The application of weld metal transfer (short arc, spray etc.)
- The relationships between amperage/wire feed, voltage, gas flow, electrode and material
- Types of gases and their use
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

### **Range statement**

**Welds** may include:

- Fillet and butt welds carried out in all positions

**Materials** may include:

- Ferrous materials including carbon or stainless steel
- Non-ferrous metals and alloys suitable for GMAW

Preparation of **materials** may include:

- Joint preparation (e.g. bevelling)
- Pre-heating
- Setting up of jigs, fixtures and clamps

**Equipment** may include:

- AC or DC welding machines

**Distortion** prevention measures may include:

- Pre-heating
- Setting up of jigs, fixtures and clamps

**Rectified** refers to:

- Air arc equipment
- Grinding devices
- Oxy acetylene

**Defects** may include:

- Discontinuities
- Lack of penetration
- Porosity
- Slag inclusions
- Undercut

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-B6 Weld using gas tungsten arc welding process (GTAW or TIG)

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### Unit details

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Functional area B	<b>Mechanical services common tasks</b>
Unit title	<b>Work safely in the mechanical services industry</b>
Unit code	<b>MS-B6</b>

### Description

This unit describes the skills and knowledge required to effectively weld using gas tungsten arc welding (GTAW) also called TIG welding.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare for work	<p>1.1 Weld requirements are identified from specifications and/or drawings.</p> <p>1.2 Safety requirements and environmental considerations are observed throughout the work.</p> <p>1.3 <b>Materials</b> for repairs and replacements are selected and inspected for quality.</p> <p>1.4 Tools and equipment are identified and checked for safe use.</p> <p>1.5 Products are determined to minimize waste material.</p>
2. Set up welding equipment and apply distortion measures	<p>2.1 <b>Welding equipment</b> is assembled and set up and materials prepared and aligned in accordance with the work specifications.</p> <p>2.2 <b>Distortion prevention measures</b> are identified and applied in accordance with job requirements.</p>
3. Carry out GTAW welding procedures	<p>3.1 Equipment start-up procedures and test runs follow workplace standard operating procedures.</p> <p>3.2 GTAW welding procedures are completed without causing damage to component or system.</p> <p>3.3 Welds are cleaned using <b>appropriate tools</b> and techniques in accordance with workplace procedures.</p>
4. Inspect weld and complete job	<p>4.1 Weld specifications are confirmed by <b>non-destructive testing</b> and inspection, in accordance with standard work practices.</p> <p>4.2 Defects are identified and repaired in accordance with the workplace procedures.</p> <p>4.3 <b>Work completion</b> details are finalised in accordance with workplace procedures.</p>

- |   |   |     |  |
|---|---|-----|--|
| 5 | Clean up work area and maintain equipment | 5.1 | Material that can be reused is collected and stored and waste removed following workplace procedures.                                      |
|   |   | 5.2 | Equipment and work area is cleaned and inspected for serviceable condition.  |
|   |   | 5.3 | <b>Maintenance</b> of equipment is undertaken and any faulty equipment is tagged and identified in accordance with workplace requirements. |
|   |   | 5.4 | Tools and equipment are stored in accordance with workplace procedures.  |
|   |   | 5.5 | Weld records are completed as required.  |

### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

### **Critical skills and essential knowledge**

The ability to:

- apply techniques to prevent and rectify distortion;
- clean welds;
- complete gas tungsten arc weld using required safety procedures;
- control distortion of materials;
- inspect and identify defects in welds;
- maintain welding and heating equipment;
- make measurements relating to joint preparation and GTAW;
- operate welding equipment to manufacturers specifications;
- prepare materials, select and set up the welding equipment;
- record information related to GTAW welds onto standard workplace forms; and
- use a variety of welding machines and electrodes

Knowledge of:

- Distortion causes and control techniques
- GTAW welding processes and techniques
- Types of fluxes, rods and their application
- Types of metals
- Weld testing techniques (non-destructive)
- Welding and material preparation techniques
- Welding equipment maintenance procedures.

- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

**Range statement**

**Materials** may include:

- Aluminum
- Cast iron
- High and low alloy steels in the appropriate profile e.g. plate, pipe, tube and round bar
- High, mild and low carbon steels
- Stainless steel

**Welding equipment** may include:

- Argon
- Filler rods
- Leads
- TIG welder
- Tungsten tips

**Distortion prevention measures** may include:

- Bolting
- Bracing
- Clamping
- Pre-setting
- Tacking

**Appropriate tools** may include:

- Angle grinder
- Wire brush

**Non-destructive testing** may include:

- Dye check
- Magnetic particle, pressure tests and ultra sound
- Visual inspection

**Work completion** details may include:

- Check sheets,
- On device labeling updates
- Plant and maintenance records, job cards
- Reporting and/or documenting equipment defects

**Maintenance** may refer to:

- Cleaning tips, nozzles and welders
- Replacing tips and gas nozzles

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

# Functional area C – Engine transmission

## MS-C1 Remove and install vehicle engines

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### Unit details

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Functional area C	<b>Engine transmission</b>
Unit title	<b>Remove and install vehicle engines</b>
Unit code	<b>MS-C1</b>

### Description

This unit describes the skills and knowledge required to safely remove and install vehicle engines.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare for work	<p>1.1 Work requirements is confirmed with supervisor.</p> <p>1.2 <b>Resources</b> and testing equipment and tools required, are sourced and checked for safe and effective operation.</p> <p>1.3 Safety requirements and environmental considerations are observed throughout the work.</p>
2. Carry out the removal of engine assemblies	<p>2.1 Methods for removal of the engine are implemented in accordance with workplace procedures and specifications.</p> <p>2.2 Observations are noted and documented during the removal.</p>
3. Install engine assemblies	<p>3.1 Procedures and information required are identified and sourced.</p> <p>3.2 Technical, tool and support requirements for installation are identified and prepared.</p> <p>3.3 Installation methods are implemented in accordance with workplace procedures and specifications.</p> <p>3.4 Tests and adjustments are conducted following installation in accordance with specifications.</p>
4. Prepare equipment for use or storage	<p>4.1 Service schedule documents are completed.</p> <p>4.2 Work area and equipment is cleaned and inspected for serviceable condition in accordance with workplace procedures.</p> <p>4.3 Final inspection is made to ensure protective guards, safety features and cowlings are in place, and to ensure work is to workplace expectations.</p>

## Evidence guide

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

## Critical skills and essential knowledge

The ability to:

- complete removal and installation of engine and associated components within workplace timeframes;
- remove and replace a range of engine assemblies in accordance with workplace and specifications; and
- use workplace technology related to the removal and installation of engine assemblies, including the use of measuring equipment, **tools and equipment**, and computerised technology.

Knowledge of:

- Dangers of working with lifting and jacking equipment
- Engine assembly removal and installation procedures
- Operating principles of vehicles systems and their relationship to each other
- Types, layout and location of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

## Range statement

**Resources** and information required for preparation may include:

- Workshop manuals
- Specifications
- Testing equipment
- Required tools

**Tools and equipment** may include:

- Gauges
- Hand tools
- Lifting, jacking and load testing devices
- Meters

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-C2 Inspect and service vehicle engines

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### Unit details

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Functional area C	<b>Engine transmission</b>
Unit title	<b>Inspect and service vehicle engines</b>
Unit code	<b>MS-C2</b>

### Description

This unit describes the skills and knowledge required to conduct an engine inspection and identify and undertake work required.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare for work	1.1 Nature and scope of work requirements is identified and confirmed.
	1.2 Resources, <b>tools and equipment</b> and materials required are sourced and checked for safe and serviceability.
	1.3 Safety requirements and environmental considerations are observed throughout the work.
2. Carry out the removal of engine assemblies	2.1 Engine systems are inspected in accordance with workplace procedures and specifications.
	2.2 <b>Engines</b> are started and run up to operating temperature and inspected for leaks, abnormal noises and pressures.
	2.3 Engine is inspected for servicing and work requirements and spare parts required are identified.
	2.4 Recommendations are made and reported in accordance with workplace procedures.
3. Install engine assemblies	3.1 Method and sequence of disassembly, testing and adjustment is selected, appropriate to the engine type.
	3.2 <b>Service</b> is implemented in accordance with workplace procedures and specifications.
	3.3 Adjustments are made in accordance with specifications.
	3.4 Final inspection is made to ensure protective guards, safety features and cowlings are in place and work is to workplace expectations.
	3.5 Required documentation is completed legibly, accurately and promptly, in accordance with workplace procedures.
4. Prepare equipment for use or storage	4.1 <b>Material</b> that can be reused is collected and stored and waste removed following workplace procedures.
	4.2 Equipment and work area is cleaned and inspected for serviceable condition.

- 4.3 Unserviceable and faulty equipment is tagged and identified in accordance with workplace requirements.
- 4.4 Tools and equipment are stored in accordance with workplace procedures.

### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

### **Critical skills and essential knowledge**

The ability to:

- accurately inspect and interpret results of analysis;
- complete the work within workplace timeframes;
- inspect and service a range of engines in accordance with workplace and requirements and specifications; and
- use workplace technology and tools to inspect and service engines

Knowledge of:

- Inspection procedures
- Operating principles of engines, lubrication, cooling and fuel systems and their relationship to each other
- Service procedures
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

### **Range statement**

**Inspection and servicing of engines** may include:

- Heavy vehicles
- Light vehicles
- Marine craft
- Motorcycle

**Tools and equipment** may include:

- Gauges
- Hand tools
- Load testing devices
- Meters
- Oil sample analysis equipment

Inspection and servicing of **engines** may include:

- Four stroke compression ignition
- Four stroke spark ignition
- Two stroke spark ignitio

Engine **service** may include:

- Check and top up coolant levels using required additives
- Draining and replacing lubricants, sump plug washer
- Replacing oil and air filters as required
- Sparking and timing components
- Tensioning/replacing drive belts/chains

**Material** may include:

- Cleaning materials
- Lubricants
- Oils

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-C3 Repair vehicle cooling systems

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### Unit details

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Functional area C	<b>Engine transmission</b>
Unit title	<b>Repair vehicle cooling systems</b>
Unit code	<b>MS-C3</b>

### Description

This unit describes the skills and knowledge required to service and repair vehicle cooling systems.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare for work	<ul style="list-style-type: none"><li>1.1 Nature and scope of work requirements is identified and confirmed.</li><li>1.2 Technical and/or calibration requirements for testing and repairing cooling systems is determined.</li><li>1.3 Equipment and tools are sourced and checked for effective operation.</li><li>1.4 Procedures to minimise task time are determined.</li></ul>
2. Test cooling systems and analyse results	<ul style="list-style-type: none"><li>2.1 Safety requirements and environmental considerations are observed throughout the work.</li><li>2.2 Cooling systems are <b>inspected</b> tests and comparisons are performed against specifications.</li><li>2.3 Recommendations are made and reported in accordance with workplace procedures.</li></ul>
3. Carry out repair	<ul style="list-style-type: none"><li>3.1 Appropriate tools, techniques and materials are selected.</li><li>3.2 Repairs, replacement of components and adjustments are carried out in accordance with workplace procedures and specifications and <b>specific requirements</b> and <b>variables</b> of the system.</li><li>3.3 Cooling system components are drained and disassembled.</li><li>3.4 System is repaired by isolating faults, dismantling, inspecting, evaluating and replacing component parts as necessary.</li><li>3.5 Cooling system is repaired and <b>serviced</b> without causing damage to component or system.</li><li>3.6 Radiator condition is assessed and flushed or sent for specialist repair/re-coring if required.</li><li>3.7 Adjustments are made after the repair and radiator is re-installed in accordance with specifications.</li><li>3.8 Operational tests are made to confirm the cooling system meets manufacturer's specifications for cooling to required temperature.</li><li>3.9 Required documentation is completed legibly, accurately and promptly, in accordance with workplace procedures.</li></ul>

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| 4. Clean up work area and maintain equipment | 4.1 <b>Material</b> that can be reused is collected and stored and waste removed following workplace procedures. |
|  | 4.2 Equipment and work area is cleaned and inspected for serviceable condition.                                  |
|  | 4.3 Unserviceable and faulty equipment is tagged and identified in accordance with workplace requirements.       |
|  | 4.4 <b>Tools and equipment</b> are stored in accordance with workplace procedures.                               |

### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. The candidate must be able to:

- conduct the repair of not less than two (2) different cooling systems in accordance with workplace and requirements;
- communicating effectively with others involved in or affected by the work;
- conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications;
- observing safety procedures and requirements;
- preparing and conducting activities in a systematic manner; and
- selecting methods and techniques appropriate to the circumstances.

### **Critical skills and essential knowledge**

The ability to:

- correctly interpret test results, identify faults and make repairs to cooling systems;
- calculate time, assess tolerances, measure accurately and calculate material needs;
- complete the work within workplace timeframes;
- identify and analyse technical information; and
- use workplace technology and tools related to the repair of cooling systems.

Knowledge of:

- Dangers of working with coolants
- Identification of component parts, including physical, fluid, gases and heat generation
- Manufacturer and/or component supplier specifications
- Repair and testing procedures for vehicle coolant systems
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures

### **Range statement**

**Inspection** methods may include:

- Visual, aural and functional assessments, including, damage, corrosion, fluid levels/leaks and wear

**Specific requirements** may include:

- Air cooled systems
- Combination systems
- Fluid cooled systems

System **variables** may include:

- Cooling fins size, material, colour and finish
- Cooling system additives
- Ferrous and non-ferrous metals
- Keel cooling, heat exchanger, raw water cooling and sacrificial anodes
- Thermostats, water pumps, hoses, ducting, fans, drive belts, heat exchanger, electric and viscous fans, sealed and non-sealed systems, interior heater and coolant heater manifold

**Servicing** may include:

- Adjustments
- Filters
- Fluids
- Operational testing, visual inspections and documents

**Materials** may include:

- Cleaning materials
- Coolant
- Spare parts

**Tools and equipment** may include:

- Hand tools
- Meters, gauges and pressure testing devices

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-C4 Service and adjust vehicle petrol and diesel fuel systems

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### Unit details

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Functional area C	<b>Engine transmission</b>
Unit title	<b>Service and adjust vehicle petrol and diesel fuel systems</b>
Unit code	<b>MS-C4</b>

### Description

This unit describes the skills and knowledge required to service vehicle petrol and diesel two and/or four stroke, spark ignition fuel systems and mechanical and basic electric/electronic components.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare to service <b>petrol and diesel fuel system components</b>	1.1 Identify scope of work fuel servicing requirements and confirm with supervisor.
	1.2 Safety requirements and environmental considerations are observed throughout the work.
	1.3 <b>Tools and equipment</b> required are obtained and checked for safe and effective operation.
2. Test system	2.1 Correct information is accessed and interpreted from manuals and specifications.
	2.2 <b>Assessments</b> and tests are used to identify servicing needs.
3. Service fuel system components and prepare for normal operation	3.1 Appropriate servicing sequence and procedures for the fuel system to be serviced are selected.
	3.2 Service of fuel system/components is carried out in accordance with specifications.
	3.3 Service is completed without causing damage to any component or system.
	3.4 Engine is run and fuel system tested for correct operation.
	3.5 Adjustments and replacements made during the service are in accordance with specifications.
	3.6 Required documentation is completed legibly, accurately and promptly, in accordance with workplace procedures.
4. Clean up work area and maintain equipment	4.1 Material that can be reused is collected and stored and waste removed following workplace procedures.
	4.2 Equipment and work area is cleaned and inspected for serviceable condition.
	4.3 Unserviceable equipment is tagged and faults identified in accordance with workplace requirements.
	4.4 Maintain and store tools and equipment in accordance with workplace procedures.

## **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

## **Critical skills and essential knowledge**

The ability to:

- accurately interpret service schedules;
- accurately interpret the test results;
- complete the work within workplace timeframes;
- conduct the service of a range of petrol and diesel fuel systems in accordance with workplace and manufacturer/component supplier requirements; and
- use relevant workplace technology, including the use of diagnostic and servicing tools and equipment

Knowledge of:

- Components of diesel and petrol fuel system
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

## **Range statement**

**Petrol Fuel system components** may include:

- Basic EFI and/or carburettors (all positions, electronic, fixed venturi, variable venturi), such as mechanical and/or electrical fuel pumps, engine shutdown systems and electronic/mechanical fuel injectors, fuel filters and associated basic fuel injection components

**Diesel fuel injection system components** may include:

- Glow plugs or computer controlled flow devices
- Induction valves
- Injectors
- Pre-combustion chambers or other devices to swirl the air in the combustion chamber or otherwise improve the ignition and combustion process

**Tools and equipment** may include:

- Exhaust gas analyser
- Hand tools
- Power tooling
- Pressure gauge tachometer and multimeter
- Vacuum gauge

Methods of **assessments** may include:

- Aural
- Functional assessments (including damage, corrosion, fluid leaks, wear and safety aspects)
- Visual

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-C5 Service vehicle manual transmissions

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### Unit details

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Functional area C	<b>Engine transmission</b>
Unit title	<b>Service vehicle manual transmissions</b>
Unit code	<b>MS-C5</b>

### Description

This unit describes the skills and knowledge required to service manual transmissions and associated components for front and/or rear wheel drive vehicles.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare to inspect manual <b>transmissions</b>	1.1 Scope of work requirements for manual transmission servicing is identified and confirmed.
	1.2 Safety requirements and environmental considerations are observed throughout the work.
	1.3 Equipment and tools required are obtained and checked for safe and effective operation.
2. Conduct inspection and analyse results	2.1 <b>Inspection</b> and testing is implemented in accordance with workplace procedures and manufacturer/component supplier specifications.
	2.2 Inspection results are compared with manufacturer or component supplier specifications to indicate compliance or non-compliance.
	2.3 Results are documented with evidence and recommendations made.
3. Carry out service	3.1 <b>Service</b> is implemented in accordance with workplace procedures and manufacturer or component supplier specifications.
	3.2 Adjustments made during the service are in accordance with manufacturer/component supplier specifications.
	3.3 Required documentation is completed legibly, accurately and promptly, in accordance with workplace procedures.
4. Prepare equipment for use or storage	4.1 Service schedule documentation is completed.
	4.2 Equipment and work area is cleaned and inspected for serviceable condition in accordance with workplace procedures.
	4.3 Final inspection is made to ensure protective guards, safety features and cowlings are in place.
	4.4 Final inspection is made to ensure work is to workplace expectations.

## **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

## **Critical skills and essential knowledge**

The ability to:

- accurately interpret service schedules;
- accurately interpret test results;
- complete the work within workplace timeframes;
- conduct the service of a range manual transmissions in accordance with workplace and manufacturer/component supplier requirements;
- inspect and service and test in accordance with workplace and manufacturer/component supplier specifications; and
- use relevant workplace technology, including the use of diagnostic and servicing tools and equipment.

Knowledge of:

- Dangers of working with manual transmissions
- Inspection procedures
- Service procedures
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

## **Range statement**

**Transmissions** may include for:

- Belt drive transmissions
- Front and/or rear wheel drive configurations
- Manual transmissions

**Inspection** methods include:

- Types and layout of service/repair manuals (hard copy and electronic)
- Visual, aural and functional assessment (including: fluid leakage, selection)

Other variables may include:

- Electrical/pneumatic controls
- Helical, double helical and spur gears
- Metal and non-metal gears
- Multiple forward and reverse gears
- Power take off assemblies
- Synchronised and non-synchronised gear selection
- Transaxle, overdrive, transfer case and belt drive speed control
- Transverse/longitudinal mounting

**Servicing** may include:

- Adjustments
- Documentation
- Filters
- Fluids
- Operational testing
- Visual inspections

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-C6 Service vehicle automatic transmissions

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### Unit details

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Functional area C	<b>Engine transmission</b>
Unit title	<b>Service vehicle automatic transmissions</b>
Unit code	<b>MS-C6</b>

### Description

This unit describes the skills and knowledge required to service vehicle semi-automatic or automatic transmissions and **components**, including torque converters for front and/or rear wheel drive and belt drive configurations.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare to inspect automatic transmissions	<p>1.1 Scope of work requirements for servicing semi-automatic/automatic <b>transmissions</b> is confirmed with supervisor.</p> <p>1.2 Safety requirements and environmental considerations are observed throughout the work.</p> <p>1.3 <b>Tools and equipment</b> required are obtained and checked for safe and effective operation.</p>
2. Conduct inspection and analyse results	<p>2.1 <b>Inspection</b> is implemented in accordance with workplace procedures and manufacturer/component supplier specifications</p> <p>2.2 Inspection results are compared with manufacturer or component supplier specifications to indicate compliance or non-compliance.</p> <p>2.3 Results are documented with evidence and recommendations made.</p>
3. Carry out service to transmission	<p>3.1 <b>Servicing</b> method and sequence are selected in accordance with standard operating procedures.</p> <p>3.2 Service is implemented, including topping up or flushing and replacing fluids and filters, in accordance with workplace procedures and manufacturer or component supplier specifications.</p> <p>3.3 Adjustments made during the service, including checks for fluid leakage and smooth selection of gears, are in accordance with manufacturer/component supplier specifications.</p> <p>3.4 Required documentation is completed legibly, accurately and promptly, in accordance with workplace procedures.</p>
4. Prepare equipment for use or storage	<p>4.1 Service schedule documentation is completed.</p> <p>4.2 Equipment and work area is cleaned and inspected for serviceable condition in accordance with workplace procedures.</p> <p>4.3 Final inspection is made to ensure protective guards, safety features and cowlings are in place.</p>

#### 4.4 Final inspection is made to ensure work is to workplace expectations.

##### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

##### **Critical skills and essential knowledge**

The ability to:

- accurately interpret service schedules;
- accurately interpret test results;
- complete the work within workplace timeframes;
- conduct the inspection and servicing of a range of transmission types in accordance with workplace and manufacturer/component supplier requirements;
- inspect, service and test in accordance with workplace and manufacturer/component supplier specifications; and
- use relevant workplace technology, including the use of diagnostic and servicing tools and equipment.

Knowledge of:

- Drive flow paths
- Five laws of simple planetary gear sets
- Fluid dynamics
- Gear selection mechanisms
- Identification of component parts, including physical fluids, gases, heat generated
- Superior driving member rule
- The application, purpose and operating principles of automatic transmissions
- Three laws of compound planetary gear sets
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

##### **Range statement**

**Transmissions** may be:

- Automatic
- Front and/or rear wheel drive configurations
- Power shift transmissions
- Semi-automatic

and may include:

- Electronically controlled transmissions
- Power take-off assemblies
- Pre-selective transmissions

**Tools and equipment** may include:

- Gauges
- Hand tools
- Load testing devices
- Lubricants and seals
- Meters
- Spare parts and workshop manuals and specifications.

Transmission components for testing may include:

- Bands, valve bodies
- Gaskets
- Hydraulic systems
- Planetary gear sets
- Power take off assemblies
- Pumps and torque converters
- Seals

**Inspection** methods may include:

- Operational testing, including checking for out of specification range noise, vibration, engine vacuum leaks or erratic shift behaviour
- Visual, aural and functional assessment (including: fluid leakage, selection).

**Servicing** may include checking:

- Adjustments
- Filters
- Fluids
- Operational testing
- Visual inspections

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-C7 Service vehicle clutch assemblies

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### Unit details

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Functional area C	<b>Engine transmission</b>
Unit title	<b>Service vehicle clutch assemblies</b>
Unit code	<b>MS-C7</b>

### Description

This unit describes the skills and knowledge required to test and service **clutch assemblies**.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare to inspect braking system	<p>1.1 Nature and scope of work requirements is identified and confirmed.</p> <p>1.2 Resources, tools and equipment and materials required are sourced and checked for safe and serviceability.</p> <p>1.3 Safety requirements and environmental considerations are observed throughout the work.</p>
2. Test clutch and assembly systems	<p>2.1 System tests are implemented in accordance with specifications and <b>faults</b> identified.</p> <p>2.2 Results are compared with manufacturer/component supplier specifications to indicate compliance or non-compliance.</p> <p>2.3 Results are documented with evidence and supporting information and recommendations made.</p>
3. Carry out service and/or repair	<p>3.1 Methods for <b>service</b> and/or <b>repair methods sequence</b> are implemented in accordance with specifications and any <b>specific requirements</b> or <b>other variables</b>.</p> <p>3.2 Adjustments made during the service are in accordance with manufacturer/component supplier specifications.</p>
4. Prepare vehicle for use or storage	<p>4.1 Service schedule documentation is completed.</p> <p>4.2 Equipment and work area is cleaned and inspected for serviceable condition in accordance with workplace procedures.</p> <p>4.3 Final inspection is made to ensure protective guards, safety features and cowlings are in place.</p> <p>4.4 Vehicle is road tested to ensure all steering and suspension system components are operating safely and effectively for road holding and cornering with minimal weave, wobble or shimmy and adjusted as required.</p>

## **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

## **Critical skills and essential knowledge**

The ability to:

- apply a full repair sequence as per the Range statement to a clutch assembly;
- complete service and repair of the clutch assembly and associated components within workplace timeframes;
- interpret test results; and
- use workplace technology related to the service and/or repair of clutch assemblies and associated components.

Knowledge of:

- Clutch repair procedures
- Clutch servicing procedures
- Operating principles of clutch systems, components and their relationship to each other
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

## **Range statement**

**Clutch assemblies** include:

- Over-centre
- Pressure plates
- Single, dual and multiple plate clutches
- Two-stage clutch assemblies

**Faults** may include:

- Clutch not fully releasing
- Slipping clutch.

**Servicing** may include:

- Adjustments
- Lubrication
- Operational tests
- Visual inspection and records

**Repair methods and sequence** are to include:

- Isolation of fault(s), dismantling, inspection and evaluation, replacement of components parts, assembly and completion of operational tests and records

**Specific requirements** may include:

- Actuating mechanisms, including mechanical, hydraulic and pneumatic assisted
- Clutch assemblies, including single or multi-plate, wet and dry construction, standard and heavy duty types

**Other variables** may include:

- Centrifugal, semi-centrifugal, dog, one-way, cone, over centre, slip, and two-stage construction
- Steering clutches

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

# Functional area D – Brakes, driveline and exhaust

## MS-D1 Service and repair anti-lock braking and traction control systems

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### Unit details

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Functional area D	<b>Brakes, driveline and exhaust</b>
Unit title	<b>Service and repair anti-lock braking and traction control systems</b>
Unit code	<b>MS-D1</b>

### Description

This unit of competency describes the skills and knowledge required to service and repair **electronically controlled anti-locking braking systems** fitted to light vehicles and motorcycles and traction control systems fitted to light vehicles.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare for work	<p>1.1 Nature and scope of work requirements is identified and confirmed.</p> <p>1.2 <b>Resources, tools and equipment</b> and materials required are sourced and checked for serviceability.</p> <p>1.3 Electronic system protection devices, processes and precautions appropriate to the application are identified.</p> <p>1.4 Safety requirements and environmental considerations are observed throughout the work.</p>
2. Test control system, diagnose <b>faults</b> and determine service/repair requirements	<p>2.1 Tests are carried out according to manufacturer/component supplier recommended procedures.</p> <p>2.2 Test results are used to diagnose system/component faults.</p> <p>2.3 Service/repair requirements are determined and documented.</p>
3. Service/repair anti-lock braking systems	<p>3.1 Correct information is accessed and interpreted from <b>specifications</b>.</p> <p>3.2 Service/repair requirements are carried out according to recommended specifications and procedures.</p> <p>3.3 <b>Critical precautions</b> are observed throughout testing, service/repair is completed without causing damage to component or system.</p> <p>3.4 Electronic systems are tested and results are documented in accordance with workplace policies and procedures.</p>

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|  | 3.5 | Workplace reports and documents are completed in accordance with site requirements.                          |
| 4. Clean up work area and maintain equipment | 4.1 | Material that can be reused is collected and stored and waste removed following workplace procedures.        |
|  | 4.2 | Clean equipment and work area and inspect for serviceable condition in accordance with workplace procedures. |
|  | 4.3 | Unserviceable equipment is tagged and faults identified in accordance with workplace requirements.           |
|  | 4.4 | Tools and equipment are maintained in accordance with workplace procedures.                                  |

### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. The candidate must be able to transfer competency to different circumstances in the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

### **Critical skills**

The ability to:

- complete the work within workplace timeframes;
- diagnose and determine the repair/replacement requirements to rectify faults;
- service/repair electronic anti-lock braking systems to specifications;
- test, inspect and evaluate electronic anti-lock wheel systems, speed sensors and related components; and
- use workplace technology related to the service and repair of electronically controlled anti-lock braking systems, including the use of specialist tools and equipment.

Knowledge of:

- Construction and operation of electronic anti-lock braking systems
- Operating principles of electronic anti-lock braking systems
- Relationship to other electronically controlled systems, including shared components (e.g. ECUs, sensors)
- Servicing/repairing, removal, replacement and adjustment procedures relevant to application
- Testing, diagnosis and fault determination procedures
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

## **Range statement**

**Electronically controlled anti-locking braking systems** fitted to

- Heavy vehicles
- Light vehicles
- Motorcycles

**Resources** may include:

- Manufacturer specifications
- Work procedures
- Workshop manuals

**Tools and equipment** may include:

- Brake dynamometer
- Electronic testing equipment
- Hand tools
- Multimeter
- Oscilloscope and scan tools
- Power tools
- Specialist tools for removal/replacement
- Vehicle lifting devices

**Faults** may include:

- component malfunction
- Incorrect inputs and outputs and incorrect information
- Open, short and grounded circuits
- System adjustment

Fault finding methods may include:

- Diagnosis and determining faults
- Pre- and post-repair testing of system and component operation
- Removal, dismantling, reassembly and refitting and retrieval and assessment of electronic systems data such as fault codes
- Service and repair adjustments
- Service and repair/replacement of system components

**Specifications** refer to those supplied by:

Component supplier  
Manufacturer  
The workplace

**Critical precautions** may include:

- Manufacturer/component supplier procedures which must be applied as poor working practices are likely to damage electronic system ECUs and/or other components

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-D2 Remove steering, suspension and brake system components

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### Unit details

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Functional area D	<b>Brakes, driveline and exhaust</b>
Unit title	<b>Remove steering, suspension and brake system components</b>
Unit code	<b>MS-D2</b>

### Description

This unit of competency describes the outcomes required to prepare, remove and **tag** steering, suspension and brake system components for inspection, service, repair or replacement.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare for work	<p>1.1 Nature and scope of work requirements is identified and confirmed.</p> <p>1.2 Resources, <b>tools and equipment</b> and materials required are sourced and checked for safe and serviceability.</p> <p>1.3 Safety requirements and environmental considerations are observed throughout the work.</p>
2. Remove steering, suspension and brake system components	<p>2.1 Hand and power tools, materials and equipment such as clamps for suspension component compression and workshop manuals are selected as required.</p> <p>2.2 Most appropriate disassembly method and sequence is selected, in accordance with manufacturer/component supplier specifications.</p> <p>2.3 Steering components are disassembled in correct sequence and without damage.</p> <p>2.4 Suspension system components are removed in correct sequence and without damage.</p> <p>2.5 Brake components are removed in correct sequence and without damage.</p>
3. Tag steering, suspension and brake system components	<p>3.1 Correct information is accessed and interpreted from specifications.</p> <p>3.2 Tests are carried out according to recommended procedures, using recommended tools, equipment and techniques.</p> <p>3.3 Testing is completed without causing damage to component or system.</p> <p>3.4 Test results are used to diagnose system/component faults.</p> <p>3.5 Service/repair requirements are determined and documented.</p>

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| 4. Clean up work area and maintain equipment | 4.1 Material that can be reused is collected and stored and waste removed following workplace procedures.        |
|  | 4.2 Clean equipment and work area and inspect for serviceable condition in accordance with workplace procedures. |
|  | 4.3 Unserviceable equipment is tagged and faults identified in accordance with workplace requirements.           |
|  | 4.4 Tools and equipment are maintained in accordance with workplace procedures.                                  |

### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

### **Critical skills and essential knowledge**

- Accurately interpret inspection results
- Complete the work safely and within workplace timeframes
- Complete the work within workplace timeframes
- Conduct service of a range of steering systems in accordance with the workplace and manufacturer/component supplier requirements
- Determine the repair/replacement requirements to rectify faults

Knowledge of:

- Construction and operation of electronic anti-lock braking systems
- Operating principles of electronic anti-lock braking systems
- Relationship to other electronically controlled systems, including shared components (e.g. ECUs, sensors)
- Service procedures
- Servicing/repairing, removal, replacement and adjustment procedures relevant to application
- Testing, diagnosis and fault determination procedures
- Types and layout of service/repair manuals (hard copy and electronic)
- Types and layout of service/repair manuals (hard copy and electronic)
- Work organisation and planning processes
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

### **Range statement**

**Steering components** include:

- Bushings
- Hydraulic or electrical/electronic power steering systems and pumps
- Rack and pinion
- Recirculating ball
- Rubber or other material mountings
- Worm and sector and forks (motorcycle)

**Suspension system components** include:

- Air springs (possibly leaf spring systems on older vehicles)
- Bushings
- Rubber or other material mountings
- Shock absorbers
- Stabilizer bars
- Suspension arms and/or MacPherson struts
- Torsion bars

**System components** include:

- "I" beam axle
- Ball joints
- Duo servo and disc braking components
- Independent suspension
- Leading and trailing shoe
- Steering linkages
- Tie rod ends

**Brake components** include:

- Brake fluid lines
- Cables (hand brakes)
- Cylinders (drum brakes)
- Discs
- Drum
- Master cylinders
- Pads and calipers (disc brakes)
- Shoes

**Tagging** is to be by:

- Title and application

**Tools and equipment** may include:

- Hand tools and hand-held power tools

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-D3 Repair exhaust system components

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### Unit details

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Functional area D	<b>Brakes, driveline and exhaust</b>
Unit title	<b>Repair exhaust system components</b>
Unit code	<b>MS-D3</b>

### Description

This unit of competency describes the skills and knowledge required to test and repair and/or replace faulty components of light vehicle or motorcycle exhaust systems.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare to undertake <b>inspection</b> and servicing of <b>steering systems</b> and related components	1.1 Nature and scope of work requirements is identified and confirmed.
	1.2 Resources required for inspecting and servicing steering systems, such as workshop manuals and specifications, and <b>tools and equipment</b> required, are sourced and checked for usability.
	1.3 Safety requirements and environmental considerations are observed throughout the work.
2. Conduct inspection and analyse results	2.1 Vehicle is suspended for access to all exhaust system components and checks are made for rusted or chaffed pipework.
	2.2 Results are compared with specifications to indicate compliance or non-compliance.
	2.3 Results are documented with evidence and supporting information and recommendations made.
3. Carry out repairs and/or servicing	3.1 <b>Repairs</b> and/or replacements to faulty exhaust system/components are carried out in accordance with specifications, using correct mounting and fixings, parts and materials.
	3.2 Servicing is implemented in accordance with workplace procedures and specifications.
4. Prepare vehicle for customer or storage	4.1 Service schedule documentation is completed.
	4.2 Final inspection is made to ensure work is to workplace expectations.

### Evidence guide

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Application of the full repair sequence to an exhaust system as per the Range statement relative to the qualification being sought
- Communicating effectively with others involved in or affected by the work
- Conducting repair in accordance with workplace and manufacturer/component supplier requirements and specifications
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting **methods** and techniques appropriate to the circumstances

### **Critical skills and essential knowledge**

- Accurately interpret inspection results
- Complete the work safely and within workplace timeframes
- Service a range of exhaust systems in accordance with workplace and manufacturer/component supplier requirements
- Use workplace technology related to the removal, repair and replacement of faulty exhaust system/components

Knowledge of:

- Exhaust system/component repair procedures and techniques
- Identification of system/component parts, including physical, fluid, gases and heat generation
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

### **Range statement**

**System components** may include:

- Catalytic converters
- Replaceable baffles

**System components for inspection** may include:

- Ball joints
- Electronic controlled systems
- Idler arms
- Rose joints, struts
- Steering boxes and columns
- Two and four wheel steer and full hydraulic steering, including articulated vehicles and tracked type systems
- Wheel bearings

**Steering systems** may be in:

- Light and heavy vehicles
- Motorcycles
- Outdoor power equipment
- Wheeled and tracked vehicles

Methods may include:

- Aural
- Functional assessments
- Including damage, corrosion, wear and electrical
- Visual

**Tools and equipment** may include:

- Cutting equipment
- Decibel meters
- Gauges
- Hand tools and power tools, hydraulic testing equipment and devices
- Lifting equipment
- Meters
- Specialist tools for removal/replacement, testing equipment
- Welding equipment

**Repair methods** include:

- Checking, comparing, removal/replacement, welding (OAW, GMAW/GTAW)
- Decoking exhaust components to unblock
- Repacking mufflers with replaceable baffles
- Service spark arrester

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-D4 Inspect and service braking system

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### Unit details

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Functional area D	<b>Brakes, driveline and exhaust</b>
Unit title	<b>Inspect and service braking systems</b>
Unit code	<b>MS-D4</b>

### Description

This unit of competency describes the skills and knowledge required to inspect light vehicle and motorcycle braking systems, determine servicing work requirements; and service braking systems; to meet required specifications.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare to inspect <b>braking system</b>	1.1 Nature and scope of work requirements is identified and confirmed.
	1.2 Resources, <b>tools and equipment</b> and materials required are sourced and checked for safe and serviceability.
	1.3 Safety requirements and environmental considerations are observed throughout the work.
2. Conduct braking system wear analysis	2.1 Braking system analysis is implemented in accordance with workplace procedures and specifications.
	2.2 Brake wear measurement results are compared with specifications to indicate compliance or non-compliance.
	2.3 Results are documented and recommendations made.
3. Carry out servicing of braking systems and/or associated components	3.1 Servicing is implemented in accordance with workplace procedures and specifications.
	3.2 Brake fluid is bled as required.
	3.3 <b>Braking system components</b> are replaced or repaired as required and re-fitted.
	3.4 Adjustments made during the servicing are in accordance with specifications.
	3.5 Brake fluid is replaced and pressure tests conducted.
	3.6 Adjustments are made in accordance with specifications.
4. Prepare equipment for use or storage	4.1 Service schedule documentation is completed.
	4.2 Equipment and work area is cleaned and inspected for serviceable condition in accordance with workplace procedures.
	4.3 Vehicle is road tested to ensure all braking system components are operating safely and effectively and adjusted as required.

## Evidence guide

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

## Critical skills

- Accurately interpret wear analysis results
- Complete the work safely within workplace timeframes
- Completing service of braking systems in accordance with workplace and manufacturer/component supplier requirements
- Conduct the inspection in accordance with workplace and manufacturer/component supplier requirements
- Use workplace technology related to the inspection and servicing of braking systems

Knowledge of:

- Mechanical and electronic fuel systems
- Operating principles of braking systems, components and their relationship to each other
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

## Range statement

Types of **braking systems** may include:

- Air
- Disc/drum braking
- Hand and parking
- Hydraulic
- Mechanical
- Pneumatic

**Tools and equipment** may include:

- Hand tools, gauges (including dial, verniers and micrometers), bleeding and brake testing devices, dust extraction equipment and grease guns

**Braking system components** may include:

- Brake actuators
- Brake callipers
- Brake hoses

- Brake shoes
- Disc pads
- Master cylinders
- Mechanical devices
- Valves

**Methods** may include:

- Measurements of pedal travel, free-play, disc runout, disc thickness, drum wear and pad/lining thickness
- Visual, aural and functional assessments (including damage, corrosion, fluid leaks, wear)

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-D5 Remove and refit driveline components

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### Unit details

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Functional area D	<b>Brakes, driveline and exhaust</b>
Unit title	<b>Remove and refit driveline components</b>
Unit code	<b>MS- D5</b>

### Description

This unit of competency describes the skills and knowledge required to remove light vehicle driveline **system components**, inspect and test; refit system components.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare to test and repair driveline components	<p>1.1 Nature and scope of work requirements is identified and confirmed.</p> <p>1.2 Resources, <b>tools and equipment</b> and materials required are sourced and checked for safe and serviceability.</p> <p>1.3 Safety requirements and environmental considerations are observed throughout the work.</p>
2. Remove driveline components	<p>2.1 Removal procedure information is accessed and interpreted from technical publications prior to removal of components.</p> <p>2.2 System components are removed using hand tools and specialist equipment without causing damage and set out in order of disassembly.</p>
3. Refit and adjust driveline components	<p>3.1 Removed components are examined for serviceability prior to commencing the refitting procedures.</p> <p>3.2 Replacement or repaired components are refitted and driveline is adjusted to specifications and instructions.</p> <p>3.3 Fluids and lubricants required during the refitting procedures are used in accordance with specifications.</p>
4. Prepare equipment for use or storage	<p>4.1 Vehicle is road tested to ensure all driveline system components are operating safely and effectively and adjust as required to meet manufacturer's specifications.</p> <p>4.2 Service schedule documentation is completed.</p> <p>4.3 Equipment and work area is cleaned and inspected for serviceable condition in accordance with workplace procedures.</p>

## Evidence guide

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conduct removal and refitting in accordance with workplace and manufacturer/component supplier requirements
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

## Critical skills and essential knowledge

Ability to:

- accurately interpret test results;
- complete the work safely and within workplace timeframes; and
- use workplace technology related to the removal and refitting of driveline components.

Knowledge of:

- Construction and operation of FWD drive shafts
- Dismantling, assembling and adjusting procedures
- Methods of fitting air clips
- Methods of using lubricants and sealants
- Principles and construction of constant velocity joints
- Principles of driveline operation
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

## Range statement

Types of **system components** may include:

- Constant velocity joints
- Drive shafts
- Forward drive shafts
- Independent rear suspension

**Tools and equipment** may include:

- Hand tools
- Jacking equipment

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-D6 Inspect and service steering systems

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### Unit details

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Functional area D	<b>Brakes, driveline and exhaust</b>
Unit title	<b>Inspect and service steering systems</b>
Unit code	<b>MS-D6</b>

### Description

This unit of competency describes the skills and knowledge required to inspect and service light vehicle and motorcycle steering systems and associated components.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare to <b>inspect and service steering systems and related components</b>	1.1 Nature and scope of work requirements is identified and confirmed.
	1.2 Resources, <b>tools and equipment</b> and materials required are sourced and checked for safe and serviceability.
	1.3 Safety requirements and environmental considerations are observed throughout the work.
2. Conduct inspection and analyse results	2.1 Inspection are implemented in accordance with workplace procedures and specifications.
	2.2 Results are compared with specifications to indicate compliance or non-compliance.
	2.3 Results are documented with evidence and supporting information and recommendation(s) made.
	2.4 Report is forwarded to persons for action in accordance with workplace procedures.
3. Carry out servicing	3.1 Servicing are implemented in accordance with workplace procedures and specifications.
	3.2 Adjustments, including wheel bearing adjustments are made during the service are in accordance with specifications.
4. Prepare equipment for use or storage	4.1 Service schedule documentation is completed.
	4.2 Equipment and work area is cleaned and inspected for serviceable condition in accordance with workplace procedures.
	4.3 Final inspection is made to ensure work is to workplace expectations.

## **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conduct service of a range of steering systems in accordance with workplace and manufacturer/component supplier requirements
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

## **Critical skills and essential knowledge**

Ability to:

- accurately interpret inspection results; and
- use workplace technology related to the inspection and servicing of steering.

Knowledge of:

- Operating principles of mechanical and hydraulic steering systems and their relationship to each other
- Service procedures
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

## **Range statement**

**Steering systems** may be in:

- Light and heavy vehicles
- Motorcycles
- Outdoor power equipment
- Wheeled and tracked vehicles

**System components for inspection** may include:

- Ball joints
- Electronic controlled systems
- Idler arms, including articulated vehicles and tracked type systems
- Rose joints
- Steering boxes and columns, struts
- Two and four wheel steer and full hydraulic steering
- Wheel bearings

**Tools and equipment** may include:

- Gauges
- Hand tools
- Hydraulic testing equipment and devices
- Meters

Methods are to include:

- Aural
- Functional assessments
- Including damage, corrosion, wear and electrical
- Visual

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-D7 Inspect and service suspension systems

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### Unit details

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Functional area D	<b>Brakes, driveline and exhaust</b>
Unit title	<b>Inspect and service suspension systems</b>
Unit code	<b>MS-D7</b>

### Description

This unit of competency describes the skills and knowledge required to inspect and service light vehicle **suspension systems** and associated components.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare to inspect and service suspension <b>systems</b> and associated components	1.1 Nature and scope of work requirements is identified and confirmed.
	1.2 Resources, <b>tools and equipment</b> and materials required are sourced and checked for safe and serviceability.
	1.3 Safety requirements and environmental considerations are observed throughout the work.
2. Conduct inspection and analysis	2.1 Inspection is implemented in accordance with workplace procedures and specifications.
	2.2 Inspection results are compared with manufacturer/component supplier specifications to indicate compliance or non-compliance.
	2.3 Results are documented and recommendations made.
3. Carry out service	3.1 Service is implemented in accordance with workplace procedures and specifications.
	3.2 Adjustments made during the service are in accordance with specifications.
4. Prepare equipment for use or storage	4.1 Service schedule documentation is completed.
	4.2 Equipment and work area is cleaned and inspected for serviceable condition in accordance with workplace procedures.
	4.3 Final inspection is made to ensure work is to workplace expectations and specifications.

## **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conduct the inspection and servicing a range of suspension systems in accordance with workplace and manufacturer/component supplier requirements
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances.

### **Critical skills and essential knowledge**

- Accurately interpret test results
- Complete the work safely and within workplace timeframes
- Use workplace technology related to the inspection and service of suspension systems

Knowledge of:

- Suspension system testing and servicing procedures
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

### **Range statement**

**Suspension systems** may be:

- Gas
- Hydraulic
- Mechanical and rubber suspension
- Pneumatic

**Suspension systems** may be found on:

- Light and heavy vehicles
- Motorcycles
- Outdoor power equipment
- Trailers

**Systems** may include:

- Ball joints
- Height control
- Independent suspension
- Lateral and longitudinal arms
- Ride control
- Rose joints
- Self-levelling device
- Tracked type systems

**Tools and equipment** may include:

- Hand tools and power tools
- Lifting equipment
- Measuring equipment
- Safety stands and supporting equipment
- Testing equipment

Methods may include:

- Adjustment of shock absorbers
- Functional testing, pressure testing, measurement
- Visual, aural and functional assessments (including damage, corrosion, leakage, wear)

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-D8 Repair motorcycle steering and suspension systems

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### Unit details

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Functional area D	<b>Brakes, driveline and exhaust</b>
Unit title	<b>Repair motorcycle steering and suspension systems</b>
Unit code	<b>MS-D8</b>

### Description

This unit of competency describes the skills and knowledge required to determine and carry out motorcycle steering and suspension system repair work requirements.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare to repair steering system and suspension system and associated components	1.1 Nature and scope of work requirements is identified and confirmed.
	1.2 Resources, <b>tools and equipment</b> and materials required are sourced and checked for safe and serviceability.
	1.3 Safety requirements and environmental considerations are observed throughout the work.
2. Conduct inspection/test and analysis	2.1 Motor cycle is <b>road tested for safe operation</b> and adjusted as required.
	2.2 Methods for inspection/test procedures and <b>specifications</b> .
	2.3 Inspection/test results are compared with specifications to indicate compliance or non-compliance.
	2.4 Results are documented and recommendations made.
3. Carry out repairs	3.1 <b>Replacement and repairs of worn or damaged</b> parts of steering systems are conducted in accordance with and specifications.
	3.2 Wheel bearing adjustments are made during the <b>repair</b> in accordance with specifications.
4. Prepare vehicle for use or storage	3.3 Service schedule documentation is completed.
	3.4 Equipment and work area is cleaned and inspected for serviceable condition in accordance with workplace procedures
	3.5 Motorcycle is road tested to ensure all steering and suspension system components are operating safely and effectively and adjusted as required.

## Evidence guide

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conduct repair of a range of systems in accordance with workplace and manufacturer/component supplier requirements
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

## Critical skills and essential knowledge

### Ability to:

- accurately interpret test result; and
- complete the work within workplace timeframes.

### Knowledge of:

- Steering systems repair procedures
- Steering systems testing and adjusting procedures

## Range statement

### Suspension systems may be:

- Gas
- Hydraulic
- Mechanical
- Rubber suspension

### Suspension systems may include:

Ball joints, rose joints  
Lateral and longitudinal arms, independent suspension  
Self-levelling device, ride control, height control

### Tools and equipment may include:

- Computerised diagnostic equipment
- Gauges
- Hand tools
- Load testing devices
- Meters
- Shock absorber testers

### Motorcycle is **road tested for safe operation** to ensure:

- All steering and suspension system components are operating safely and effectively for road holding and cornering with minimal weave, wobble or shimmy

**Worn or damaged parts for repair/replacement** may include:

- Gas, hydraulic, mechanical or rubber suspension systems telescopic (front) fork systems
- Telelever
- Duolever and (rear) monoshock or twin-shock
- Regular swingarm
- Monoshock single-shock swingarm
- Rear monolever
- Rear paralever

**Repair of damaged parts** may include:

- Replace all rubber or other material mountings and bushings
- Rectify any damage from corrosion, wear and electrical faults

**Repair methods** may include:

- Component and /or system adjustments
- Operational testing
- Principles, angles and geometry of wheel alignment
- Visual, aural and functional assessments (including: damage, corrosion, wear)

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

# Functional area E – Body trim and repair (car and motorcycles)

## MS-E1 Prepare vehicles for body repair

### Unit details

Functional area E                      **Body trim and repair (cars and motorcycles)**

Unit title                                      **Prepare vehicles for body repair**

Unit code                                      **MS-E1**

### Description

This unit of competency describes knowledge and skills required to determine preparation needs for body repair of light vehicles and motorcycles.

### Element of competency                      Performance criteria

- |   |  |
|---|--|
| 1. Prepare for work                                 | 1.1. Nature and scope of work requirements is identified and confirmed.<br>1.2. Resources, <b>tools and equipment</b> and materials required are sourced and checked for safe and effective operation.<br>1.3. Safety requirements and environmental considerations are observed throughout the work.  |
| 2. Clean components prior to repairs and/or storage | 2.1 Cleaning agents are used according to specifications.<br>2.2 Components of vehicle are cleaned to facilitate inspection, assessment, replacement, repair and/or storage.<br>2.3 <b>Cleaning</b> of components is achieved without causing damage to component or system.<br>2.4 Cleaning activities are carried out safely and according workplace procedures. |
| 3. Remove, tag and store components                 | 3.1 Components are <b>removed</b> , tagged and stored without causing damage to components or system.<br>3.2 A final inspection is made to ensure all required parts and components have been removed and/or cleaned ready for repair and replacement.   |
| 4. Clean up work area and maintain equipment        | 4.1 Waste, cleaning agents and damaged components are disposed of carefully in accordance with enterprise procedures.<br>4.2 Equipment and tools are cleaned and inspected for serviceable condition, with faulty equipment or tools tagged and identified in accordance with workplace procedures.  |

### 4.3 Workplace documentation is completed as required.

#### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Prepare a range of vehicles for repair in accordance with workplace and manufacturer/component supplier requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

#### **Critical skills and essential knowledge**

Ability to:

- apply vehicle protection methods;
- complete the work safely and within workplace timeframes;
- remove, clean, tag and store a range of component parts; and
- use workplace technology related to pre-repair operations.

Knowledge of:

- Component tagging methods
- Related technical information
- Removal and storage procedures
- Types and layout of service/repair manuals (hard copy and electronic)
- Use and handling of cleaning agents
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

#### **Range statement**

**Tools and equipment** may include

- Hand tools and equipment
- Jacks
- Lifting equipment
- Power tools
- Special equipment (pressure washers, steam cleaners and spray equipment)
- Stands
- Storage tabs and racks
- Vehicle protection

**Cleaning and removal** may include:

- Bright-work
- Glass
- Plastics

- Rubber engine components
- Suspension and final drive components
- Trim brake system components
- Vehicle electrics (special attention should be paid to safe disconnection of electrical components and their storage)
- Vehicle paint-work
- Vehicle under-body
- Wiring looms

**Cleaning and removal** methods may include:

- Dismantling
- Manual washing, machine assisted washing, use of protective coverings

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-E2 Remove and install vehicle glass

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### Unit details

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Functional area E                      **Body trim and repair (cars and motorcycles)**

Unit title                                **Remove and install vehicle glass**

Unit code                                **MS-E2**

### Description

This unit of competency describes the outcomes required to remove and install **vehicle** glass and seals without damage to body panels.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare for work	<p>1.1 Nature and scope of work requirements is identified and confirmed.</p> <p>1.2 <b>Resources</b>, tools and equipment and <b>materials</b> required are sourced and checked for serviceability.</p> <p>1.3 Safety requirements and environmental considerations are observed throughout the work.</p>
2. Remove fixed body glass	<p>2.1 Components that may be affected by work, such as airbags and supplementary restraint systems, are located and isolated.</p> <p>2.2 Fixed glass, such as windscreens and rear windows, is removed after removing the wipers and sealant and, with assistance, breaking the bond.</p> <p>2.3 Moveable glass is removed, after removing all trims, run channels, seals and covers and disconnecting electric or manual winding systems.</p> <p>2.4 Removal is completed without causing damage to any component or system.</p> <p>2.5 Removal is completed in accordance with vehicle manufacturer/component supplier specifications and tolerances physically and measurements taken.</p>
3. Install fixed body glass	<p>3.1 Fixed vehicle glass is installed, using bolted, rubber and adhesive <b>installation methods</b>.</p> <p>3.2 Movable body glass is installed and winding mechanisms re-connected.</p> <p>3.3 Installation is completed without causing damage to any component or system.</p> <p>3.4 Information is accessed and interpreted from manufacturer/component supplier <b>specifications</b>.</p>

- 3.5 Installation of fixed body glass is carried out in accordance with vehicle manufacturer/component supplier specifications and tolerances.
  - 3.6 Final inspection is made to ensure all glass components, wipers, moldings/trims, electrical and mechanical components and systems drainage are fitted to specification and in clean condition.
  - 3.7 Removed glass is disposed of safely, to ensure safety to others.
  - 3.8 Workplace documentation is completed as required.
4. Clean up
- 4.1 Workplace documentation is completed as required.
  - 4.2 Material that can be reused is collected and stored and waste removed following workplace procedures.
  - 4.3 Equipment and work area are cleaned, inspected for faults and maintained in accordance with workplace procedures.

### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Remove and install vehicle glass in a range of vehicles in accordance with workplace and manufacturer/component supplier requirements
- Selecting methods and techniques appropriate to the circumstances

### **Critical skills**

Ability to:

- adjust fixed glass components;
- complete the work safely and within workplace timeframes;
- remove and replace fixed glass components;
- use vehicle protection methods; and
- use workplace technology related to removal, replacement and removal and installation of fixed body glass.

Knowledge of:

- Protection procedures for electrical/electronic systems and equipment
- Removal and storage procedures
- Removal, replacement and alignment procedures for bolt-on body panels sections and fittings
- Reporting/documenting of results
- Sealant selection and application
- Technical information
- Types and layout of service/repair manuals (hard copy and electronic)
- Use of tools and equipment
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

**Range statement**

**Vehicles** may include:

- Caravans and motor homes
- Commercial (small and large)
- Forestry
- Marine craft
- Mining
- Outdoor equipment
- Passenger type
- Plant and agricultural equipment
- Recreational
- Recreational boating

**Resources** may include:

- Manufacturer or supplier specifications
- Workshop manuals and specifications

**Resources** may include:

- Adhesives
- Cutting equipment
- Hand tools
- Lifting equipment
- Power tools
- Scaffolds
- Sealing equipment
- Solvents
- Specification documents

**Materials** include:

- Cleaning materials
- Minor spare parts
- Oils and lubricants

Specific requirements are to include:

- Electrical and mechanical components
- Electrical system(s)
- Glass components
- Mouldings/trims
- Systems drainage

**Installation methods** may include:

- Bolted
- Butyl
- Encapsulated installation
- Rubber
- Urethane

**Specifications** refer to:

- Component supplier
- Manufacturer
- Workplace procedures

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-E3 Realign and repair major vehicle body components

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### Unit details

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Functional area E	<b>Body trim and repair (cars and motorcycles)</b>
Unit title	<b>Realign and repair major vehicle body components</b>
Unit code	<b>MS-E3</b>

### Description

This unit of competency describes the skills and knowledge required to determine requirements for and undertake vehicle body alignment/repair work.

<b>Element of competency</b>	<b>Performance criteria</b>
1 Prepare for work	<p>1.1 Nature and scope of work requirements is identified and confirmed.</p> <p>1.2 Resources, <b>tools and equipment</b> and <b>materials</b> required are sourced and checked for serviceability.</p> <p>1.3 Safety requirements and environmental considerations are observed throughout the work.</p>
2 Conduct initial inspection	<p>2.1 Vehicle for repair is examined visually, mechanically and physically and measurements taken.</p> <p>2.2 Nature and extent of misalignment, including under-body damage, sway, sag and/or twist, is identified using approved measuring methods.</p> <p>2.3 Body panels and components for realignment/repair are identified.</p>
3 Remove components for realignment work	<p>3.1 Vehicle is prepared and installed on the alignment equipment in accordance with specifications.</p> <p>3.2 Hydraulic repair equipment is attached using manufacturer/component supplier approved methods such as heating, hydraulic reforming, sectional repair for a range of joints (e.g. staggered).</p> <p>3.3 <b>Vehicle components</b>, body panels, <b>bolt-on panels and fittings</b> are removed as required without causing damage, tagged and stored.</p>
4 Repair body parts	<p>4.1 Body parts are repaired using appropriate <b>work methods</b> and <b>repair methods</b>.</p> <p>4.2 Suspension, steering, transmissions and other components are replaced to re-aligned bodywork.</p>
5 Replace and realign panels and ancillary fittings	<p>5.1 Replacement components and ancillary fittings meet <b>specifications</b> for dimensions, material and functional capability.</p>

- 5.2 Components and ancillary fittings are replaced and realigned using approved methods, material and equipment, without causing damage.
  - 5.3 Sealant is selected and applied according to specification for type, method of application and thickness.
  - 5.4 Assistance is sought, if required, where there has been a disturbance to electrical, mechanical, electronic or other system.
  - 5.5 Vehicle alignment is reinstated to *specifications* and tolerances without causing damage to any component or system.
  - 5.6 Vehicle components are replaced to re-aligned bodywork.
  - 5.7 Alignment and repair work is checked and re-measured to ensure compliance with manufacturer specification.
- 6 Clean up
- 6.1 Workplace documentation is completed as required.
  - 6.2 Material that can be reused is collected and stored and waste removed following workplace procedures.
  - 6.3 Equipment and work area are cleaned, inspected for faults and maintained in accordance with workplace procedures.

### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Completing in accordance with workplace and manufacturer/component supplier requirements the removal, replacement and realigning operations, at a minimum, to cover:
  - A full front-end, including radiator support and skirt hardware
  - A full door assembly
  - An interior hood lining (or equivalent)
  - Tagging and storing parts.
- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

### **Critical skills**

The candidate must be able to complete removal, replacement and realigning operations, at a minimum, to cover:

- A full front-end, including radiator support and skirt hardware
- A full door assembly
- An interior hood lining (or equivalent)
- Tagging and storing parts.
- Use workplace technology related to removal, replacement and realignment of bolt-on panels and fittings

Knowledge of:

- Protection procedures for electrical/electronic systems and equipment
- Removal and storage procedures
- Removal, replacement and alignment procedures for bolt-on body panels sections and fittings
- Reporting/documenting of results
- Sealant selection and application
- Technical information
- Types and layout of service/repair manuals (hard copy and electronic)
- Use of tools and equipment
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

**Range statement**

**Tools and equipment** may include:

- Hand tools and power tools
- Heating and welding equipment (including oxy acetylene, arc, mig, tig)
- Lifting equipment, lifting and hydraulic push/pull equipment
- Measuring systems/equipment (jigging systems)
- Repair consumables
- Sealing equipment
- Templates
- Vehicle alignment bench (including a range of clamping and anchoring procedures/methods)
- Welding and fastening materials

**Materials** may include:

- Adhesives
- Bolts
- Cleaning materials
- Spare parts

**Vehicle components** may include:

- Mechanical
- Other components
- Steering
- Suspension
- Transmissions

**Bolt-on panels and fittings** may be interior and exterior components, including:

- Bonnets, boot covers, box panels, bumper bars
- Chassis
- Doors, door hardware, door trims, double panels
- Frames
- Guards
- High-stress steels
- In situ panels
- Lamps/lights
- Mono construction
- Plastic body panels
- Seats, sill panels
- Turrets

**Work methods** are to include:

- Headlight aiming
- Measuring and alignment
- Removal and replacement/refitting
- Tagging and storing of parts

**Repair methods** may include:

- Heating
- Mechanical fastening
- Metal cutting
- Panel beating
- Riveting
- Welding

**Specifications** refer to:

- Component supplier
- Manufacturer
- Workplace procedures

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-E4 Replace major welded vehicle panels

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### Unit details

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Functional area E                      **Body trim and repair (cars and motorcycles)**

Unit title                                **Replace major welded vehicle panels**

Unit code                                **MS-E4**

### Description

This unit of competency describes the skills and knowledge required to remove, replace and re-align major welded panels.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare for work	<p>1.1 Nature and scope of work requirements is identified and confirmed.</p> <p>1.2. Resources, <b>tools and equipment</b> and materials required are sourced and checked for serviceability.</p> <p>1.3. Safety requirements and environmental considerations are observed throughout the work.</p>
2. Remove welded panels/panel sections	<p>2.1. Components are removed using approved methods and equipment in accordance with <b>specifications</b>.</p> <p>2.2. Caution is taken to avoid damage where removal of components causes disturbance to electrical, mechanical, air conditioning systems or trim.</p>
3. Replace and align welded panel/panel sections	<p>3.1 <b>Major welded panels</b>/panel sections are replaced and aligned using approved methods and equipment, in accordance with specifications.</p> <p>3.2 <b>Replacements</b> are carried out to pre-paint condition.</p> <p>3.3 Replacement and alignment work is checked and panel fit is measured to ensure compliance with specifications.</p>
4. Clean up	<p>4.1 Workplace documentation is completed as required.</p> <p>4.2 Material that can be reused is collected and stored and waste removed following workplace procedures.</p> <p>4.3 Equipment and work area are cleaned, inspected for faults and maintained in accordance with workplace.</p>

## **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Complete replacement of a minimum of three major panels to manufacturer/component supplier and workplace requirements, including one rail and skirt and one centre pillar and sill panel assembly
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

## **Critical skills and essential knowledge**

Ability to:

- complete the work safely and within workplace timeframes; and
- use workplace technology related to pre-repair operations.

Knowledge of:

- Major welded panel replacement procedures and techniques
- Types and layout of service/repair manuals (hard copy and electronic)
- Types of metal materials
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

## **Range statement**

**Tools and equipment** may include:

- Hand tools
- Heating and welding equipment which may include: arc, oxy acetylene, mig, tig
- Measuring equipment and/or systems
- Power tools and equipment, including hydraulic push pull
- Vehicle protection specialist tools and equipment

**Specifications** refer to those supplied by:

- Component supplier
- Manufacturer
- The workplace

**Major welded panels** may include:

- Beaver panels
- Door skins
- Outer pillar panels
- Outer sill panels
- Quarter panels
- Radiator support panels
- Turret skins.

**Replacement** methods are to include:

- Heat shrinking
- Hydraulic forming
- Measuring and alignment techniques
- Welded panel replacement
- Welding (oxy acetylene, MIG, TIG and spot)

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-E5 Remove paint from vehicles

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### Unit details

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Functional area E                      **Body trim and repair (cars and motorcycles)**

Unit title                                **Remove paint from vehicles**

Unit code                                **MS-E5**

### Description

This unit of competency describes the skills and knowledge required to remove paint from vehicles in preparation for rectifying paint faults.

### Element of competency      Performance criteria

- |                     |   |
|---------------------|---|
| 1. Prepare for work | 1.1 Nature and scope of work requirements is identified and confirmed.  |
|                     | 1.2 Resources, <b>tools and equipment</b> and materials required are sourced and checked for serviceability.                                    |
|                     | 1.3 Safety requirements and environmental considerations are observed throughout the work.  |
| 2. Remove paint     | 2.1 Paint removal procedures are determined based on the required finish material.  |
|                     | 2.2 Protection is given to body/trim parts that are not having paint removed.   |
|                     | 2.3 Paint is removed, using combinations of chemical and mechanical <b>methods</b> and tools, equipment and material suitable to type of paint. |
|                     | 2.4 Under-paint damage requiring panel repair/replacement is identified and reported to the supervisor.   |
|                     | 2.5 Unpainted surfaces are detailed manually and protective coating is applied to prepare for painting.   |
| 3. Clean up         | 3.1 Workplace documentation is completed as required.   |
|                     | 3.2 Material that can be reused is collected and stored and waste removed following workplace procedures.                                       |
|                     | 3.3 Equipment and work area are cleaned, inspected for faults and maintained in accordance with workplace.                                      |

### Evidence guide

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Remove paint from a range of vehicles in accordance with workplace and manufacturer/component supplier requirements
- Selecting methods and techniques appropriate to the circumstances

### **Critical skills and essential knowledge**

Ability to:

- apply protection methods;
- apply workplace technology related to the application of paint removal methods;
- complete the work safely and within workplace timeframes;
- determine the paint removal process;
- remove paint (chemically and mechanically); and
- use communication skills in dealing with customers and team members.

Knowledge of:

- Paint removal procedures, tools and equipment
- Paint removal processes and materials
- Types and layout of service/repair manuals (hard copy and electronic)
- Types of refinishing materials
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

### **Range statement**

**Tools and equipment** may include:

- Abrasives
- Grinders
- Scrapers

**Methods** may include:

- Chemical substances
- Mechanical means
- Protection of body/trim components
- Polishing and detailing of surfaces

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-E6 Repair vehicle body panels

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### Unit details

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Functional area E                      **Body trim and repair (cars and motorcycles)**

Unit title                                **Repair vehicle body panels**

Unit code                                **MS-E6**

### Description

This unit of competency describes the skills and knowledge required to determine requirements for and apply body panel beating and split **panel repair** work.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare for work	<p>1.1 Nature and scope of work requirements is identified and confirmed.</p> <p>1.2 Resources, <b>tools and equipment</b> and materials required are sourced and checked for safe and serviceability.</p> <p>1.3 Safety requirements and environmental considerations are observed throughout the work.</p>
2. Carry out metal panel beating repairs/ Carry out metal finishing / Carry out repairs using body fillers	<p>2.1 Damaged area is roughed out for repair and metal straightened using templates and dolly and hammer for dents.</p> <p>2.2 Templates are made for return-shaped panels and straightened as required.</p> <p>2.3 Components are repaired using approved <b>methods</b> and equipment in accordance with specifications.</p> <p>2.4 Where repair of components may include disturbance to electrical, mechanical, air conditioning systems or trim, assistance is sought as required.</p> <p>2.5 Repairs are carried out to pre-paint condition.</p> <p>2.6 Repairs are checked to specification and are prepared for the next repair operation or painting.</p>
3. Carry out metal panel split repairs	<p>3.1 Torn edges of split panels are aligned and tack-welded before applying final repair weld.</p> <p>3.2 Components are repaired using approved <b>methods</b> and equipment in accordance with <b>specifications</b>.</p> <p>3.3 Where repair of components includes disturbance to electrical, mechanical, air conditioning systems or trim, assistance is sought as required.</p> <p>3.4 Repairs are carried out to pre-paint condition.</p>

- 3.5 Repairs are checked to specification and are fully prepared for the next repair operation or painting.
- 4. Carry out metal heat shrinking operations
  - 4.1 Metal heat shrinking operations are carried out for high spots using oxy-acetylene or electric shrinking rod as required.
  - 4.2 Components are repaired using approved methods and equipment in accordance with specifications.
  - 4.3 Repairs are checked to specification and are fully prepared for the next repair operation or painting.
- 5. Clean up
  - 5.1 Workplace documentation is completed as required.
  - 5.2 Material that can be reused is collected and stored and waste removed following workplace procedures.
  - 5.3 Equipment and work area are cleaned, inspected for faults and maintained in accordance with workplace requirements.

### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Repair body parts of a range of vehicles in accordance with workplace and manufacturer/component supplier requirements
- Selecting methods and techniques appropriate to the circumstances

### **Critical skills**

Ability to:

- apply heat shrinking procedures to industry standard;
- apply panel beating repair procedures to industry standard;
- apply panel beating repair, split-panel repair and heat shrinking and procedures;
- apply split-panel repair procedures to industry standard;
- apply vehicle protection methods;
- complete the work safely and within workplace timeframes; and
- use workplace technology related to repair of body panels.

Knowledge of:

- Body filler repair procedures and techniques
- Heat shrinking methods and techniques
- Metal material types and stress limits
- Panel beating and split panel repair methods and techniques
- Types and layout of service/repair manuals (hard copy and electronic)
- Types of body filler and their application
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

### **Range statement**

**Panel repair** (metal finishing) covers:

- File finishing in metals using no fillers to repair split/tear and dents
- Panels are of mild steel construction

**Tools and equipment** may include:

- Dolly and hammer
- Electric shrinking rod
- Hand tools
- Lifting equipment
- Oxy-acetylene heat shrinking equipment
- Power tools and equipment
- Special tools
- Templates
- Vehicle protection
- Welding equipment

**Repair methods** are to include:

- File finishing
- Hand dolly finishing
- Heat shrinking
- Panel stripping and preparation
- Welding

**Methods** may include:

- Heat shrinking
- Metal panel beating
- Panel split repair

**Specifications** refer to those supplied by:

Component supplier  
Manufacturer  
The workplace

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-E7 Replace and align new vehicle panels, sections and fittings

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### Unit details

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Functional area E	<b>Body trim and repair (cars and motorcycles)</b>
Unit title	<b>Replace and align new vehicle panels, sections and fittings</b>
Unit code	<b>MS-E7</b>

### Description

This unit of competency describes the skills and knowledge required to replace and align new vehicle panels, sections and fittings, realigning to match other panels and trim.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare for work	<p>1.1 Nature and scope of work requirements is identified and confirmed.</p> <p>1.2 Resources, <b>tools materials and equipment</b> required, are sourced and checked for safe and effective operation.</p> <p>1.3 Safety requirements and environmental considerations are observed throughout the work.</p>
2. Replace and align new vehicle panels, sections and fittings	<p>2.1 <b>Interior and exterior components and ancillary fittings</b> are fitted and realigned, checking to ensure specified shut lines are met, and using approved <b>work methods</b>, materials and equipment.</p> <p>2.2 Appropriate seals and sealants are selected and applied or fitted according to product specifications for type, method of application and thickness.</p> <p>2.3 Replacement and realignment of vehicle body panel sections and ancillary fittings is completed without causing damage to any component or system.</p> <p>2.4 Inspection is made of replaced panels and components to ensure they meet specifications</p> <p>2.5 Alignment is adjusted as required, including to headlight aiming, where necessary.</p>
3. Clean up	<p>3.1 Workplace documentation is completed as required.</p> <p>3.2 Material that can be reused is collected and stored and waste removed following workplace procedures.</p> <p>3.3 Equipment and work area are cleaned, inspected for faults and maintained in accordance with workplace.</p>

## **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Complete replacement of panels sections and fittings to manufacturer/component supplier and workplace requirements
- Communicating effectively with others involved in or affected by the work
- Complete panel alignment to manufacturer/component supplier and workplace requirements
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

## **Critical skills and essential knowledge**

Ability to:

- complete the work safely and within workplace timeframes; and
- use workplace technology related to the replacement of panels sections and fittings.

Knowledge of:

- Protection procedures for electrical/electronic systems and equipment
- Replacement and alignment procedures for panels sections and fittings
- Requirements for reporting/documenting of results
- Sealant selection and application
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

## **Range statement**

**Tools, materials and equipment** may include:

- Adhesives
- Bolts
- Cleaning materials
- Hand and power tools
- Heating and welding equipment (including oxy acetylene, arc, mig, tig)
- Lifting equipment
- Measuring systems/equipment
- Sealing equipment, spare parts
- Templates
- Vehicle alignment bench (including a range of clamping and anchoring procedures/methods),
- Welding and fastening materials

**Interior and exterior components and ancillary fittings** may include:

- Bonnets, boot covers, bumper bars
- Doors, door hardware, door trims
- Guards
- Lamps/lights
- Seats

**Work methods** are to include:

- Fitting
- Headlight aiming
- Measuring and alignment
- Welding

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-E8 Repair and align motorcycle frames

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### Unit details

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Functional area E	<b>Body trim and repair (cars and motorcycles)</b>
Unit title	<b>Repair and align motorcycle frames</b>
Unit code	<b>MS-E8</b>

### Description

This unit of competency describes the skills and knowledge required to replace or repair and align motorcycle frames.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare to undertake frame alignment and repair	1.1 Nature and scope of work requirements is identified and confirmed.
	1.2. Resources, <b>tools and equipment</b> and materials required are sourced and checked for safe and serviceability.
	1.3. Safety requirements and environmental considerations are observed throughout the work.
2. Inspect and measure to determine repair requirements	2.1 Engine, transmission and ancillary components are removed from the frame.
	2.2 Frame is <b>inspected, and most appropriate method for repair/alignment</b> is determined.
	2.3 Work is completed without causing damage to any component or system.
	2.4 Results of inspection are documented/processed in accordance with enterprise requirements.
3. Replace repair and frame and components	3.1 Alignment of frame and components is carried out in accordance with vehicle specifications for methods, equipment used and tolerances.
	3.2 Engine, transmission and other ancillary components are replaced onto the re-aligned frame.
	3.3 Alignment is completed without causing damage to any component or system.
4. Prepare frame for delivery and/or storage	3.1 Alignment/repair documentation completed.
	3.2 Equipment and work area is cleaned and inspected for serviceable condition in accordance with workplace procedures.
	3.3 Final inspection is made to ensure protective guards, safety features and cowlings are in place and re-measurement of frame ensures it meets manufacturer's specifications.

### 3.4 Frame is prepared and/or stored to workplace expectations.

#### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conduct the repair and alignment of a range of frames in accordance with the workplace and manufacturer/component supplier requirements
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

#### **Critical skills and essential knowledge**

Ability to:

- accurately interpret measurements;
- complete repair and alignment of frames and associated components safely and within workplace timeframes; and
- use workplace technology related to repair and alignment of motorcycle frames.

Knowledge of:

- Alignment procedures
- Principles of frame alignment and steering geometry as applied to motorcycles
- Repair procedures
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

#### **Range statement**

**Tools and equipment** may include:

- Air operated equipment
- Hand tools and power tools
- Heating equipment
- Lifting equipment
- Measuring equipment
- Pressing equipment
- Pullers
- Specialist tools for removal/adjustment
- Testing equipment
- Welders - MMAW, OXY, GMAW, GTAW

**Inspection, repair and alignment methods** may include:

- Using principles, angles and geometry of vehicle wheel and frame alignment
- Visual, aural and functional assessment

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-E9 Finish vehicle body panels for painting

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### Unit details

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Functional area E                      **Body trim and repair (cars and motorcycles)**

Unit title                                **Finish vehicle body panels for painting**

Unit code                                **MS-E9**

### Description

This unit of competency describes the skills and knowledge required to determine minor panel repair and finish work repairs for damaged vehicles, apply fillers and protective coatings in preparation for painting.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare for work	1.1 Nature and scope of work requirements is identified and confirmed.
	1.2 Resources, <b>tools and equipment</b> and <b>materials</b> required are sourced and checked for safe and serviceability.
	1.3 Safety requirements and environmental considerations are observed throughout the work.
2. Prepare vehicle surfaces for painting	2.1 Surfaces adjacent to the surfaces to be painted are protected using approved methods and material.
	2.2 Surfaces to be painted are cleaned of contaminants.
	2.3 Minor rust is removed and surface cleaned to bare metal setting aside panels with too much damage for repair for replacement.
	2.4 Components and ancillary fittings that can be affected by the painting process are protected and/or removed and stored securely.
	2.5 Surfaces to be painted are <b>prepared</b> using approved <b>methods</b> , material and equipment.
3. Apply primers	3.1 <b>Vehicle components</b> and ancillary fittings that can be affected by application processes are protected and/or removed and stored safely.
	3.2 Primers/primer surfaces are applied using approved methods, materials and equipment.
	3.3 Work is completed without causing damage to any component or system.
4. Prepare primed surface for refinishing	4.1 Surfaces to be refinished are prepared using approved methods, materials and equipment.
	4.2 Work is completed without causing damage to any component or system.

- 4.3 Carry out all repairs out to pre-paint condition using body fillers as necessary.
- 4.4 Final inspection is made to ensure all panel and components are smooth, contoured to specification and have been fully prepared for painting.
- 5. Clean up
  - 5.1 Workplace documentation is completed as required.
  - 5.2 Material that can be reused is collected and stored and waste removed following workplace procedures.
  - 5.3 Equipment and work area are cleaned, inspected for faults and maintained in accordance with workplace requirements.

### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Finish vehicle body panels for painting in a minimum of three vehicles in accordance with workplace and manufacturer/component supplier requirements
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

### **Critical skills and essential knowledge**

#### **Ability to:**

- apply primers to specifications;
- clean and mask the areas/equipment for paint repairs;
- complete the work safely and within workplace timeframes; and
- remove components and ancillary fittings for protection.

#### **Knowledge of:**

- Cleaning materials
- Preparation methods
- Primer/paint application methods, including rolling
- Rubbing down procedures
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

### **Range statement**

#### **Tools and equipment** may include:

- Adhesive equipment
- Cleaning equipment
- Hand tools

- Hand touch-up equipment
- Paint rollers
- Power tools
- Rubbing down equipment
- Spray painting equipment

**Materials** may include:

- Abrasives, adhesives
- Cleaning materials
- Fillers
- Glazing and spot putty
- Paint primers, primers
- Rigid/flexible plastic spreaders
- Specialist tools and lifting equipment
- Template
- Vehicle protection
- Welding and heating equipment

**Vehicle components** to be prepared are to include:

- Bonnets
- Doors
- Glasswork
- In-situ panels
- Plastic components

**Preparation** may include:

- Accessories
- Decals
- Internal and external trim
- Lights
- Protective strips
- Rubber seals
- Striping

**Preparation methods** are to include:

- Adhesive bonding
- Chemical cleaning
- Masking
- Paint touch-up
- Priming
- Sanding (wet and dry)
- Surface preparation

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-E10 Mask vehicles for painting

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### Unit details

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Functional area E                      **Body trim and repair (cars and motorcycles)**

Unit title                                **Mask vehicles for painting**

Unit code                                **MS-E10**

### Description

This unit of competency describes the skills and knowledge required to prepare and apply masking medium in preparation for vehicle/component painting.

### Element of competency            Performance criteria

- |   |  |
|---|--|
| 1. Prepare for work                         | 1.1 Nature and scope of work requirements is identified and confirmed.   |
|   | 1.2 Resources, <b>tools and equipment</b> and <b>materials</b> required are sourced and checked for safe and serviceability.   |
|   | 1.3 Safety requirements and environmental considerations are observed throughout the work.   |
| 2. Prepare vehicle body surfaces by masking | 2.1 Surfaces to be refinished are cleaned of contaminants.   |
|   | 2.2 Components and ancillary fittings that can be affected by the refinishing process are protected and/or removed, tagged and stored securely.                                      |
|   | 2.3 Surfaces adjacent to the surfaces to be refinished are protected using approved <b>masking methods</b> and materials.  |
|   | 2.4 Preparation is completed without causing damage to component or system.  |
|   | 2.5 Masked areas are inspected for compliance with instructions and to ensure no paint bleeding can occur onto other areas and the areas to be painted are free of masking material. |
| 3. Clean up                                 | 3.1 Workplace documentation is completed as required.  |
|   | 3.2 Material that can be reused is collected and stored and waste removed following workplace procedures.  |
|   | 3.3 Equipment and work area are cleaned, inspected for faults and maintained in accordance with workplace.   |

## Evidence guide

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Mask a minimum of three vehicles in preparation for painting in accordance with workplace and manufacturer/component supplier requirements
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

### Critical skills

- Apply vehicle protection methods
- Complete the masking of a range of materials and surfaces
- Complete the work safely and within workplace timeframes
- Use workplace technology related to carrying out masking procedures

Knowledge of:

- Cleaning agents
- Masking materials and procedures
- **Masking procedures**
- Operating procedure of equipment
- Technical information
- Work organisation and planning processes

### Range statement

**Tools and equipment** may include:

- Cutting blades/scalpels
- Dispensers and spray equipment
- Masking machines

**Materials** may include:

- Cleaning materials
- Marking papers and films
- Various masking tapes (crepe, PVC, door aperture and trim masking tapes)

**Masking methods** are to include:

- Dispensing
- Masking
- Spraying

**Masking procedures** are to be applied to

- Bonnets
- Boots
- Doors
- Fenders

- Glass work
- In-situ panels
- Other relevant components
- Plastic components

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-E11 Apply solid acrylic enamel refinishing

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### Unit details

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Functional area E	Body trim and repair (cars and motorcycles)
Unit title	Apply solid acrylic enamel refinishing
Unit code	MS-E11

### Description

This unit of competency describes the skills and knowledge required to apply solid acrylic enamel refinishing materials to prepared substrates to cars and motorcycles.

Element of competency	Performance criteria
1. Prepare for work	<p>1.1 Nature and scope of work requirements, including method, equipment, materials type, color, quality and quantity is identified and confirmed.</p> <p>1.2 Resources, <b>tools and equipment</b> and <b>materials</b> required are sourced and checked for safe and serviceability.</p> <p>1.3 Safety requirements and environmental considerations are observed throughout the work.</p>
2. Apply solid acrylic enamel refinishing materials by spray gun	<p>2.1 The environment for application of <b>refinishing materials</b> conforms to requirements for temperature, extraction of fumes and cleanliness.</p> <p>2.2 Refinishing materials are applied at manufacturer/component supplier recommended intervals using approved <b>methods</b>.</p> <p>2.3 Refinishing materials are dried using approved methods and equipment.</p> <p>2.4 Paint film surface faults are removed using compounds, polishes and glazes.</p> <p>2.5 Refinishing materials are prepared, ensuring accurate paint mixing for colour and consistency.</p> <p>2.6 Refinishing materials are applied without causing damage to any component or system.</p> <p>2.7 The finish produced meets specifications for colour, texture, depth and gloss and is contaminant-free, blending into the surrounding surfaces.</p> <p>2.8 Surface refinishing is completed within approved timeframes.</p>

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| 3. Identify paint faults, causes and rectification procedures                        | 3.1 Paint faults are identified according to industry and workplace procedures.   |
|  | 3.2 Paint fault causes are determined according to industry and workplace procedures.   |
|  | 3.3 Rectification procedures are determined according to fault and type of finish material, industry standard practices and workplace requirements. |
| 4. Rectify and touch up paint faults of solid (two component system) paint materials | 4.1 Materials to restore paintwork to as-new condition are determined from industry and standards.  |
|  | 4.2 Damaged paintwork is rectified to blend with existing paintwork on vehicle.   |
|  | 4.3 Masking is removed without any damage to previous or new panel finish after drying.   |
|  | 4.4 Paint faults are rectified without causing damage to any component or system.   |
| 5. Clean up  | 5.1 Workplace documentation is completed as required.   |
|  | 5.2 Material that can be reused is collected and stored and waste removed following workplace procedures.   |
|  | 5.3 Equipment and work area are cleaned, inspected for faults and maintained in accordance with workplace   |

### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Prepare and apply solid acrylic enamel (two component system) paint in accordance with workplace and manufacturer/component supplier requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

### **Critical skills**

Ability to:

- apply solid acrylic enamel refinishing materials (two component system);
- complete the work safely and within workplace timeframes;
- identify and analyse technical information;
- identify paint faults and determine rectification procedures;
- prepare solid acrylic enamel (two component system) paint;

- rectify paint faults; and
- use workplace technology related to application of solid acrylic enamel refinishing materials.

Knowledge of:

- Drying methods for solid acrylic enamel refinishing material (two component system)
- Paint application methods
- Paint surface fault identification and rectification procedures
- Spray gun cleaning methods
- Spray gun operation (spraying techniques)
- Types and layout of service/repair manuals (hard copy and electronic)
- Types of solid acrylic enamel refinishing materials (two component system)
- Types of spray guns
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

### **Range statement**

**Tools and equipment** may include:

- Air compressors
- Air pressure regulators
- Baking ovens
- Ford cup
- Heating and lighting systems
- Measuring sticks
- Safety equipment
- Spray booths
- Strainers
- Various spray guns

**Materials** may include:

- Cleaning materials
- Compounds
- Glazes
- Polishing buffs and pads
- Rags
- Solvents

**Refinishing materials** may include:

- Hardeners
- Reducers
- Solid acrylic enamels

**Refinishing methods** may include:

- Compound polishing
- Detailing of surfaces
- Drying procedures
- Paint mixing
- Spray gun selection equipment protection methods
- Various spraying techniques

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-E12 Use vehicle paint finishing techniques

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### Unit details

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Functional area E	<b>Body trim and repair (cars and motorcycles)</b>
Unit title	<b>Use vehicle paint finishing techniques</b>
Unit code	<b>MS-E12</b>

### Description

This unit of competency describes the skills and knowledge required to undertake denibbing, buffing, polishing procedures to required finish for cars and motorcycles.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare for work	1.1 Nature and scope of work requirements is identified and confirmed.
	1.2 Resources, <b>tools and equipment</b> and <b>materials</b> required are sourced and checked for safe and serviceability.
	1.3 Safety requirements and environmental considerations are observed throughout the work.
2. Denib work	2.1 Surface materials and <b>methods</b> to achieve finish requirements are identified.
	2.2 Denibbing heads are installed and set-up according to workplace procedures.
	2.3 Paint surface is machine ground/denibbed to workplace requirements.
	2.4 All denibbing procedures are completed within recognised workplace guidelines.
	2.5 Work is denibbed without causing damage to any component or system.
3. Buff work	3.1 Surface materials and finish requirements are identified.
	3.2 Buffing heads are installed and set-up according to workplace procedures.
	3.3 Paint surface is buffed to workplace requirements, using manual techniques as required.
	3.4 All finishing procedures are completed within recognised workplace guidelines.
	3.5 Work is buffed without causing damage to any component or system.

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|----------------|---|
| 4. Polish work | 4.1 Surface materials and finish requirements are identified.   |
|                | 4.2 Polishing heads are installed and set-up according to workplace procedures.   |
|                | 4.3 Body refinishing materials and solid and liquid compositions are applied using underhand and overhand techniques.   |
|                | 4.4 Job surface is polished to workplace requirements, using manual techniques as required.   |
|                | 4.5 All finished surfaces are checked for faults or buffing/polishing errors and rectified as required to ensure the finished surfaces meet workplace specifications. |
| 5. Clean up    | 5.1 Workplace documentation is completed as required.   |
|                | 5.2 Material that can be reused is collected and stored and waste removed following workplace procedures.   |
|                | 5.3 Equipment and work area are cleaned, inspected for faults and maintained in accordance with workplace   |

### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Safely denib, buff and polish a minimum of three vehicles in accordance with workplace and manufacturer/component supplier requirements
- Selecting methods and techniques appropriate to the circumstances

### **Critical skills**

Ability to:

- achieve painted surface finish outcome;
- buff painted surfaces without causing damage to equipment or injury to persons;
- complete the work safely and within workplace timeframes;
- denib painted surfaces without causing damage to equipment or injury to persons;
- polish painted surfaces without causing damage to equipment or injury to persons; and
- use workplace technology related to denibbing, buffing and polishing of refinishing materials.

Knowledge of:

- Application of denibbing buffing and polishing equipment
- Denibbing, buffing and polishing procedures and techniques
- Operating procedures for denibbing, buffing and polishing equipment
- Surface materials and finish requirements
- Types and layout of service/repair manuals (hard copy and electronic)

- Workplace policies and procedures, including quality requirements, reporting and recording procedures

**Range statement**

**Tools and equipment** may include:

- Power tools, including flexible drive appliances

**Materials** may include:

- Cleaning materials
- Fabric mops
- Felt wheels
- Polishes

**Methods** are to include:

- Buffing
- Denibbing
- Hand and machine grinding
- Polishing
- Underhand and overhand techniques

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

# Functional area F – Electrical and electronic systems

## MS-F1 Vehicle charging systems

### Unit details

Functional area F	<b>Mechanical Services</b>
Unit title	<b>Vehicle charging systems</b>
Unit code	<b>MS-F1</b>

### Description

This unit describes the skills and knowledge required to determine work needs to test and repair vehicle charging systems.

Element of competency	Performance criteria
1. Prepare for work	1.1 Nature and scope of work requirements <b>to test and repair charging systems</b> is identified and confirmed.
	1.2 Resources, <b>tools and equipment</b> and <b>materials</b> required are sourced and checked for safe and serviceability.
	1.3 Safety requirements and environmental considerations, are observed throughout the work.
2. Test systems/ components and identify faults	2.1 Battery connection is checked to ensure it is in working order, can carry a full charge and is correctly connected to the charging system.
	2.2 Tests are carried out to determine <b>faults</b> , using appropriate tools and techniques.
	2.3 Tests are completed without causing damage to component or system.
	2.4 Faults are identified and preferred repair action decided.
3. Repair charging systems and/or associated components	3.1 Repairs, component replacement and adjustments are carried out to specifications.
	3.2 Appropriate selection and use is made of tools, techniques and materials.
	3.3 Charging systems are repaired without causing damage to component or system.
	3.4 Retests are performed to ensure charging system is operating safely and correctly.
	3.5 Battery is re-charged and vehicle checks completed.
4. Clean up	4.1 Workplace documentation is completed as required.
	4.2 Material that can be reused is collected and stored and waste removed following workplace procedures.

- 4.3 Equipment and work area are cleaned, inspected for faults and maintained in accordance with workplace requirements.

### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Repair charging systems to manufacturer/component supplier requirements
- Selecting methods and techniques appropriate to the circumstances

### **Critical skills and essential knowledge**

Ability to:

- accurately diagnose and determine faults;
- complete the work within workplace timeframes;
- conduct post-repair test charging systems to requirements;
- test charging systems/components; and
- use problem solving skills to apply procedures to test and identify faults.

Knowledge of:

- Adjustment procedures of systems/components
- Construction and operation of charging systems relevant to application
- Repair/removal and replacement procedures
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

### **Range statement**

**Repair and test methods** may include:

- Amp tests on running units
- Electrical measurements, diagnosis and determining faults
- Ohms tests on components
- Pre- and post-repair testing of system and component operation
- Reading/interpreting wiring diagrams
- Removal and replacement
- Repair adjustments
- Repair/replacement of system components

**Charging systems** may include:

- Alternators, electromagnetic and permanent magnet
- Battery-sensed and non-battery-sensed regulation
- Belt and/or direct drive, single/multiple belt drive and adjustable tensioning devices

- Dynastart, solid state and mechanical regulation
- Generators
- Internal/external regulation
- Single phase, half wave rectified and full wave rectified
- Solar systems, including single and ganged panels, internal and external regulation, battery sensed and non-battery sensed, 6 v, 12 v and 24 v operation, and solid state controlled

**Charging systems** may be fitted to:

- Heavy commercial vehicles
- Light vehicles
- Marine vessels
- Outdoor power equipment
- Plant and equipment

**Tools and equipment** may include:

- Cro or oscilloscope
- Electrical loading equipment
- Hand tools
- Induction ammeter
- Power tools and air tools
- Single and ganged panels
- Soldering equipment
- Test benches
- Test light
- Testing equipment, including multimeters, voltmeters and ammeters

**Materials** may include:

- Cleaning material
- Soldering consumables
- Spare parts

**Faults** may include:

- Alternator drive problems
- Internal alternator faults, including open and short circuits and ground circuits
- Regulator malfunction
- System not charging

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-F2 Remove and replace electrical/electronic components

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### Unit details

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Functional area F	<b>Electrical and electronic systems</b>
Unit title	<b>Remove and replace electrical/electronic components</b>
Unit code	<b>MS-F2</b>

### Description

This unit describes the skills and knowledge required to remove or replace light vehicle and motorcycle components, electrical/electronic components, and computer control units to prepare for body repair activities.

**Note:** Assistance may be required when removing/replacing air conditioning system/components and for decommissioning and re-commissioning.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare for work	<p>1.1 Nature and scope of work requirements is identified and confirmed.</p> <p>1.2 Resources, tools and equipment and <b>materials</b> required are sourced and checked for safe and serviceability.</p> <p>1.3 Safety requirements and environmental considerations are observed throughout the work.</p>
2. Remove <b>electrical/electronic units/assemblies</b>	<p>2.1 Equipment is disconnected and <b>tested</b> before removal to ensure it is isolated from the vehicle power supply.</p> <p>2.2 Electrical/electronic units/assemblies are removed using approved methods, tools and equipment.</p> <p>2.3 Assistance is sought, where required, in relation to air conditioning and LPG/NGV system/ components removal.</p> <p>2.4 Removal is completed without causing damage to component or system.</p> <p>2.5 Units/assemblies are handled and stored in accordance with requirements.</p>
3. Replace assemblies	<p>3.1 Replacement units/assemblies are obtained and manufacturer's parts/catalogue number checked to confirm it is the correct component.</p> <p>3.2 Electrical units/assemblies are replaced using approved methods, tools and equipment.</p> <p>3.3 Assistance is sought where required, in relation to air conditioning and LPG/NGV system/ components replacement.</p> <p>3.4 Replacement is completed without causing damage to component or system.</p>

- 3.5 Electrical units/assemblies are refitted using approved methods, tools and equipment without causing damage to component or system.
- 3.6 Power supply system is reconnected to vehicle.
- 3.7 Replaced units/assemblies are tested to ensure correct and safe operation to manufacturer's specification.
- 4. Clean up
  - 4.1 Workplace documentation is completed as required.
  - 4.2 Material that can be reused is collected and stored and waste removed following workplace procedures.
  - 4.3 Equipment and work area are cleaned, inspected for faults and maintained in accordance with workplace.

### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Complete final functional test to specifications
- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Remove and replace a minimum of four units/assemblies to workplace and manufacturer/component supplier requirements, including:
  - One supplementary restraint system
  - One body electronic module
  - One engine module
- Selecting methods and techniques appropriate to the circumstances

### **Critical skills and essential knowledge**

The ability to:

- complete final functional test to specifications;
- remove and replace a minimum of four units/assemblies to workplace and manufacturer/component supplier requirements, including:
  - One supplementary restraint system
  - One body electronic module
  - One engine module
- use relevant tools and equipment; and
- use workplace technology related to removal and replacement of electrical and electronic units/assemblies, including use of specialist tools, measuring equipment and communication devices and the reporting/documenting of results.

Knowledge of:

- Removal and replacement procedures for electrical/electronic units/assemblies
- Sealant selection and application
- Types, applications and external specifications of electrical/electronic units/assemblies
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

**Range statement**

**Tools and equipment** may include:

- Hand tools
- Jacking
- Special equipment for removal and replacement
- Support and lifting equipment

**Materials** may include:

- Cleaning material
- Minor spare parts

**Electrical/electronic units/assemblies** may include:

- Activities
- Headlights

Critical precautions may include:

- Manufacturer/component supplier procedures which must be applied, as poor working practices are likely to damage electronic system ecus and/or other components.

**Testing equipment** may include:

- Ammeters
- Multimeters
- Voltmeters

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-F3 Service, maintain and replace batteries

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### Unit details

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Functional area F	<b>Vehicle charging systems</b>
Unit title	<b>Service, maintain and replace batteries</b>
Unit code	<b>MS-F3</b>

### Description

This unit describes the skills and knowledge required to test batteries, analyze test results and service or remove and replace vehicle batteries.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare for work	<p>1.1 Nature and scope of work requirements is identified and confirmed.</p> <p>1.2 Resources, <b>tools and equipment</b> and <b>materials</b> required are sourced and checked for safe and serviceability.</p> <p>1.3 Technical and/or calibration requirements for testing batteries are sourced and support equipment is identified and prepared.</p> <p>1.4 Safety requirements and environmental considerations are observed throughout the work.</p>
2. Conduct battery test	<p>2.1 Methods for the conduct of tests are implemented in accordance with workplace procedures and specifications.</p> <p>2.2 Battery is disconnected from vehicle power supply and isolation is confirmed.</p> <p>2.3 Battery and cable test results are compared with specifications to indicate compliance or non-compliance.</p> <p>2.4 Results are documented and recommendations made.</p>
3. Service batteries	<p>3.1 Service battery by checking electrolyte levels, topping up.</p> <p>3.2 Electrolyte levels are checked and topped up as required, in accordance with site procedures.</p> <p>3.3 Batteries and terminals are cleaned in accordance with site procedures.</p> <p>3.4 Battery is retested to determine whether it meets performance requirements.</p> <p>3.5 Terminals are re-connected to vehicle power supply and check all electrical components are receiving suitable power for operation.</p>

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| 4. Remove and replace battery           | 4.1 | Procedures and information are identified and sourced.  |
|   | 4.2 | Where test results show non-complaint performance, battery is removed and replaced, in accordance with workplace procedures and specifications. |
| 5. Prepare equipment for use or storage | 5.1 | Service schedule documentation is completed.  |
|   | 5.2 | Equipment and work area is cleaned and inspected for serviceable condition in accordance with workplace procedures.                             |
|   | 5.3 | Final inspection is made to ensure protective guards, safety features and cowlings are in place.  |
|   | 5.4 | Final inspection is made to ensure work is to workplace expectations.   |

### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conduct servicing, removal and replacement in accordance with workplace and manufacturer/component supplier requirements
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

### **Critical skills and essential knowledge**

The ability to:

- accurately interpret inspection results;
- carry out testing to requirements;
- complete work safely and within workplace timeframes; and
- use workplace technology related to servicing, maintenance and replacement of batteries, including use of specialist tooling, measuring equipment and communication devices and the reporting/documenting of results.

Knowledge of:

- Operating principles of batteries and chargers and their relationship to each other
- Testing procedures
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

## **Range statement**

**Tools and equipment** may include:

- Ammeter
- Gauges
- Hand tools
- Load testing devices.
- Meters
- Power tools
- Voltmeter

**Materials** may include:

- Battery consumables
- Cables
- Cleaning materials
- New batteries

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-F4 Repair vehicle low voltage single electrical circuits

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### Unit details

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Functional area F	<b>Vehicle charging systems</b>
Unit title	<b>Repair vehicle low voltage single electrical circuits</b>
Unit code	<b>MS-F4</b>

### Description

This unit describes the skills and knowledge required to test and repair low voltage single electrical circuits.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare for work	<p>1.1 Nature and scope of work requirements is identified and confirmed.</p> <p>1.2 Resources, <b>tools and equipment</b> and materials required are sourced and checked for safe and serviceability.</p> <p>1.3 Safety requirements and environmental considerations, are observed throughout the work.</p>
2. Test circuits/ components and identify faults	<p>2.1 Electrical measurements and <b>tests</b> are carried out to determine faults using tools and techniques.</p> <p>2.2 Circuits/components are tested without causing damage to component or system.</p> <p>2.3 Faults are identified and preferred repair action determined.</p>
3. Complete repairs to circuit wiring	<p>3.1 Repairs, component replacement and adjustments are carried out using tools, techniques and materials.</p> <p>3.2 <b>Repairs to circuit wiring</b> are completed without causing damage to component or system.</p> <p>3.3 Components are re-connected to the circuit and re-tested for operation to specification.</p>
4. Clean up	<p>4.1 Workplace documentation is completed as required.</p> <p>4.2 Material that can be reused is collected and stored and waste removed following workplace procedures.</p> <p>4.3 Equipment and work area are cleaned, inspected for faults and maintained in accordance with workplace.</p>

## Evidence guide

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Repair a range of vehicle low voltage single electrical circuits in accordance with workplace and manufacturer/component supplier requirements
- Selecting methods and techniques appropriate to the circumstances

## Critical skills and essential knowledge

The ability to:

- carry out repairs to electrical circuits, covering open and short circuits and earthing, while ensuring:
  - Electrical connections, including crimping and soldering to specification
  - Electrical repairs to specification
  - Isolating power supply to components
  - Safe and correct use of tooling and equipment
  - Testing and identification of faults
  - Use workplace technology related to repairing electrical circuits, including use of specialist tooling, measuring equipment, computerised technology and communication devices and the reporting/documenting of results

Knowledge of:

- Circuit types, diagrams, symbols and faults
- Electrical measuring and testing procedures
- Electrical principles (including current, voltage, resistance, conductors, insulators)
- Procedures to avoid damage to electronic systems/components
- Repair procedures
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

## Range statement

**Repairing electrical** circuits may include:

- Replacement of fuses, bulbs and terminals
- Wiring repairs i.e. open circuits/short circuits/earthing

**Repair methods** are to include:

- Electrical measurements
- Fault finding using aural, visual and functional assessments for damage, corrosion, wear and electrical defects
- Pre- and post-repair testing
- Reading circuit diagrams
- Repairs and adjustments
- Soldering
- Testing and identifying faults

**Critical precautions** may include:

- Manufacturer/component supplier procedures which must be applied as poor working practices are likely to damage electronic system ECUs and/or other components

**Tools and equipment** may include:

- Crimping tools
- Hand tools
- Multimeter
- Power/air tools
- Special testing equipment and soldering equipment.
- Specialist tools for removal/replacement
- Test lamp

**Materials** may include:

- Cleaning material
- Soldering consumables
- Spare parts
- Wiring diagrams

**Tests for fault finding** may include:

- Aural
- For damage, corrosion, wear and electrical defects
- Functional assessments
- Visual

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-F5 Repair vehicle wiring harness/looms

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### Unit details

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Functional area F	<b>Vehicle charging systems</b>
Unit title	<b>Repair vehicle wiring harness/looms</b>
Unit code	<b>MS-F5</b>

### Description

This unit describes the skills and knowledge required to test wiring operation for wiring harness/looms and replace or repair harness/looms.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare for work	<p>1.1 Nature and scope of work requirements is identified and confirmed.</p> <p>1.2 Resources, <b>tools and equipment</b> and <b>materials</b> required are sourced and checked for safe and serviceability.</p> <p>1.3 Safety requirements and environmental considerations, are observed throughout the work.</p>
2. Check/test <b>wiring harness/loom</b> and decide preferred <b>repair</b> action	<p>2.1 Correct information is accessed and interpreted from specifications.</p> <p>2.2 Visual checks are carried out to establish the extent of damage.</p> <p>2.3 Tests are carried out to determine faults using tooling and techniques.</p> <p>2.4 <b>Faults</b> are identified and preferred repair action is determined.</p> <p>2.5 Checking/testing is achieved without causing damage to component or system.</p>
3. Remove, replace and label wiring harness/loom	<p>3.1 Correct information is accessed and interpreted from specifications.</p> <p>3.2 Wiring harness/loom is labelled and removed using tooling and techniques.</p> <p>3.3 Associated components are labelled, removed and tagged for storage.</p> <p>3.4 Repaired/remanufactured harness/loom is correctly refitted to vehicle and reconnected according to specifications and/or labels.</p> <p>3.5 Removal, replacement and labelling is completed without causing damage to component or system.</p>
4. Repair wiring harness/loom	<p>4.1 Correct information is accessed and interpreted from specifications.</p> <p>4.2 Repairs are carried out using tooling, techniques and materials.</p>

- |                                    |  |
|------------------------------------|--|
| 5. Manufacture wiring harness/loom | 5.1 Electrical circuit wiring diagrams are accessed and interpreted from specifications.   |
|                                    | 5.2 Harness/loom is manufactured to approved specifications using tooling, techniques and materials.                                     |
|                                    | 5.3 Harness/loom is tested prior to placing in service and results are documented in accordance with enterprise policies and procedures. |
| 6. Clean up                        | 6.1 Workplace documentation is completed as required.  |
|                                    | 6.2 Material that can be reused is collected and stored and waste removed following workplace procedures.                                |
|                                    | 6.3 Equipment and work area are cleaned, inspected for faults and maintained in accordance with workplace.                               |

### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Replace and repair wiring harness/looms in accordance with workplace and manufacturer/component supplier requirements
- Selecting methods and techniques appropriate to the circumstances

### **Critical skills and essential knowledge**

The ability to:

- apply problem-solving skills for a limited range of procedural issues;
- correctly complete installation, tests and measurements to ensure correct repair/manufacture of wiring harness/looms;
- manufacture wiring harnesses;
- perform electrical connections, including crimping and soldering;
- remove and replace wiring harness/looms;
- select and use material for repair/manufacture of wiring harness/looms;
- test wiring harness/looms and locating faults;
- use dexterity skills to perform the repair/manufacture of wiring harness/looms;
- use pre-checking and inspection techniques to anticipate planning and scheduling problems, avoid wastage of time and material; and
- use workplace technology related to the manufacture and repair of wiring harness/looms.

Knowledge of:

- Cable types/sizes, current carrying capacity and their application
- Fault identification and repair procedures
- Removing and replacing procedures for wiring harness/looms
- Types and layout of service/repair manuals (hard copy and electronic)
- Wiring harness/loom checking and testing procedures (voltage drop and circuit performance)
- Wiring harness/loom manufacture procedures
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

### **Range statement**

**Tools and equipment** may include:

- Cables of various types and sizes
- Electrical tape
- Fitting equipment
- Hand tools
- Terminals

**Materials** may include:

- Cleaning material
- Spare parts
- Tagging/labelling material
- Wire

**Wiring harness/looms** may be fitted to

- Heavy commercial vehicles
- Light vehicles
- Marine applications
- Plant and equipment

**Faults** may include:

- Broken harnesses
- Burnt wiring
- Frayed wires
- Insulation damage
- Short and open circuits
- Shorts to ground

**Manufacture and repair methods** are to include:

- Crimping
- Fault-finding using aural, visual and functional assessments for damage, corrosion, wear and electrical defects
- Harness/loom taping
- Identifying faults
- Reading/interpreting wiring diagrams
- Repairing/replacing wiring and terminals

- Soldering
- Tagging disconnected components or wiring
- Testing electrical measurements
- Adjustments and post-repair testing

Other variables may include:

- Fibre optics
- Multi flexing

Critical precautions may include:

- Manufacturer/component supplier procedures must be applied as poor working practices are likely to damage electronic system ecus and/or other components

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-F6 Repair vehicle instruments and warning systems

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### Unit details

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Functional area F	<b>Vehicle charging systems</b>
Unit title	<b>Repair vehicle instruments and warning systems</b>
Unit code	<b>MS-F6</b>

### Description

This unit describes the skills and knowledge required to **test and repair instrument and warning systems**.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare for work	<p>1.1 Nature and scope of work requirements is identified and confirmed.</p> <p>1.2 Resources, <b>tools and equipment</b> and <b>materials</b> required are sourced and checked for safe and serviceability.</p> <p>1.3 Safety requirements and environmental considerations, are observed throughout the work.</p>
2. Test systems/ components and identify faults	<p>2.1 <b>Tests</b> are carried out to determine faults using appropriate equipment and techniques, without causing damage to component or system particularly electronic system ECUs and/or other components.</p> <p>2.2 Instruments or system are disconnected and isolated for repair.</p> <p>2.3 <b>Faults</b> are identified and preferred repair action determined.</p>
3. Repair instrument and warning systems and/or associated components	<p>3.1 <b>Repairs</b>, component replacement and adjustments are carried out using appropriate tools, techniques and materials, in line with manufacturer's specifications.</p> <p>3.2 Repairs component replacement and adjustments are completed without causing damage to component or system.</p> <p>3.3 Retests are carried out to ensure correct and safe instrument and warning system operation to manufacturer's specifications.</p>
4. Clean up	<p>4.1 Workplace documentation is completed as required.</p> <p>4.2 Material that can be reused is collected and stored and waste removed following workplace procedures.</p> <p>4.3 Equipment and work area are cleaned, inspected for faults and maintained in accordance with workplace</p>

## **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Repair a range of instrument and warning systems to site and manufacturer or component supplier requirements
- Selecting methods and techniques appropriate to the circumstances

## **Critical skills and essential knowledge**

The ability to:

- apply problem-solving skills for a range of procedural issues;
- test and retest instruments and warning systems;
- use manipulative and dexterity skills to perform instrument and warning system testing and repair/replacement procedures; and
- use workplace technology related to the repair of instruments and warning systems.

Knowledge of:

- Construction and operation of instruments and warning systems relevant to application
- Interpretation of technical material, graphic symbols and diagrams
- Operation of instruments and warning systems relevant to application
- Repair procedures
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

## **Range statement**

**Tests** to be carried out may include:

- Analysing electronic systems data such as fault codes, sensor measurement and control unit input/output signals

**Repair methods** are to include:

- Diagnosing and determining repair requirements
- Electrical measurements
- Electronic systems data (including fault codes, sensor measurement and control unit input/output signals)
- Fault finding using aural, visual and functional assessments for damage, corrosion, wear and electrical short/broken circuits
- Reading/interpreting wiring diagrams
- Testing, dismantling, assembling, removal and replacement

**Instruments and warning systems** may include:

- Audible reverse warning systems
- Dash lamps
- Engine shutdown systems
- Gauges
- Warning lights.

**Tools and equipment** may include:

- Air tools
- Hand tools
- Oscilloscopes
- Power tools
- Scan tools
- Specialist tools for removal/adjustment
- Testing equipment, including multimeters

**Materials** may include:

- Cleaning material
- Spare parts

**Faults** may include:

- Gauge/instrument warning system not working
- Incorrect gauge/instrument readings
- Open circuits, short circuits, earthing problems

Critical precautions may include:

- Manufacturer/component supplier procedures which must be applied, as poor working practices are likely to damage electronic system ecus and/or other components

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-F7 Repair vehicle ignition systems

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### Unit details

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Functional area F                      **Vehicle charging systems**

Unit title                                **Repair vehicle ignition systems**

Unit code                                **MS-F7**

### Description

This unit describes the skills and knowledge required to test and repair kettering and electronic ignition systems (not systems associated with electronic engine management), magnetos and associated components.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare for work	1.1 Nature and scope of work requirements is identified and confirmed. 1.2 Resources, <b>tools and equipment</b> and <b>materials</b> required are sourced and checked for safe and serviceability. 1.3 Safety requirements and environmental considerations, are observed throughout the work.
2. Test <b>ignition systems</b> and <b>components</b> and identify faults	2.1 Tests are carried out to determine faults using appropriate tools and techniques. 2.2 Tests are completed without causing damage to <b>component</b> or system. 2.3 <b>Faults</b> are identified and preferred repair action decided.
3. Repair ignition systems and components	3.1 <b>Repairs</b> , component replacement and adjustments to specifications are carried out. 3.2 Appropriate tools, techniques and materials are selected and used. 3.3 Ignition systems are repaired without causing damage to component or system. 3.4 Retests are performed to ensure correct and safe ignition system operation.
4. Clean up work area and maintain equipment	4.1 Workplace documentation is completed as required. 4.2 Material that can be reused is collected and stored and waste removed following workplace procedures. 4.3 Equipment and work area are cleaned, inspected for faults and maintained in accordance with workplace.

## **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Complete the repair of a minimum of two (2) ignition systems with a minimum of one (1) electronic and one (1) other (kettering or magneto) in accordance with workplace and manufacturer/component supplier requirements
- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

## **Critical skills and essential knowledge**

The ability to:

- conduct post-repair test ignition systems to manufacturer/ component supplier requirements;
- diagnose and determine faults in ignition systems;
- repair ignition systems to requirements;
- repair ignition to specifications; and
- test ignition system/components.

Knowledge of:

- Adjustment procedures of systems/components
- Construction and operation of ignition systems relevant to application
- Mechanical and electronic fuel systems
- Repair/removal and replacement procedures
- Service procedures
- Testing and fault identification procedures
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

## **Range statement**

**Tools and equipment** may include:

- Distributor test bench
- Dynamometers
- Engine analysers
- Hand tools
- Insulation testers
- Power tools and air tools
- Spark plug cleaner/tester
- Testing equipment, including multimeters, ohmmeters, voltmeters and tachometers
- Timing light
- Tune scopes

**Materials** may include:

- Cleaning material
- Coil
- Condensers
- Leads
- Transistors
- Wiring diagrams

**Ignition systems** may include:

- Electronic ignition systems
- Kettering
- Magnetos and associated components

**Ignition systems** may be fitted to:

- Vehicles, plant, marine craft and outdoor power equipment

**Components** may include:

- Advance mechanisms (mechanical, vacuum, electronic, capacitor discharge ignition (cdi), magnetic pulse, optic and hall effect)
- Ballast and non-ballast primary circuits
- Single and dual points
- Single and multiple distributors
- Spark plug, resistor plug and cap
- Suppressed and non-suppressed high-tension leads
- Transistor assisted
- Transistor controlled ignition (tci) systems

**Faults** may include:

- Engine difficult to start/will not start
- Engine misfire
- Overheating
- Poor performance

**Repair methods** may include:

- Component identification and testing
- Conducting repairs, including disassembly, assembly, component replacement, adjustments and rechecks
- Diagnosing and determining faults
- Electrical measurements
- Peak voltage testing
- Pre- and post-repair testing
- Visual and functional assessments, including damage and wear

Critical precautions may include:

- Manufacturer/component supplier procedures to avoid damage to electronic system, engine control units (ecus) and/or other components
- Personal safety procedures which must be applied as contact with high output ignition systems may result in electrocution

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-F8 Identify motorcycle electrical/electronic system faults

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### Unit details

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Functional area F	<b>Mechanical Services</b>
Unit title	<b>Identify motorcycle electrical/electronic system faults</b>
Unit code	<b>MS-F8</b>

### Description

This unit describes the skills and knowledge required to analyse **motorcycle electrical/electronic system** faults and sustain, vary or enhance performance.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare for work	<p>1.1 Nature and scope of work requirements is identified and confirmed.</p> <p>1.2 Resources, tools and equipment and materials required are sourced and checked for safe and serviceability.</p> <p>1.3 Safety requirements and environmental considerations, are observed throughout the work.</p>
2. Prepare for analysis and evaluation	<p>2.1 Evaluative criteria are developed/adopted to meet the objective of the work.</p> <p>2.2 Technical support and diagnostic systems are analysed to identify system performance achievements or discrepancies.</p> <p>2.3 Method of analysis, including diagnostic process, sequence, tests and <b>testing equipment</b> is selected from the range of available options.</p> <p>2.4 Tools and materials required for the diagnostic process are identified, selected and prepared for use.</p> <p>2.5 Motorcycle electrical/electronic system components are prepared for the diagnostic process, including park-up, isolation and cleaning requirements.</p>
3. Apply analysis and select response measure evaluative methodology	<p>3.1 Selected diagnostic process is followed and <b>tests conducted</b> in accordance with <b>specifications</b>.</p> <p>3.2 Findings and results are evaluated against the agreed criteria.</p> <p>3.3 Valid conclusions are drawn from the available evidence and documented to workplace requirements.</p> <p>3.4 Options for responding to the objective or need are identified from further research of technical support information and the most appropriate response selected.</p>
4. Clean up	<p>4.1 Workplace documentation is completed as required.</p> <p>4.2 Material that can be reused is collected and stored and waste removed following workplace procedures.</p> <p>4.3 Equipment and work area are cleaned, inspected for faults and maintained in accordance with workplace.</p>

## Evidence guide

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Analyse and recommend variations to a minimum of two available repair/modification procedures for motorcycle electrical/electronic systems
- Complete failure analyses on a minimum of three motorcycle electrical/electronic systems with multi-system and intermittent faults and identify, evaluate, select and document the most appropriate rectification measure

Document and report the diagnostic process and findings and recommended rectification for two of the above.

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

## Critical skills and essential knowledge

The ability to:

- use workplace technology applicable to motorcycle electrical/electronic system faults.

Knowledge of:

- Detailed knowledge of the types, function, operations and limitations of motorcycle electrical/electronic systems/components
- Detailed knowledge of the types, functions, operations and limitations of diagnostic motorcycle terminology and definitions
- Electrical theory covering voltage, current, resistance, power, magnetics and inductance
- General knowledge of requirements related to motorcycle electrical/electronic systems
- General knowledge of the theory of diagnosis, including concept, design and planning
- Mechanical theory covering the concepts and principles of mechanical, hydraulic and pneumatic systems
- Testing equipment
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

## Range statement

**The objective of the failure analysis and evaluation process** may be to:

- Determine fault rectification measures
- To effect variation in system characteristics and parameters
- To enhance system performance

**Motorcycles** are to include:

- Two-wheel
- Four-wheel
- Two-wheel fitted with sidecar

**Electrical/electronic system failures** covered in this unit are to include:

- Abs (intermittent faults, operator feedback)
- Engine management (poor performance, lack of power, erratic running, induction interference)
- Fuel injection (contamination, loss of power, no-start, poor or erratic running, abnormal emissions)
- Ignition (no-start, no-run, misfire, erratic operation, lack of power, charging, security lock-out)
- Indirect faults caused by the influence of external systems which may or may not be faulty in their primary operations
- Lighting (short circuit, grounded circuit, open circuit, faulty equipment, switches and relays)
- Safety lock-out systems (failure to crank, engine stops)

**Testing equipment** may include:

- Abs diagnostic tooling
- Computer-based diagnostic systems
- Electronic vacuum gauge
- Engine control unit analyser
- Engine emission tester
- Fuel pressure and flow meter
- Headlight aiming testing equipment
- Injector tester
- Led test lights
- Magnetic coil condenser tester
- Multimeter
- Peak voltage meters
- Resister flow dynamometer
- Vacuum gauge

**Tests to be conducted** are to include:

- Accumulator pressure
- Disc stack height
- Monitoring/analysis of computer-based diagnostic systems
- Pressure
- Sampling (collection and processing)
- Sensor/actuator and wiring harness integrity
- System performance (distance/balance)
- Wear analysis (drum/disc/lining material)

**Specifications** refer to those supplied by:

- Component supplier
- Manufacturer

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

# Functional area G – Refrigeration and air conditioning

## MS-G1 Install refrigeration systems

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### Unit details

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Functional area G      **Refrigeration and Air conditioning**

Unit title              **Install refrigeration systems**

Unit code              **MS-G1**

### Description

This unit describes the skills and knowledge required to determine work needs, and assemble and install components for gas system refrigeration stand-alone or insulated cold room system installation work needs to ensure cold room temperature maintenance.

### Element of competency

### Performance criteria

- |   |  |
|---|--|
| 1. Prepare for work                         | 1.1 Requirements for installing refrigeration system, including method, materials and equipment are determined.<br>1.2 Safety requirements and environmental considerations, are observed throughout the work.<br>1.3 <b>Tools and equipment</b> , are identified and checked for correct operation.   |
| 2. Determine fitting requirements           | 2.1 Standalone component of cold room is checked to determine fitting requirements for the refrigeration system.<br>2.2 Component installation points are prepared and located according to job specifications.  |
| 3. Install pipework, fittings and materials | 3.1 Liquid, suction and discharge line piping is fabricated to suit system requirements and installed, using appropriate fittings and materials and flashing all penetrations.<br>3.2 Pipework is insulated, using recommended materials to minimize energy loss/wastage.<br>3.3 <b>Exterior components</b> are installed, with a stable base, to required clearances and to minimize noise and vibration.<br>3.4 The <b>internal components</b> and the control panel are installed according to <b>specifications</b> .<br>3.5 The system is gassed in accordance with specifications. |
| 4. Test system operation                    | 4.1 The system is connected to power supply and <b>tests</b> made to all switches, thermostat and circuits are tested for correct operation.<br>4.2 All door seals and safety systems are installed to specifications.   |

- 4.3 Installed system is performance tested, using approved methods, tools and equipment, including maintaining the required refrigerated temperature to verify it is operation.
- 4.4 Temperature controls on the main system are set and checked for correct operation.
- 5. Clean up
  - 5.1 Installation and workplace documentation is completed.
  - 5.2 Equipment and work area is cleaned and inspected for serviceable condition and faulty equipment tagged.
  - 5.3 Tools and equipment are maintained in accordance with workplace procedures.

### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

### **Critical skills and essential knowledge**

The ability to:

- attach ancillary devices;
- compare system and component performance/operation against specification
- identify faulty components and non-compliances
- install service and repair refrigeration systems, safely, to manufacturer specifications
- make required adjustments to achieve specifications
- plan and sequence operations
- safely remove, contain or add refrigerant
- use appropriate test equipment to identify non-compliance
- use tools, techniques and equipment necessary to check for correct operation.

Knowledge of:

- Measuring instruments/equipment, specifications and procedures for checking temperature and system performance and testing components
- Procedures for:
  - Checking air flow
  - Evacuating system
  - Handling and adding refrigerant
  - Installing refrigeration pipework
  - Pressure and leak testing
- Process for identifying refrigerant type
- Specifications, operational characteristics and process for identifying system components

- Standard electrical measurements for earth continuity, insulation resistance, circuit resistance, supply voltage and current
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

**Range statement**

**Tools and equipment** may include:

- Analogue and digital vacuum measuring gauges
- Cleaning materials.
- Digital scales
- Electronic leak detectors
- Hand and power tools refrigeration gauge manifold
- Load refrigerant gas devices
- Lubricants
- Minor parts consumables
- Quick connect couplings
- Refrigerant and refrigerant oils
- Refrigerant containers/cylinders
- Refrigerant recovery unit
- Schraeder access valves
- Thermometer/thermocouple temperature measuring devices
- Vacuum pump

**Exterior components** may include:

- Compressor
- Condenser
- Expansion valve
- Fan kit

**Internal components** may include:

- Blower
- Evaporator
- Filter/s

**Specifications** refer to those supplied by:

Manufacturer  
Component supplier

Standard electrical **tests** may include:

- Circuit resistance
- Earth continuity
- Insulation resistance
- Testing of supply voltage and the appliance or individual component current draw

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-G2 Service and repair refrigeration systems

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### Unit details

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Functional area G	<b>Refrigeration and Air conditioning</b>
Unit title	<b>Service and repair refrigeration systems</b>
Unit code	<b>MS-G2</b>

### Description

This unit describes the skills and knowledge required to test and repair operational faults and conduct **service** needs and **routine maintenance** activities for **domestic refrigeration appliances**.

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare for work	<p>1.1 Nature and scope of refrigeration servicing work requirements is identified and confirmed.</p> <p>1.2 Resources, <b>tools and equipment</b> and <b>testing devices</b> required are sourced and checked for safe and serviceability.</p> <p>1.3 Safety requirements and environmental considerations, are observed throughout the work.</p>
2. <b>Test</b> refrigeration system	<p>2.1 Performance testing of the system is conducted, including door/access sealing and refrigerant leak detection and any malfunction confirmed in accordance with specifications.</p>
3. Repair faults	<p>3.1 Isolate the system from the power supply and discharge the capacitor.</p> <p>3.2 The refrigerant is removed safely from the system and contained in accordance with standard operating procedures.</p> <p>3.3 Faulty components are dismantled and repaired/replaced to manufacturers' specifications as required</p> <p>3.4 Door gaskets are checked and replaced where there is a broken or insufficient seal.</p> <p>3.5 Heated double-glazed glass doors/panels are tested and repaired if required.</p>
4. Service refrigeration system and perform checks	<p>4.1 Undertake refrigeration system service without causing damage to any component or system.</p> <p>4.2 Ensure air ducts are free and the defrost timer and heater (freezer) are working to specification, adjusting, repairing or replacing as required.</p> <p>4.3 Check all piping to ensure correct operation and repair/replace any blocked or leaking pipes and drain pan.</p>

- 4.4 Re-test the thermostat and freezer/refrigeration section controls and confirm results are in accordance with manufactures specification, replacing the thermostat if required.
- 4.5 System is gassed or re-gassed to specifications and pressure tested.
- 5. Finalize service
  - 5.1 Removed refrigeration gas is disposed of safely, in an environmentally aware manner.
  - 5.2 Service schedule/repair documentation is completed.
  - 5.3 Equipment and work area is cleaned and inspected for serviceable condition in accordance with workplace procedures.
  - 5.4 Final inspection is made to ensure protective guards and safety features are in place.

### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

### **Critical skills and essential knowledge**

The ability to:

- attach ancillary devices
- check and clarify task information
- compare system and component operation against specifications
- conduct full testing of refrigeration systems
- de-gas and re-gas refrigeration systems
- identify faults in refrigeration systems
- make adjustments to achieve specifications
- repair and service refrigeration system
- safely remove, contain or add refrigerant to standards .

Knowledge of:

- Hazards and control measures associated with installing air conditioning systems
- Measuring instruments/equipment, specifications and procedures for checking temperature and system performance and testing components
- Procedure for checking air flow
- Procedures complying to all requirements for safely removing the refrigerant and charging and evacuating the system
- Procedures for brazing refrigeration pipework

- Procedures for completing documentation
- Procedures for evacuating system
- Procedures for handling and adding refrigerant
- Procedures for pressure and leak testing
- Procedures for reporting non-conformances
- Process for identifying refrigerant type
- Safety requirements and environmental considerations for handling refrigerants
- Specifications, operational characteristics and processes for identifying system components
- Standard electrical measurements for earth continuity, insulation resistance, circuit resistance, supply voltage and current
- Types and layout of service/repair manuals (hard copy and electronic)
- Workplace policies and procedures, including quality requirements, reporting and recording procedures

### **Range statement**

#### **Service system** may include:

- Cleaning and lubricating condensers and condenser fans without causing damage to any component or system
- Lubrication as required
- Repair or replacement of minor parts
- Replacing door or other light switches
- Replacing worn insulation

#### **Routine maintenance** may include:

- Checking temperatures, pressures, component operation, air flow and system capacity
- Cleaning condensers
- Cleaning filters
- Clearing drains
- Electrical testing of the appliance
- Polarity testing

#### **Domestic refrigeration appliances** may include:

- Freezers - chest and vertical door using, for example, refrigeration systems with cyclic defrost, frost-free with electric and hot-gas defrost, and manual defrost
- Refrigerators - single door, two door and two door side by side
- Self-contained plug in appliances primarily designed for domestic and residential situations

#### **Tools and equipment** may include:

- Cleaning materials
- Evacuation equipment
- Hand and power tools
- Lubricants
- Minor parts
- Refrigerant and refrigerant oils
- Refrigerant leak detecting equipment

- Refrigerant re-gassing equipment
- Refrigerant recovery and/or recycling equipment
- Thermometers

**Testing devices** may include:

- Analogue and digital vacuum measuring gauges
- Digital scales
- Electronic leak detectors
- Quick connect couplings
- Refrigerant containers/cylinders
- Refrigerant recovery unit
- Refrigeration gauge manifold
- Schraeder access valves
- Thermometer/thermocouple temperature measuring devices
- Vacuum pump

**Standard electrical tests** may include:

- Circuit resistance
- Earth continuity
- Insulation resistance
- Testing of supply voltage and the appliance or individual component current draw

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-G3 Install domestic air conditioning systems

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### Unit details

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Functional area G	<b>Refrigeration and air conditioning</b>
Unit title	<b>Install domestic air conditioning systems</b>
Unit code	<b>MS-G3</b>

### Description

This unit describes the skills and knowledge required to install single or split system domestic air-conditioning systems (including reverse cycle).

<b>Element of competency</b>	<b>Performance criteria</b>
1. Prepare for work	<p>1.1 Nature and scope of work requirements is identified and confirmed.</p> <p>1.2 Resources, <b>tools and equipment</b> and materials required are sourced and checked for safe and serviceability.</p> <p>1.3 Safety requirements and environmental considerations are observed throughout the work.</p>
2. Install system	<p>2.1 Installation area for air-conditioning is checked for suitability for the size and planned location of the air-conditioning system.</p> <p>2.2 Mounting location/pod is identified according to job specification.</p> <p>2.3 Hoses and copper piping are fabricated to suit system requirements and installed using appropriate fittings, materials and flashing on all wall and/or ceiling penetrations.</p> <p>2.4 Pipe work is insulated using recommended materials to minimise energy loss/wastage.</p> <p>2.5 Exterior components are installed in the appropriate site with a stable base, to required clearances and to minimise noise and vibration.</p> <p>2.6 System interior components are installed without causing damage to any property and according to manufacturer's instruction and specifications.</p> <p>2.7 Excess water from the dehumidifier is taken to a suitable external waste-water pipe.</p> <p>2.8 Gassing information is obtained from the manufacturer specifications and the system gassed.</p>
3. Commission system	<p>3.1 Air conditioning is connected to power supply and all switches, thermostat and circuits <b>tested</b> for correct operation.</p> <p>3.2 Temperature, timing and other controls are set on the main system components and/or remote controls and checked for correct operation.</p>

4. Prepare equipment for use or storage
- 4.1 Workplace documentation is completed as required.
  - 4.2 Equipment and work area is cleaned and inspected for serviceable condition in accordance with workplace procedures.
  - 4.3 Final performance test is made of the installed system using approved methods, including maintaining the required area temperature to verify it is operational in accordance with specifications.
  - 4.4 Final inspection is made to ensure work is to workplace expectations.

### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

### **Critical skills and essential knowledge**

The ability to:

- apply safety procedures and standard operating procedures to all work undertaken;
- attach ancillary devices;
- check and clarify task related information;
- commission air conditioning system and ensure operation to specifications;
- complete required documentation;
- complete the work safely;
- document results of the adjustments;
- install domestic air conditioning single system;
- install domestic air conditioning split system (including reverse cycle);
- plan and sequence operations;
- prepare in a systematic manner; and
- read, interpret and follow information on written job instructions, specifications, drawings and other applicable reference documents.

### **Range statement**

Equipment and tools may include:

- Cleaning materials
- Evacuation equipment
- Hand and power tools
- Lubricants
- Refrigerant
- Refrigerant leak detecting equipment
- Refrigerant oils
- Refrigerant re-gassing equipment
- Refrigerant recovery and/or recycling equipment
- Thermometers

**Testing devices** may include:

- Refrigeration gauge manifold
- Schraeder/refridgeration access valves
- Quick connect couplings
- Thermometer/thermocouple temperature measuring devices
- Analogue and digital vacuum measuring gauges
- Digital scales
- Refrigerant recovery unit
- Vacuum pump
- Electronic leak detectors
- Refrigerant containers/cylinders.

**Checks** may include:

- Checking temperatures, pressures, component operation, air flow and system capacity
- Electrical testing of the appliance
- Polarity testing

**Standard electrical tests** may include:

- Circuit resistance to meet electrical equipment regulations
- Earth continuity
- Insulation resistance
- Testing of supply voltage and the appliance or individual component current draw

**Standard refrigeration return to service procedures**

- Leak detection
- Evacuation
- refrigerant charging of domestic air conditioning and refrigeration plug in appliances.

**System requirements**

- Pressure
- Temperature
- Sub cooling
- Superheating
- Evaporator coil to air temperature difference

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-G4 Service air conditioning systems

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### Unit details

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Functional area G                      **Refrigeration and Air conditioning**

Unit title                                **Service air conditioning systems**

Unit code                                **MS-G4**

### Description

This unit describes the skills and knowledge required to service air conditioning systems.

### Element of competency              Performance criteria

- |  |  |
|--|--|
| 1. Prepare for work                                  | 1.1. Work instructions are used to determine job requirements, including quality, material, equipment quantities and service manuals.<br>1.2. Safety requirements and environmental considerations, including personal protection needs, are observed throughout the work.<br>1.3. Equipment and tools are identified and checked for correct operation.   |
| 2. Test system and de-gas for repair                 | 2.1. System is performance tested to determine compliance or non-compliance with specifications.<br>2.2. Components requiring repair or replacement are identified and the appropriate method for disassembly and re-fitting.<br>2.3. System is de-gassed, using an approved recovery unit, in accordance with manufacturer/component supplier specifications.<br>2.4. Requirements for handling and disposing of ozone depleting substances are followed.   |
| 3. Test air conditioning system                      | 3.1. Tests are made of the system's performance, including testing for refrigerant leakage.<br>3.2. Required air conditioning service needs and procedures are determined, in accordance with specifications.  |
| 4. Service air conditioning system and re-gas system | 4.1. System is isolated from the power supply.<br>4.2. System is de-gassed, using an approved recovery unit in accordance with manufacturer/component supplier specifications.<br>4.3. Requirements for handling and disposing of ozone depleting substances are followed.<br>4.4. Service of air conditioning system is completed without causing damage to any component or system.<br>4.5. All piping, including evaporation drain lines, is checked to ensure correct operation and repair/replace any blocked or leaking pipes. |

- 4.6. System controls, including climate control systems, are re-tested and results are confirmed to be in accordance with manufactures specification.
- 5. Finalize service
  - 5.1. All guards, covers and other protective components are replaced.
  - 5.2. Tools and equipment are clean and stored, inspecting for serviceable condition and identifying any faulty equipment or tools in accordance with enterprise requirements.
  - 5.3. Workplace documentation is completed as required.

### **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

### **Critical skills and essential knowledge**

The ability to:

- apply safety procedures and standard operating procedures to all work undertaken;
- attach ancillary devices;
- check and clarify task related information;
- compare system and component performance/operation against specification;
- conduct full testing of air conditioning systems;
- de-gas and re-gas air conditioning systems;
- document results of the adjustments;
- identify faults in air conditioning systems;
- make required adjustments to achieve specifications;
- plan and sequence operations;
- read, interpret and follow information on written job instructions, specifications, drawings and other applicable reference documents;
- safely remove, contain or add refrigerant to standards or codes and regulations;
- service air conditioning systems; and
- use tools, techniques and equipment necessary to check for correct operation.

Knowledge of:

- Hazards and control measures associated with installing air conditioning systems
- Measuring instruments/equipment, specifications and procedures for checking temperature and system performance and testing components
- Procedure for checking air flow
- Procedures complying to all requirements for safely removing the refrigerant and charging and evacuating the system
- Procedures for:
  - Brazing refrigeration pipework

- Completing documentation
- Evacuating system
- Handling and adding refrigerant
- Pressure and leak testing
- Process for identifying refrigerant type
- Standard electrical measurements for earth continuity, insulation resistance, circuit resistance, supply voltage and current

**Range statement**

**Equipment and tools** may include:

- Cleaning materials
- Evacuation equipment
- Hand and power tools
- Lubricants
- Minor parts
- Refrigerant
- Refrigerant leak detecting equipment
- Refrigerant oils
- Refrigerant re-gassing equipment
- Refrigerant recovery and/or recycling equipment
- Thermometers

**Service of air conditioning system** may include:

- Cleaning air filters
- Lubrication as required
- Re-aligning fans
- Repair or replacement of minor parts
- Replacing worn insulation

**Routine maintenance** may include:

- Checking temperatures, pressures, component operation, air flow and system capacity
- Cleaning condensers
- Cleaning filters
- Clearing drains
- Electrical testing of the appliance
- Polarity testing

**Standard electrical tests** may include:

- Circuit resistance to meet electrical equipment regulations
- Earth continuity
- Insulation resistance
- Testing of supply voltage and the appliance or individual component current draw
- containers/cylinders.

**Equipment and testing devices** may include:

- Analogue and digital vacuum measuring gauges
- Digital scales
- Electronic leak detectors
- Quick connect couplings
- Refrigerant containers/cylinders
- Refrigerant recovery unit
- Refrigeration gauge manifold
- Schraeder access valves
- Thermometer/thermocouple temperature measuring devices
- Vacuum pump

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.

## MS-G5 Repair air conditioning systems

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### Unit details

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Functional area G                      **Refrigeration and air conditioning**

Unit title                                **Repair air conditioning systems**

Unit code                                **MS-G5**

### Description

This unit describes the skills and knowledge required to repair air-conditioning systems.

### Element of competency      Performance criteria

- |                                      |  |
|--------------------------------------|--|
| 1. Prepare for work                  | 1.1 Work instructions are used to determine job requirements, including quality, material, equipment quantities and service manuals.                               |
|                                      | 1.2 Safety requirements and environmental considerations, including personal protection needs, are observed throughout the work.                                   |
|                                      | 1.3 <b>Equipment and tools</b> are identified and checked for correct operation.   |
| 2. Test system and de-gas for repair | 2.1 Performance test the system to determine compliance or non-compliance with specifications.   |
|                                      | 2.2 Identify the <b>components</b> requiring repair or replacement and the appropriate method for disassembly and re-fitting.                                      |
|                                      | 2.3 Degas system using an approved recovery unit in accordance with manufacturer/ component supplier specifications.   |
|                                      | 2.4 Ensure requirements for handling and disposing of ozone depleting substances are followed.   |
| 3. Repair system                     | 3.1 Repair the system using correct replacement parts and components as required.  |
|                                      | 3.2 Charge the system with refrigerant in accordance with enterprise procedures and manufacturer's specifications.   |
|                                      | 3.3 Start-up air conditioning plant and equipment and check operation for conformance to specification.  |
| 4. Document and clean up             | 4.1 Repair documentation is completed as required.   |
|                                      | 4.2 Tools and equipment are cleaned, inspecting for serviceable condition and faulty equipment or tools are identified in accordance with enterprise requirements. |

## **Evidence guide**

To demonstrate competence, the candidate must meet performance criteria and essential skills and knowledge requirements. Performance must show that competence can be transferred to different circumstances and demonstrates the critical aspects of:

- Communicating effectively with others involved in or affected by the work
- Conducting work in accordance with workplace and manufacturer/component supplier requirements and specifications
- Observing safety procedures and requirements
- Preparing and conducting activities in a systematic manner
- Selecting methods and techniques appropriate to the circumstances

## **Critical skills and essential knowledge**

The ability to:

- conduct full testing of air conditioning systems;
- identify faults in air conditioning systems;
- de-gas and re-gas air conditioning systems;
- dispose of used materials in consideration of environmental issues;
- undertake repairs of air conditioning systems; and
- use workplace technology related to the repair of air conditioning systems.

Knowledge of:

- Service procedures

## **Range statement**

**Equipment and tools** may include:

- Cleaning materials
- Evacuation equipment
- Hand and power tools
- Ram air fan
- Refrigerant
- Refrigerant leak detecting equipment
- Refrigerant oils
- Refrigerant re-gassing equipment
- Refrigerant recovery and/or recycling equipment
- Spare parts
- Thermometers

**Components** may include:

- Compressors
- Condensers
- Controllers
- Evaporators
- Fans
- Recorders
- Sensors
- Solenoids
- Switches

- Thermostats
- Valves

**Competency is to be assessed through a combination of:**

- Demonstration with questioning
- Interview
- Third party report.

**Competency is to be assessed** while a task is being undertaken in the workplace or in a simulated workplace setting.



## Reference

Abao, C. V. 2009. *Minding the builders - The plight of construction workers and implications for ASEAN economic integration*. Available at : <http://www2.asetuc.org/media/Minding%20the%20Builders.pdf> [12 June 2014].

A Joint Initiative of the Australian and State and Territory Governments. *AUR12 The automotive industry retail, service and repair training package*. Available at: <http://training.gov.au/Training/Details/aur12> [1 May 2014].

A Joint Initiative of the Australian and State and Territory Governments. *Electrotechnology industry by the electrocomms and energy utilities industry skills council, E-Oz training standards, UEE11-electrotechnology training package*. Available at: <https://training.gov.au/Training/Details/UEE11> [1 May 2014].

Aring, M. 2012. *Youth and skills: Putting education to work - Report on skills gaps*. Background paper prepared for the Education for All Global Monitoring Report 2012.

Chang, J. H and Rynhart, G. 2014. *The road to the ASEAN Economic Community 2015: The challenges and opportunities for enterprises and their representative organizations* (Bangkok).

International Labour Organization (ILO). 2014. *Assessment of the readiness of ASEAN Member States for implementation of the commitment to the free flow of skilled labor within the ASEAN Economic Community from 2015* (Bangkok).

—. 2012. *The youth employment crisis: A call for action*. Resolution and conclusions of the 101st Session of the International Labour Conference (Geneva).

—. 2010. *Guidelines for recognizing the skills of returning migrant workers* (Bangkok).

## Useful links

A Joint Initiative of the Australian and State and Territory Governments. The official National Register on VET in Australia and is the authoritative source of information on training packages, qualifications, accredited courses, units of competency, skill sets and Registered Training Organizations. Available at: <https://training.gov.au/Home/Tga> [12 May 2015].

Australian Government, Department of Education and Training. *Up-to-date information on training courses for school leavers, students, apprentices, and employers*. Available at: <http://www.myskills.gov.au/> [12 May 2015].

# Regional Model Competency Standards: Mechanical services

The skills development and recognition of workers in mechanical services plays an important part in meeting the demand for skilled labour. To help accelerate the improvement of training systems and the mutual recognition of skills, the ILO has developed, in consultation with employers, governments and workers, the Regional Model Competency Standards (RMCS). These have been developed in identified priority areas and are in a simplified format. The RMCS will benefit those countries that are in the process of developing standards or reviewing existing national standards in light of similar standards available in the region. Moreover, the RMCS are intended to be a regional reference for developing competency standards for those countries that are in the process of creating standards, or reviewing existing national standards.

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