



Australian Government

AURETU004 Diagnose and repair air conditioning and HVAC systems

Release: 1

AURETU004 Diagnose and repair air conditioning and HVAC systems

Modification History

Release	Comment
Release 1	New unit of competency.

Application

This unit describes the performance outcomes required to diagnose and repair faults in the air conditioning systems, including heating, ventilation and air conditioning (HVAC) systems, fitted to a range of vehicles and machinery for passenger convenience and comfort. It involves preparing for the task, selecting the correct diagnostic procedure, carrying out the diagnosis and the repair, performing post-repair testing, and completing workplace processes and documentation.

It applies to those working in an automotive service and repair industry. Automotive air conditioners, including HVAC systems, include those in agricultural machinery, heavy commercial vehicles, light vehicles or mobile plant machinery.

Licensing requirements apply to this unit. Users are advised to check with relevant regulatory authority.

Competency Field

Electrical

Unit Sector

Technical - Air Conditioning and HVAC

Elements and Performance Criteria

Elements	Performance Criteria
Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold and italicised text is used, further information is detailed in the range of conditions section.
1. Prepare to diagnose and	1.1 Job requirements are determined from workplace instructions

Elements Elements describe the essential outcomes.	Performance Criteria Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold and italicised text is used, further information is detailed in the range of conditions section.
repair air conditioning and HVAC system	1.2 Diagnostic information is sourced and interpreted 1.3 Diagnostic options are analysed and those most appropriate to the circumstances are selected 1.4 Hazards associated with the work are identified and risks are managed 1.5 Diagnostic tools and equipment are selected and checked for serviceability
2. Diagnose air conditioning and HVAC system	2.1 Diagnostic tests are carried out according to workplace procedures and safety and environmental requirements using appropriate tools and techniques without causing damage to components or system 2.2 Faults are identified from diagnostic test results and causes of faults are determined 2.3 Diagnosis findings and recommendations for necessary repairs or adjustments are reported according to workplace procedures
3. Repair air conditioning and HVAC system	3.1 Repair information is sourced and interpreted 3.2 Repair options are analysed and those most appropriate to the circumstances are selected 3.3 Repair tools, equipment and materials are selected and checked according to manufacturer specifications and workplace procedures 3.4 Repairs and component replacements and adjustments are carried out according to requirements , and without causing damage to components or systems 3.5 System is recharged with the appropriate refrigerant gas according to manufacturer specifications and workplace procedures 3.6 Post-repair testing is carried out according to workplace procedures to confirm fault rectification, and any further problems detected as having been introduced during the repair process are rectified
4. Complete work processes	4.1 Final inspection is made to ensure work is to workplace expectations and the vehicle or machinery is presented ready for use 4.2 Work area is cleaned, waste and non-recyclable materials are disposed of, and recyclable material is collected 4.3 Tools and equipment are checked and stored and faulty electrical equipment is identified, tagged and isolated according to workplace procedures

Elements	Performance Criteria
Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold and italicised text is used, further information is detailed in the range of conditions section.
	4.4 <i>Australian Refrigeration Council accredited service decal sticker (ARCTick)</i> and other required workplace documentation are completed and processed according to workplace procedures

Foundation Skills

This section describes those language, literacy, numeracy and employment skills that are essential to performance and are not explicit in the performance criteria.

Skills	Description
Learning skills to:	identify and locate various sources of information efficiently.
Reading skills to:	- interpret text, symbols and wiring diagrams relating to diagnostic and repair information from manufacturer specifications and workplace instructions and procedures - interpret requirements relevant to diagnosing and repairing air conditioning and HVAC systems of the Australian automotive code of practice.
Writing skills to:	legibly and accurately fill out workplace documentation, including ARCTick stickers, when reporting diagnostic findings, making repair recommendations, and recording parts and material used.
Oral communication skills to:	- clarify instructions - report diagnostic findings and make repair recommendations.
Numeracy skills to:	- match refrigerant types and identification numbers to workplace instructions, parts lists, manufacturer specifications, code of practice and regulatory requirements - interpret weight measurements, including tare and gross weights - interpret readings on pressure gauges - measure temperatures and pressures and use basic mathematical operations, including addition and subtraction, to calculate deviations from manufacturer specifications.
Planning and organising skills to:	plan own work requirements and prioritise actions to achieve required outcomes and ensure tasks are completed within workplace timeframes.
Technology skills to:	use specialised equipment, including refrigerant vacuum recovery equipment and manifold gauges.

Range of Conditions

This section specifies work environments and conditions that may affect performance.

Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included.

Bold italicised wording, if used in the performance criteria, is detailed below.

<i>Safety and environmental requirements</i> must include:	• work health and safety (WHS) and occupational health and safety (OHS) requirements, including procedures for: • working with refrigerants at boiling point given risk of frostbite • working with system lubricants, including carcinogenic oils • handling flammable refrigerants • using personal protective equipment (PPE) • identifying and using fire safety equipment • environmental requirements, including procedures for preventing loss of refrigerant to the atmosphere.
<i>Repairs and component replacement and adjustment requirements</i> must include:	• manufacturer specifications • workplace procedures • Australian automotive code of practice: Control of refrigerant gases during manufacture, installation, servicing or de-commissioning of motor vehicle air conditioners.
<i>Post-repair testing</i> must include:	• validating the effectiveness of the repair action by checking the following: • ambient temperature • centre vent temperature • condenser and suction line temperature • manifold gauge pressure readings • refrigerant leaks • heater core and system water coolant leaks.
<i>Australian Refrigeration Council accredited (ARCtick) service decal sticker</i> information must include:	• name of the service organisation • name of technician • Refrigerant Handling Licence Number • vehicle registration number • service date • refrigerant type • lubricant type.

Unit Mapping Information

Equivalent to AURETU3004 Diagnose and repair air conditioning and HVAC systems

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b4278d82-d487-4070-a8c4-78045ec695b1>

Assessment Requirements for AURETU004 Diagnose and repair air conditioning and HVAC systems

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Performance Evidence

Before competency can be determined, individuals must demonstrate they can perform the following according to the standard defined in the unit's elements and performance criteria, range of conditions and foundation skills:

- diagnose and repair a fault in the air conditioning and heating, ventilation and cooling (HVAC) systems of two different vehicles or machinery, in which the work must involve removing, refitting or replacing two of the following:
 - condenser
 - evaporator
 - expansion valve
 - compressor
 - heater box.

Knowledge Evidence

Individuals must be able to demonstrate knowledge of:

- work health and safety (WHS) and occupational health and safety (OHS) requirements relating to diagnosing and repairing air conditioning and HVAC systems, including procedures for:
 - working with refrigerants at boiling point given risk of frostbite
 - working with system lubricants, including carcinogenic oils
 - handling flammable refrigerants
 - using personal protective equipment (PPE)
 - identifying and using fire safety equipment
- environmental requirements, including procedures for preventing loss of refrigerant to the atmosphere

- key requirements relevant to diagnosing and repairing air conditioning and HVAC systems detailed in the Australian automotive code of practice: Control of refrigerant gases during manufacture, installation, servicing or de-commissioning of motor vehicle air conditioners
- air conditioning and HVAC system principles, including:
 - heat transfer principles, including convection, conduction and radiation
 - functions of the following air conditioning components:
 - compressor
 - condenser
 - receiver-drier
 - evaporator
 - blower fan
 - refrigerant
 - functions of the following heating components:
 - radiator
 - thermostat
 - radiator and heater hoses
 - heater tap
 - heater box
 - single zone and multi-zone vehicle layouts
- application, purpose and operation of air conditioning and HVAC systems and components, including:
 - high pressure and low pressure sides of air conditioning systems
 - compressors, including:
 - axial type, including variable capacity compressors
 - scroll type
 - vane type
 - electromagnetic clutches
 - condensers
 - receiver-dryer, including filters and desiccants
 - expansion valves, including capillary tube
 - evaporator
 - thermostat
 - refrigerants, including R12, R134, R1234yf and hydrocarbon refrigerants
 - compressor oils
 - air conditioner and heating controls, including levers and ducting
 - air conditioner and heating electrical circuits and sensors, including:
 - high and low pressure switches
 - pressure relief valves
 - temperature sensors

- climate control systems
- diagnostic testing procedures for air conditioning and HVAC systems, including:
 - using diagnostic flow charts
 - using manifold gauges on systems with different refrigerants, including analysis of high and low pressure readings in conjunction with temperature probes
 - testing electrical systems, including procedures for:
 - accessing electrical terminals and using test probes without damaging connectors, fuse holders or wiring
 - resistance and voltage drop tests
 - open and short circuit tests
 - checking shorts to signal, power circuits and grounds
- repair procedures for air conditioning and HVAC systems, including procedures for:
 - using manifold gauges to discharge, evacuate and charge system refrigerants
 - removing and replacing system components
- post-repair testing procedures for air conditioning and HVAC systems, including procedures for checking for:
 - refrigerant leaks
 - heater core and system water coolant leaks
- static and dynamic performance tests of air conditioning and HVAC systems, including checking:
 - ambient temperature
 - vent temperature
 - condenser and suction line temperature.

Assessment Conditions

Assessors must satisfy NVR/AQTF assessor requirements and hold an Australian Refrigerant Council (ARC) Refrigerant Handling licence.

Competency is to be assessed in the workplace or a simulated environment that accurately reflects performance in a real workplace setting.

Assessment must include direct observation of tasks.

Where assessment of competency includes third-party evidence, individuals must provide evidence that links them to the air conditioning and HVAC systems that they have worked on, e.g. repair orders.

Assessors must verify performance evidence through questioning on skills and knowledge to ensure correct interpretation and application.

The following resources must be made available:

- automotive repair workplace or simulated workplace
- workplace instructions
- manufacturer specifications for air conditioning and HVAC systems

- Australian automotive code of practice: Control of refrigerant gases during manufacture, installation, servicing or de-commissioning of motor vehicle air conditioners
- ARCTick service decal stickers
- procedures for servicing and adjusting vehicle air conditioning and HVAC systems
- two different vehicles or machinery with air conditioning and HVAC system faults
- diagnosis and repair equipment for air conditioning and HVAC systems, including:
 - manifold and gauge set
 - recovery unit
 - vacuum pump
 - electronic leak detector
 - nitrogen cylinder and regulator
 - multimeter
 - electronic scales
 - oil injector
 - infra-red thermometer
 - temperature probe
 - scan tool.

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