



**Australian Government**

# **CPCPMS4011B Design, size and lay out heating and cooling systems**

**Release 1**

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## **Modification History**

Minor changes throughout the unit  
Equivalent to CPCPMS4011A

## **Unit Descriptor**

This unit of competency specifies the outcomes required to design, size and document the layout of heating and cooling systems for multi-floor structures.

It covers preparing for the work, identifying and confirming system specifications and requirements, designing system layout, and work finalisation processes, including records and documentation.

## **Application of the Unit**

This unit applies:

to ducting systems for air conditioning, heating or ventilation purposes in buildings Class 1 or 2 with a maximum static pressure of 0.75kPa and a maximum velocity of 12.5 metres per second piping systems conveying heating and chilled water operating at a maximum pressure of 700kPa or a maximum temperature of 100°C, and systems having a maximum output of 50kW and total air quantities not exceeding 950 litres per second.

Site location for the application of the plan will be residential and commercial, and may be a new work site or an existing structure being renovated, extended, restored or maintained.

## **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

- |   |                               |   |
|---|-------------------------------|---|
| 1 | Prepare for design.           | <p>1.1 Nature and scope of design task are identified and confirmed.</p> <p>1.2 <b><i>Work health and safety</i></b> (WHS) and <b><i>environmental requirements</i></b> planning, sizing and documenting the layout of heating and cooling systems are adhered to throughout the work.</p> <p>1.3 Work is organised and sequenced in conjunction with others involved in or affected by the work.</p> <p>1.4 <b><i>Tools and equipment</i></b> required for designing, sizing and documenting the layout of heating and cooling systems, including personal protective equipment, are selected and checked for serviceability.</p> <p>1.5 Work area in which design process is to be conducted is prepared.</p> |
| 2 | Identify system requirements. | <p>2.1 Information and specifications for required work are obtained and confirmed, if necessary by site inspection.</p> <p>2.2 <b><i>Statutory and regulatory authorities'</i></b> requirements relevant to work are consulted and applied to all aspects of the work, using relevant <b><i>information</i></b>.</p> <p>2.3 Heating and cooling requirements are determined from building drawings, plans and specifications.</p> <p>2.4 <b><i>Air conditioning or small bore heating system</i></b> is sized to provide for required heating and cooling load and to provide required piping and ducting according to standards, and regulatory authorities' and workplace</p>                                |

- requirements.
- 2.5 ***Sustainability principles and concepts*** are observed when preparing for and undertaking work process.
- 3 Design system layout.
- 3.1 Layout of heating and cooling system is designed according to building plans, relevant standards and workplace procedures.
- 3.2 ***Materials*** required are specified and optimised according to standards from the proposed design.
- 3.3 Plans are recorded according to regulatory authorities' and workplace requirements.
- 4 Restore work area.
- 4.1 Work area is restored according to workplace procedures.
- 4.2 Tools and equipment used in the process are refurbished and left according to workplace procedures.
- 4.3 Documentation, including work backup, is completed according to workplace requirements.

## Required Skills and Knowledge

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

### Required skills

- communication skills to:
  - access information
  - enable clear and direct communication, using questioning to identify and confirm requirements, share information, listen and understand
  - follow instructions
  - identify requirements, including system requirements
  - report faults
  - use language and concepts appropriate to cultural differences
  - use and interpret non-verbal communication, such as hand signals
- literacy skills to:
  - complete written workplace documentation, including:
    - work backup
    - record plans
  - read and interpret:
    - documentation from a variety of sources
    - regulations, standards, plans, specifications and drawings
- numeracy skills to apply measurements and calculations
- planning and organising skills to:
  - plan and sequence tasks with others
  - plan and set out work
- teamwork skills to work with others to action tasks and relate to people from a range of cultural and ethnic backgrounds and with varying physical and mental abilities
- technical skills to:
  - identify and accurately report to appropriate personnel any faults in tools, equipment or materials
  - interpret plans and specifications to design, size and document the layout of heating and cooling systems for multi-floor buildings up to a height of six floors
- technology skills to:
  - access and understand site-specific instructions in a variety of media
  - use mobile communication technology

### Required knowledge

- characteristics and application of different fixing and joining techniques and methods
- characteristics and application of pipe and ducting systems, including their fittings and fixture supports and fixing and joining techniques
- design concepts and performance measures for heating and cooling systems
- effective isolation processes and procedures
- electrical and electronic principles and safety requirements
- environmental impact of gases and Environment Protection Authority (EPA) requirements
- job safety analysis (JSA) and safe work method statements (SWMS)
- principles, operation and characteristics of heating and cooling systems
- process of designing, sizing and documenting the layout of heating and cooling systems
- properties of water and air, including pressure and flow rates
- relevant information sources for the work activity
- relevant statutory requirements related to designing, sizing and documenting the layout of heating and cooling systems
- SI system of measurements
- standards applicable to heating and cooling systems
- use of computers and relevant computer-aided design (CAD) software
- workplace and equipment safety requirements

## Evidence Guide

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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.

### 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 provide evidence of:

- locating, interpreting and applying relevant information, standards and specifications to planning, sizing and documenting the layout of a heating and cooling system
- applying safety requirements throughout the work sequence, including electrical safety requirements and the use of personal protective clothing and equipment
- given the plans and specifications, designing, sizing and documenting the layout details of a domestic heating and cooling system requiring a minimum heat load of 150 megajoules (MJ) per hour plus a commercial heating and cooling system for a structure with at least four floors, ensuring:
  - application of sustainability principles and concepts
  - correct identification of details of the plan
  - correct selection and use of appropriate processes, tools and equipment
  - completion of all work to specification
  - compliance with regulations, standards and organisational quality procedures and processes
  - communicating and working effectively and safely with others.

### 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

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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.

***Work health and safety*** is to be according to commonwealth, state and territory legislation and regulations and may include:

- handling of materials
- hazard control
- personal protective clothing and equipment prescribed under legislation, regulations and workplace policies and practices
- safe operating procedures, including recognising and preventing hazards associated with:
  - electricity
  - hazardous materials and substances
  - other machines
  - surrounding structure and facilities
  - trip hazards
  - underground services
  - use of tools and equipment

- work site visitors and the public
- working at heights
- working in confined spaces
- working in proximity to others
- use of firefighting equipment
- use of first aid equipment
- workplace environment and safety.

***Environmental requirements*** cover water quality management and may include:

- clean-up protection
- stormwater protection
- waste management.

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

- computers running appropriate CAD software
- drawing instruments
- measuring equipment.

***Statutory and regulatory authorities*** include:

- commonwealth, state or territory, and local authorities administering applicable Acts, regulations and codes of practice.

***Information*** may include:

- charts and hand drawings
- instructions issued by authorised organisational or external personnel
- job drawings
- manufacturer specifications and instructions
- material safety data sheets (MSDS)
- memos
- organisation work specifications and requirements
- plans and sketches
- regulatory and legislative requirements, particularly those pertaining to:
  - building codes
  - WHS and environmental requirements
  - plumbing regulations
- relevant Australian standards
- safe work procedures relating to designing, sizing and documenting heating and cooling systems
- signage
- verbal, written and graphical instructions
- work bulletins

- work schedules, plans and specifications.

***Air conditioning*** may include:

- evaporative cooling system
- hydronic heating system
- hydronic cooling system
- warm air system
- refrigerated air conditioning system.

***Small bore heating systems*** include:

- boilers
- piping
- radiators.

***Sustainability principles and concepts:***

- cover the current and future social, economic and environmental use of resources
- may include:
  - use of efficient design principles throughout
  - incorporating efficient use of material in the design
  - design that ensures minimal environmental impact
  - choice of appropriate components and equipment to ensure minimal environment impact.

***Materials*** may include:

- drafting materials and equipment
- relevant structure plans and specifications.

## **Unit Sector(s)**

### **Functional area**

#### **Unit sector**

Plumbing and services

## **Custom Content Section**

Not applicable.