



**Australian Government**

# **AURETU3005 Retrofit and modify air conditioning and HVAC systems**

**Release 1**

## AURETU3005 Retrofit and modify air conditioning and HVAC systems

### Modification History

Release	Comment
Release 1	Replaces AURT322666A Repair/retrofit air conditioning systems Performance Criteria, Range Statement and Critical Aspects of Evidence updated to reflect technologies

### Unit Descriptor

Unit descriptor	<p>This unit describes the performance outcomes required to retrofit and modify automotive air conditioning systems – including heating, ventilation, air conditioning and cooling (HVAC) systems – that are fitted to a range of vehicles and equipment for passenger convenience and comfort.</p> <p>The unit involves diagnosing deviations from correct operation, the retrofit and modification of vehicle air conditioning and HVAC system components and associated systems, and applying post-modification testing procedures.</p> <p>The unit also involves identifying and confirming work requirements, preparing for work, de-gassing and re-gassing systems, and completing work finalisation processes, including clean-up and documentation.</p> <p>Licensing, legislative, regulatory or certification requirements apply to this unit. Users are advised to check with the relevant regulatory authority.</p>
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## Application of the Unit

<b>Application of the unit</b>	<p>Work applies to automotive air conditioners, including HVAC systems fitted in light and heavy vehicle, mining, construction, agricultural, motorcycle and outdoor power equipment environments.</p> <p>Work requires individuals to demonstrate discretion, judgement and problem-solving skills in managing own work activities and contributing to a productive team environment.</p>
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## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare to retrofit air conditioning and HVAC system	1.1. Nature and <i>scope of work</i> requirements are identified and confirmed 1.2. <i>Workplace health and safety (WHS) requirements</i> are observed throughout the work 1.3. <i>Procedures and information</i> are sourced and interpreted 1.4. Australian Refrigeration Council (ARC) code of practice is sourced and complied with 1.5. <i>Retrofit options</i> are analysed and those most appropriate to the circumstances are selected and prepared 1.6. Technical and calibration requirements for retrofit are sourced and support equipment is identified and prepared 1.7. <i>Tools and equipment</i> are identified for effective retrofit and modification methods 1.8. <i>Critical precautions</i> in relation to working with air conditioning, refrigerant and refrigerant oils are observed
2. De-gas and re-gas air conditioning and HVAC system	2.1. Correct information is accessed and interpreted from manufacturer and component supplier specifications 2.2. System is de-gassed using approved recovery unit and appropriate refrigerant recovery cylinder for individual refrigerant type 2.3. Oil recovered is measured for replacement purposes 2.4. System is evacuated according to manufacturer and component supplier specifications and industry codes of practice, including state and territory legislation with reference to ozone depleting substances 2.5. System is pressure tested for leaks prior to being re-gassed and performance tested using approved methods and equipment 2.6. Recovery and charging of air conditioning system are completed without causing damage to components or systems and in line with requirements for ozone depleting substances, industry regulations and guidelines, WHS legislation, and relevant industry codes of practice
3. Retrofit air conditioning and HVAC system	3.1. Correct information is accessed and interpreted from manufacturer and component supplier specifications 3.2. Air conditioning retrofit procedures are determined after performance testing 3.3. Retrofit of the system and components is carried out according to manufacturer and component supplier specifications

ELEMENT	PERFORMANCE CRITERIA
	<p>3.4.Modifications are carried out without additional pressures associated with the performance of the system or any loss to system integrity</p> <p>3.5.Retrofit to air conditioning system is completed without causing damage to components or systems and according to industry regulations and guidelines, WHS legislation, and relevant industry codes of practice</p>
4. Performance test air conditioning and HVAC system	<p>4.1.System is performance tested prior to placing into service and results are documented according to workplace policies and procedures</p> <p>4.2.Service schedule documentation is completed</p> <p>4.3.Final inspection is made to ensure protective guards and safety features are in place</p>
5. Retest air conditioning and HVAC systems	<p>5.1.Retests are carried out to ensure correct and safe system performance operation</p> <p>5.2.<i>Post-retrofit testing</i> is carried out according to workplace procedures and relevant legislation</p>
6. Prepare vehicle and equipment for delivery to customer	<p>6.1.Final inspection is made to ensure work is to workplace expectations</p> <p>6.2.Vehicle is cleaned to workplace expectations and presented ready for use</p> <p>6.3.Workplace documentation is processed according to workplace procedures</p> <p>6.4.Appropriate <i>decal sticker</i> is placed in engine compartment</p>
7. Clean up work area and maintain equipment	<p>7.1.Material that can be reused is collected and stored in the appropriate designated area and</p> <p>7.2.Waste and scrap are removed following workplace procedures and disposed of according to environmental regulations</p> <p>7.3.Equipment and work area are cleaned and inspected for serviceable condition according to workplace procedures</p> <p>7.4.Faulty equipment is identified, tagged and isolated according to workplace procedures and WHS regulations</p> <p>7.5.Operator maintenance is completed according to manufacturer and component supplier specifications, site procedures and ARC code of practice</p> <p>7.6.Tools and equipment are maintained according to workplace procedures</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- communication skills to:
  - follow verbal and written instructions
  - clarify workplace instructions and determine job requirements
  - gain information from appropriate persons and assistance as required
- initiative and enterprise skills to:
  - apply learning when retrofitting and modifying various air conditioning and HVAC systems
  - recognise a workplace problem or potential problem and take action
- learning skills to identify sources of information, assistance and expert knowledge to expand skills, knowledge and understanding
- literacy skills to:
  - read and follow information in written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
  - obtain and record measurements
  - document required repairs and parts
- numeracy skills to:
  - test, measure and analyse test equipment results compared to desired system performance
  - assess tolerances and apply accurate measurements and adjustments
- planning and organising skills to:
  - plan own work requirements and prioritise actions to achieve required outcomes and ensure tasks are completed on time
  - identify risk factors and take action to minimise them
- problem-solving skills to:
  - refer problems outside area of responsibility to appropriate person and suggest possible causes
  - seek information and assistance as required to solve problems
- self-management skills to:
  - select and use appropriate equipment, materials, processes and procedures
  - recognise limitations and seek timely advice
  - follow workplace documentation, such as codes of practice and operating procedures
- teamwork skills to apply knowledge of own role to complete activities efficiently to support team activities and tasks
- technical skills to use workplace technology and tools relating to the retrofit and modification of air conditioning and HVAC systems, including:
  - specialist tools and equipment

## REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

- measuring equipment
- computerised technology
- technology skills to:
  - operate diagnostic and test equipment
  - use technology to collect, analyse and provide information

### Required knowledge

- WHS regulations, requirements, equipment, material and personal safety requirements, including:
  - legislation
  - ARC code of practice
- principles of operation of automotive air conditioning and HVAC systems, including:
  - piston, scroll and rotary vane compressors
  - electric compressors
  - variable displacement compressors
  - clutchless compressors
- application, purpose and operation of air conditioning and HVAC systems, including:
  - climate control
  - multi-zone systems
- technical information relating to air conditioning and HVAC systems, including:
  - refrigerant saturation temperatures in relation to ambient temperatures and changing levels of humidity
  - graphic symbols and diagrams
- diagnostic and testing procedures, including:
  - use of manifold gauges and surface probe thermocouples for complete system analysis
  - diagnostic procedures for air conditioning and HVAC systems, including:
    - accessing and interpreting diagnostic trouble codes
    - diagnostic flow charts
  - analysis of system operation using gauges, temperature probes, electrical test equipment, scan tools, oscilloscopes and other industry-relevant test equipment
  - visual, aural and functional assessments, including:
    - component damage and wear
    - component corrosion
    - vacuum and leaks
- repair procedures, including:
  - component removal and replacement procedures
  - component and associated system adjustment procedures





## Evidence Guide

<b>EVIDENCE GUIDE</b>	
<p>The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.</p>	
<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>The evidence required to demonstrate competency in this unit must be relevant to workplace operations and satisfy all of the requirements of the performance criteria and required skills and knowledge.</p> <p>A person who demonstrates competency in this unit must be able to:</p> <ul style="list-style-type: none"> <li>• observe safety procedures and requirements, in particular the dangers associated with handling refrigerants</li> <li>• select methods and techniques appropriate to the retrofit and modification of an air conditioning system</li> <li>• conduct performance testing to establish viability of retrofit and modification</li> <li>• complete preparatory activity in a systematic manner</li> <li>• apply full retrofit and modify sequence in line with scope of work</li> <li>• accurately interpret air conditioning performance test results</li> <li>• conduct refrigerant recovery and evacuation of refrigerant operations according to industry codes of practice and legislation, and charge the system with the appropriate refrigerant and oil type</li> <li>• complete a retrofit and modification of air conditioning system and associated components within workplace time frames</li> <li>• present vehicle and equipment in a condition that complies with workplace requirements</li> <li>• complete workplace and equipment documents to ARC code of practice requirements</li> <li>• clean up work area and maintain equipment to workplace standards.</li> </ul>
<b>Context of, and specific resources for assessment</b>	<p>Competency is to be assessed in the workplace or a simulated workplace environment that accurately reflects performance in a real workplace setting.</p> <p>Assessment is to occur:</p> <ul style="list-style-type: none"> <li>• using standard workplace practices and procedures</li> <li>• following safety requirements</li> </ul>

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### Overview of assessment

- applying environmental constraints.

Assessment is to comply with relevant:

- regulatory requirements
- Australian standards
- industry codes of practice
- ARC code of practice.

The following resources must be made available for the assessment of this unit:

- workplace location or simulated workplace
- light and heavy vehicles with air conditioning and HVAC systems relevant to the qualification being sought
- material relevant to perform a retrofit and modification of air conditioning systems
- equipment appropriate for the retrofit or modification of light and heavy vehicle air conditioning and HVAC systems, including:
  - manifold and gauge set
  - recovery unit
  - vacuum pump
  - electronic leak detector
  - nitrogen cylinder and regulator
  - digital vacuum gauge (vacrometer)
  - digital multimeter
  - electronic scales
  - oil injector
  - infra-red thermometer (pyrometer)
  - electronic temperature probe
  - valve core removing/replacement tool
  - psychrometer (humidity detector)
  - various refrigerant hoses and couplers
  - diagnostic scan tool
- specifications and work instructions
- service procedures for above equipment appropriate for the retrofit and modification of vehicle air conditioning and HVAC

**EVIDENCE GUIDE**

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**Overview of assessment**

systems.

**Method of assessment**

Assessment must satisfy the endorsed Assessment Guidelines of this Training Package.

Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with the application of required skills and knowledge.

Assessment methods must be by direct observation of tasks and include questioning on required skills and knowledge to ensure correct interpretation and application.

Competence in this unit may be assessed in conjunction with other units which together form part of a holistic work role.

Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate the needs of diverse clients.

Assessment processes and techniques must be culturally sensitive and appropriate to the language, literacy and numeracy capacity of the candidate and the work being performed.

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<p><b><i>Scope of work</i></b> may include:</p>	<ul style="list-style-type: none"> <li>• type of system fitted</li> <li>• refrigerant type</li> <li>• oil type</li> <li>• system variables, including:             <ul style="list-style-type: none"> <li>• refrigerant leak detecting</li> <li>• refrigerant recovery and charging</li> <li>• system evacuation</li> <li>• mechanical removal and replacement of components</li> <li>• system and component testing</li> <li>• performance testing.</li> </ul> </li> </ul>
<p><b><i>Workplace health and safety requirements</i></b> may include:</p>	<ul style="list-style-type: none"> <li>• material safety data sheets (MSDS)</li> <li>• first aid kit</li> <li>• personal protective clothing and equipment</li> <li>• use of tools and equipment</li> <li>• safe handling of material</li> <li>• use of fire-fighting equipment</li> <li>• workplace safety policies and procedures</li> <li>• workplace first aid equipment</li> <li>• water shower or equivalent</li> <li>• hazard control, including control of hazardous materials and toxic substances</li> <li>• dangers associated with handling refrigerants and oils.</li> </ul>
<p><b><i>Procedures and information</i></b> may include:</p>	<ul style="list-style-type: none"> <li>• verbal, written and graphical instructions</li> <li>• signage</li> <li>• work schedules, plans and specifications</li> <li>• work bulletins and memos</li> <li>• MSDS</li> <li>• diagrams and sketches</li> <li>• safe work procedures relating to the retrofit and modification to air conditioning and HVAC systems</li> <li>• regulatory and legislative requirements relating to automotive industry</li> <li>• Australian Design Rules</li> </ul>

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	<ul style="list-style-type: none"> <li>• engineer's design specifications and instructions</li> <li>• workplace work specifications and requirements</li> <li>• instructions issued by authorised workplace or external persons</li> <li>• Australian standards</li> <li>• ARC code of practice</li> <li>• vehicle service requirements and repair manuals.</li> </ul>
<b><i>Retrofit options</i></b> may include:	<ul style="list-style-type: none"> <li>• change of refrigerant gas from R12 to R134a: <ul style="list-style-type: none"> <li>• receiver dryer filter replacement</li> <li>• change of system fittings for gauge fitment</li> </ul> </li> <li>• change of refrigerant gas from R134a to R1234yf: <ul style="list-style-type: none"> <li>• change of system fittings for gauge fitment.</li> </ul> </li> </ul>
<b><i>Tools and equipment:</i></b>	<ul style="list-style-type: none"> <li>• are to include the following specialist tools, which are mandatory under the ARC code of practice: <ul style="list-style-type: none"> <li>• manifold and gauge set</li> <li>• recovery unit</li> <li>• vacuum pump</li> <li>• electronic leak detector</li> <li>• electronic scales</li> </ul> </li> <li>• may include: <ul style="list-style-type: none"> <li>• normal hand tools</li> <li>• nitrogen cylinder and regulator</li> <li>• digital vacuum gauge (vacrometer)</li> <li>• oil injector</li> <li>• infra-red thermometer (pyrometer)</li> <li>• electronic temperature probe</li> <li>• valve core removing/replacement tool</li> <li>• psychrometer (humidity detector)</li> <li>• various refrigerant hoses and couplers</li> <li>• digital multimeter</li> <li>• diagnostic scan tool.</li> </ul> </li> </ul>
<b><i>Critical precautions</i></b> may include:	<ul style="list-style-type: none"> <li>• dangers associated when working with refrigerants and lubricants, including: <ul style="list-style-type: none"> <li>• frostbite (refrigerant boiling point -36.7°C)</li> </ul> </li> </ul>

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	<ul style="list-style-type: none"> <li>• carcinogenic oil</li> <li>• care taken with some flammable refrigerants.</li> </ul>
<i>Post-retrofit testing</i> may include:	<ul style="list-style-type: none"> <li>• validating the effectiveness of the retrofit and modification action, including the following checks: <ul style="list-style-type: none"> <li>• ambient temperature</li> <li>• centre vent temperature</li> <li>• condenser and suction line temperature</li> <li>• manifold gauge pressure readings</li> <li>• refrigerant leaks</li> </ul> </li> <li>• confirming that reported faults have been rectified</li> <li>• confirming that no other faults are present as a result of the retrofit and modification action.</li> </ul>
Information on <i>decal sticker</i> must include:	<ul style="list-style-type: none"> <li>• name of the service organisation</li> <li>• quantity of refrigerant added</li> <li>• refrigerant and oil type</li> <li>• service date</li> <li>• technician's licence number</li> <li>• vehicle odometer reading.</li> </ul>

**Unit Sector(s)**

<b>Unit sector</b>	Electrical
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**Co-requisite units**

Not applicable.

## Competency field

<b>Competency field</b>	Technical – Air Conditioning and HVAC
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