



Australian Government

CPCPMS5011A Design air conditioning and ventilation systems

Release 1

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Modification History

Changes to unit descriptor, application, performance criteria, required skills and knowledge, range statement and critical aspects
Not equivalent to CPCPMS5001A

Unit Descriptor

This unit of competency specifies the outcomes required to evaluate and design air conditioning and ventilation systems for residential and commercial applications.

Application of the Unit

This unit of competency supports development of skills and knowledge required for competent workplace performance in a consultancy or supervisory capacity in relation to plumbing services and hydraulics.

Licensing/Regulatory Information

In some jurisdictions, this unit of competency may form part of accreditation, licensing, legislative, regulatory or certification requirements.

Pre-Requisites

Nil

Employability Skills Information

This unit contains employability skills.

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.

Elements and Performance Criteria

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| 1 | Evaluate design parameters. | 1.1 | Scope of work for the design of air conditioning and ventilation systems is established. |
| | | 1.2 | Design requirements are determined from relevant Australian standards, codes, plans, specifications manufacturer instructions and client briefs, including factors that contribute to quality, safety and time efficiency are determined. |
| | | 1.3 | User comfort conditions and specific use conditions are evaluated and psychometric evaluation and heat loads are calculated . |
| | | 1.4 | Building heat losses are evaluated. |
| | | 1.5 | Distribution requirements for air conditioning and ventilation system applications are specified. |
| | | 1.6 | Range of air conditioning and ventilation systems are evaluated according to given applications. |
| | | 1.7 | Mechanical services drawings are evaluated and interpreted. |
| | | 1.8 | Health risks that may arise due to poor maintenance of air conditioning and ventilation systems are evaluated. |
| | | 1.9 | Minimum performance requirements are specified for several different air conditioning and ventilation systems. |
| | | 1.10 | Manufacturer specifications and technical manuals are evaluated for suitability for a range of design applications. |
| | | 1.11 | Additional research, including a desktop study , is conducted to outline design parameters. |
| | | 1.12 | Safety of system users or building occupants is considered. |

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| 2 | Plan system components. | <p>2.1 Appropriate zoning of air conditioning and ventilation systems is planned to comply with given specific performance objectives.</p> <p>2.2 Air conditioning units are specified for optimum performance with reference to legislation, standards and other relevant documentation.</p> <p>2.3 Fan types are specified for a range of applications with reference to legislation, standards and other relevant documentation.</p> <p>2.4 Air diversion systems, including registers, are planned to ensure a balanced system with reference to legislation, standards and other relevant documentation.</p> <p>2.5 Required ventilation and duct work components are planned and locations are specified with reference to legislation, standards and other relevant documentation.</p> <p>2.6 Approved materials for air conditioning and ventilation systems are specified.</p> <p>2.7 Plans and drawings are completed using relevant Australian standards, codes, manufacturer installation requirements, drawing symbols related to air conditioning and ventilation according to legislation, and other relevant documentation.</p> |
| 3 | Design and size systems. | <p>3.1 Volume air changes per hour are calculated from given floor plans and details.</p> <p>3.2 Methods for eliminating health risks from existing or proposed systems are specified with reference to legislation, standards and other relevant documentation.</p> <p>3.3 Design and sizing for a range of air conditioning and ventilation systems are determined for given applications.</p> <p>3.4 Sustainability principles and concepts are applied throughout the design.</p> |

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| 4 | Test systems. | 4.1 | Test procedures for air conditioning and ventilation systems are evaluated. |
| | | 4.2 | Tests are conducted using appropriate testing equipment , results are recorded and report is prepared. |
| | | 4.3 | Adjustments required as a result of testing are planned, designed and specified. |
| 5 | Prepare documentation. | 5.1 | Client brief of the desired design is prepared. |
| | | 5.2 | Appropriate checklist, including formulas required to carry out an air balance to a given specification, is developed. |
| | | 5.3 | Plans and specifications are prepared for a range of air conditioning and ventilation systems. |
| | | 5.4 | Testing and commissioning schedule is prepared. |
| | | 5.5 | Operation and maintenance manual is produced, including information on how to properly and safely maintain the system. |

Required Skills and Knowledge

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

Required skills

- communication skills to:
 - communicate with others to ensure safe and effective work practices
 - confirm job specifications and client requirements
 - enable clear and direct communication, using questioning to identify and confirm requirements, share information, listen and understand
 - use language and concepts appropriate to cultural differences
 - use and interpret non-verbal communication
- literacy skills to:
 - prepare written documentation, including:
 - operation and maintenance manual
 - plans, specifications and schedules
 - read and interpret:
 - plans, specifications, drawings and design briefs
 - manufacturer requirements and manuals
 - statutory and regulatory requirements and standards
- initiative and enterprise skills to develop creative and responsive approaches
- numeracy skills to:
 - apply formulas and calculate air displacements and returns
 - calculate heat loads
- planning and organising skills to:
 - research, collect, organise and understand information relating to the design of air conditioning and ventilation systems
 - take initiative and make decisions
- problem-solving skills to analyse requirements, carry out tests, consider options and design an appropriate system
- teamwork skills to be able to work with others and action tasks and relate to people from a range of cultural ethnic backgrounds and varying physical and mental abilities.
- technology skills to:
 - access and understand site-specific instructions in a variety of media
 - use mobile communication technology

Required knowledge

- air psychometrics and the use of psychometric charts
- requirements of the National Construction Code, relevant Australian standards and other applicable codes or standard operating procedures relevant to the sector
- compliance with WHS and organisational quality procedures and processes
- hazards associated with devices used in air conditioning and ventilation systems
- heat load calculations
- installation methods used in air conditioning and ventilation systems
- nature of materials and effect of performance
- plans and specifications
- terminology and definitions used in air conditioning and ventilation systems

Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment

This unit of competency could be assessed in the workplace or a close simulation of the workplace environment providing that simulated or project-based assessment techniques fully replicate plumbing and services workplace conditions, materials, activities, responsibilities and procedures.

This unit of competency could be assessed by:

- developing an air conditioning and ventilation system for a given project, including the schedule of works and job specification
- preparing a graphical presentation of an air conditioning or ventilation system solution with specifications.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

A person who demonstrates competency in this unit must be able to as a minimum, provide evidence of the ability to:

- design, size and document the layout details for an air conditioning and ventilation system for a 10 storey residential building with ground floor shops and basement car park
- evaluate and document design parameters to relevant Australian standards, codes, regulatory, client and manufacturer requirements for system components, including:
 - air conditioning units
 - ducting systems
 - controls
 - fans
 - zones
- develop an appropriate checklist for tests to be carried out on the system, including formulas required to carry out an air balance
- conduct tests, record and evaluate test results, and prepare a report
- prepare testing and commissioning schedules for air conditioning and ventilation systems
- prepare operation and maintenance manuals for air

conditioning and ventilation systems

- apply sustainability principles and concepts throughout the air conditioning and ventilation system design
- communicate with others to ensure safe and effective workplace operations.

Context of and specific resources for assessment

This competency is to be assessed using standard and authorised work practices, safety requirements and environmental constraints.

Assessment of essential underpinning knowledge will usually be conducted in an off-site context.

Assessment is to comply with relevant regulatory or Australian standards' requirements.

Resource implications for assessment include:

- an induction procedure and requirement
- realistic tasks or simulated tasks covering the minimum task requirements
- relevant specifications and work instructions
- tools and equipment appropriate to applying safe work practices
- support materials appropriate to activity
- workplace instructions relating to safe work practices and addressing hazards and emergencies
- material safety data sheets
- research resources, including industry-related systems information.

Reasonable adjustments for people with disabilities must be made to assessment processes where required. This could include access to modified equipment and other physical resources, and the provision of appropriate assessment support.

Method of assessment

Assessment methods must:

- satisfy the endorsed Assessment Guidelines of the Construction, Plumbing and Services Training Package
- include direct observation of tasks in real or simulated work conditions, with questioning to confirm the ability to consistently identify and correctly interpret the essential underpinning

knowledge required for practical application

- reinforce the integration of employability skills with workplace tasks and job roles
- confirm that competency is verified and able to be transferred to other circumstances and environments.

Validity and sufficiency of evidence requires that:

- competency will need to be demonstrated over a period of time reflecting the scope of the role and the practical requirements of the workplace
- where the assessment is part of a structured learning experience the evidence collected must relate to a number of performances assessed at different points in time and separated by further learning and practice, with a decision on competency only taken at the point when the assessor has complete confidence in the person's demonstrated ability and applied knowledge
- all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence.

Assessment processes and techniques should as far as is practical take into account the language, literacy and numeracy capacity of the candidate in relation to the competency being assessed.

Supplementary evidence of competency may be obtained from relevant authenticated documentation from third parties, such as existing supervisors, team leaders or specialist training staff.

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, if used 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.

Scope of work may include:

- interpreting plans and specifications
- sizing and documenting layout for air conditioning and ventilation systems, including residential and

commercial systems

- new projects or an existing structure being renovated, extended, restored or maintained.

Design requirements must include:

- architectural plans
- building specifications
- fire safety
- National Construction Code
- owners
- tenants
- air-flow requirements and sizing of duct work.

Specific use conditions may include:

- age and activity of occupants
- computer requirements
- food preparation
- smoke exhaust
- wet-bulb and dry-bulb temperature and humidity.

Psychometric evaluation may include:

- absolute, specific and relative humidity
- air composition
- air properties, including:
 - density
 - expansion coefficient
 - kinematic viscosity
 - Prandtl number
 - specific heat
 - temperature
 - thermal conductivity
- altitude, density and volume
- determination of the air condition using a psychometric or Mollier chart, showing:
 - dewpoint temperature
 - dry-bulb temperature
 - enthalpy
 - humidity ratio
 - relative humidity
 - specific volume
 - wet-bulb temperature.

Calculation of heat loads must include:

- assessment of factors affecting heat load, including:
 - building materials
 - insulation
 - number of personnel
 - number of windows
 - room dimensions
 - usage
 - weather effects
- using:
 - calculations and computer software systems
 - heat load calculation methods and formulas.

Building heat losses may include:

- construction materials
- insulation materials
- maintaining plenum
- occupancy
- room sizes.

Desktop study may include collection and interpretation of data for design purposes in:

- architectural and building plans
- developer plans
- manufacturer data
- documents:
 - applications
 - brochures
 - forms
 - policies
 - other reports as available.

Legislation, standards and other relevant documentation is to be according to commonwealth, state and territory legislation and regulations and may include:

- WHS requirements, such as:
 - growth and distribution of *Legionella pneumophila* bacteria and other water and airborne infectious bacterial agents
 - handling of materials, including hazardous materials and substances
 - hazard control
 - organic and inorganic contaminants
 - personal protective clothing (PPE) and equipment
 - use of first aid equipment

- use of tools and equipment
- workplace environment and safety
- environmental requirements, including water quality management, which may include the breeding of mosquitoes
- quality assurance requirements, including:
 - AS1100 Technical drawing materials
 - AS/NZS1668 Ventilation systems: Parts 1 and 2
 - AS/NZS1677 Refrigerating systems
 - AS/NZS 3666 Handling microbial systems
 - Environment Protection Authority (EPA)
 - internal company quality assurance policy and risk management strategy
 - International Standards Organisation
 - site safety plan
 - workplace operations and procedures
- specifications and operational manuals for:
 - commissioning and testing
 - components installation
 - fittings
 - manufacturer specifications, literature and data
 - materials
 - pumps
 - systems
 - valves.

Specifications may include:

- air-flow requirements
- equipment selection
- fire safety
- jointing
- manufacturer requirements
- materials
- safety (WHS)
- specialised components
- support
- testing
- workmanship.

Plans:

- may include:
 - axonometrics

- cross-sections
- details
- elevations
- isometrics
- schematics
- sections
- may be produced using:
 - computer generation
 - drawing equipment.

Design and sizing:

- may include designs that are prescriptive and include detail relating to:
 - cost
 - materials and quality of work
 - milestones
 - nominated subcontractors
 - provision of on-site facilities and site access
 - quality assurance
 - space allowances
 - standard procedures
 - work schedules
- design parameters must include:
 - client requirements
 - legislative requirements
 - WHS requirements
 - user requirements in relation to zoning
- design and sizing may be produced using:
 - computer generation
 - drawing equipment
 - with reference to calculations, tables, regulations and manufacturer specifications.

Applications may include:

- amenities
- basement carpark
- food preparation
- residential and commercial premises.

Sustainability principles and

- cover the current and future social, economic and environmental use of resources

concepts:

- may include:
 - selecting appropriate material to ensure minimal environmental impact
 - efficient use of material
 - efficient energy usage/capital outlay comparison.

Tests and testing equipment must include:

- air pressure
- air velocity
- air volume
- humidity
- Pitot tubes
- sound power levels
- temperature.

Testing may include:

- air flow
- climate control
- defect inspection
- inspection checklist
- performance quality assurance (QA) audit.

Commissioning schedule may include:

- acoustic performance
- balancing
- system certification
- check for foreign material
- leak check
- system defects
- system functions as per design.

Operation and maintenance manual may include:

- as installed drawings
- certification documentation
- results of commissioning test
- maintenance schedules
- manufacturer brochures and technical information
- regular water quality testing
- system operation.

Unit Sector(s)

Functional area

Unit sector Plumbing and services

Custom Content Section

Not applicable.