



Australian Government

AURETU104 Diagnose and repair air conditioning and HVAC components

Release: 1

AURETU104 Diagnose and repair air conditioning and HVAC components

Modification History

Release	Comments
Release 1	This version first released with AUR Automotive Retail, Service and Repair Training Package Version 6.0

Application

This unit describes the skills and knowledge 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. The systems used vary based on the work context. It involves preparing for the task, sourcing a diagnostic testing strategy, diagnosing the cause of the fault, carrying out the repair, performing post-repair testing, and completing workplace processes and documentation.

The unit applies to those who work in an automotive service and repair industry. Automotive air conditioners, in addition to 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. An Australian Refrigeration Council accredited (ARCtick) Refrigerant Handling licence is required for those carrying out this work.

Unit Sector

Electrical Technical – Air Conditioning and HVAC

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
1. Prepare to diagnose and repair air conditioning and HVAC system	1.1 Identify job requirements from workplace instructions 1.2 Identify required information for diagnosis activity 1.3 Select diagnostic options and source testing strategy to identify cause of fault using workplace and manufacturer procedures 1.4 Identify hazards and environmental issues associated with

ELEMENT	PERFORMANCE CRITERIA
	diagnose and repair activity, assess potential risks and implement control measures in line with workplace policies and procedures 1.5 Identify tools and equipment required for testing strategy and establish serviceability according to workplace procedures
2. Diagnose air conditioning and HVAC system	2.1 Carry out diagnostic tests set out in testing strategy according to manufacturer and workplace procedures, and workplace health and safety requirements 2.2 Identify cause of fault through examination of diagnostic test results 2.3 Confirm and report cause of fault according to workplace procedures 2.4 Develop and report recommendations for necessary repairs according to workplace procedures
3. Operate recovery equipment	3.1 Identify vehicle refrigerant with a refrigerant identifier or analyser 3.2 Weigh recovery cylinder and record available capacity and tare weight of cylinder 3.3 Connect recovery equipment to vehicle according to manufacturer specifications, workplace procedures, workplace health and safety and environmental requirements 3.4 Recover refrigerant and transfer into designated recovery cylinder using recovery equipment according to manufacturer specifications, workplace procedures, and workplace health safety and environmental requirements
4. Repair air conditioning and HVAC system	4.1 Identify required information for repair activity 4.2 Identify required repair tools, equipment and materials required for repair activity and establish serviceability according to workplace procedures 4.3 Carry out repairs according to workplace and manufacturer procedures, manufacturer specifications, workplace health and safety and environmental requirements 4.4 Recharge system with required refrigerant gas according to manufacturer specifications, workplace procedures and workplace health and safety and environmental requirements 4.5 Carry out post-repair testing according to workplace procedures, workplace health and safety and environmental requirements
5. Complete work processes	5.1 Conduct final inspection according to workplace procedures and confirm vehicle is ready for use 5.2 Clear work area and dispose of or recycle materials

ELEMENT	PERFORMANCE CRITERIA
	according to workplace procedures 5.3 Complete Australian Refrigeration Council accredited (ARCtick) service decal sticker and workplace documentation according to workplace procedures.

Foundation Skills

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

SKILLS	DESCRIPTION
Learning	• Locates required sources of information efficiently • Develops a sequenced plan for a specific task
Reading	• Interprets text, symbols and wiring diagrams relating to diagnostic and repair information from manufacturer specifications and workplace instructions and procedures
Oral communication	• Clarifies instructions • Obtains information from customers and supervisors
Numeracy	• Matches refrigerant types and identification numbers to workplace instructions, parts lists, manufacturer specifications, code of practice and regulatory requirements • Interprets weight measurements, including tare and gross weights • Interprets readings on pressure gauges • Measures temperatures and pressures and uses mathematical operations, to calculate deviations from manufacturer specifications
Planning and organising	• Plans own work requirements • Prioritises actions to achieve required outcomes • Ensures tasks are completed within workplace timeframes
Technology	• Uses specialised equipment.

Unit Mapping Information

Supersedes and is equivalent to AURETU004 Diagnose and repair air conditioning and HVAC systems.

Links

Companion Volume Implementation Guide is found on VETNet -

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

Assessment Requirements for AURETU104 Diagnose and repair air conditioning and HVAC components

Modification History

Release	Comments
Release 1	This version first released with AUR Automotive Retail, Service and Repair Training Package Version 6.0

Performance Evidence

The candidate must demonstrate the ability to complete the tasks outlined in the elements, performance criteria and foundation skills of this unit, including evidence of the ability to:

- 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
- remove, refit or replace two different types of refrigerant.

Knowledge Evidence

The candidate must be able to demonstrate knowledge to complete the tasks outlined in the elements, performance criteria and foundation skills of this unit, including knowledge of:

- methods to locate and interpret information required to diagnose and repair air conditioning and HVAC systems, including:
 - information provided by customers and supervisors
 - air conditioning and HVAC system manufacturer specifications
 - Australian automotive code of practice: control of refrigerant gases during manufacture, installation, servicing or de-commissioning of motor vehicle air conditioners
- workplace procedures required to diagnose and repair air conditioning and HVAC systems, including:
 - establishing the serviceability of tools and equipment
 - documentation procedures
 - housekeeping procedures, including:

- examination of tools and equipment
- storage of equipment
- identification, tagging and isolation of faulty equipment
- safe disposal of materials
- recycling procedures
- workplace health and safety (WHS) 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
 - identifying refrigerant and oil type, including:
 - service decal sticker
 - testing refrigerant
 - types and location of service ports
 - handling, storing and transporting refrigerant cylinders and recovery cylinders, including:
 - pressure ratings
 - pressure relief devices
 - outlet connection type
 - selecting and using personal protective equipment (PPE)
 - emergency procedures and incident management requirements and procedures
 - handling flammable refrigerants
 - identifying and using fire safety equipment
- procedures for recovering automotive refrigerant, including:
 - testing refrigerant to determine its type
 - connecting manifold and gauge set and recovery unit, including types and location of service ports
 - identifying recovery cylinder suitable to the refrigerant
 - operating recovery unit, including weighing recovery cylinder before and after recovery
 - disconnecting and storing recovery unit and cylinder
- system performance testing, including:
 - using manifold gauges and thermometers to check system pressures and vent temperatures
 - checking blower fan output
 - checking engine fan output
 - checking filters
- environmental requirements relating to servicing air conditioning and HVAC, including procedures for:
 - preventing loss of refrigerant to the atmosphere
 - handling materials and refrigerant recovery equipment
- 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
- 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:
 - accessing and interpreting scan tool system data, including:
 - diagnostic trouble codes (DTCs)
 - live data
 - freeze frame data

- waveforms
- 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
 - ambient temperature
 - centre vent temperature
 - condenser and suction line temperature
 - manifold gauge pressure readings
- static and dynamic performance tests of air conditioning and HVAC systems, including checking:
 - ambient temperature
 - vent temperature
 - condenser and suction line temperature
- procedures for completing ARCTick service decal sticker, including:
 - name of service organisation
 - ARCTick business authority number
 - quantity of refrigerant added
 - refrigerant and oil type
 - service date
 - technician name and licence number.

Assessment Conditions

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
- minimum of two different types of refrigerant
- 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.

Assessors of this unit must satisfy the requirements for assessors in applicable vocational education and training legislation, frameworks and/or standards; and hold an Australian Refrigerant Council (ARC) Refrigerant Handling licence.

Links

Companion Volume Implementation Guide is found on VETNet -

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