



Australian Government

CPCPMS5010A Design steam generation and distribution systems

Release 1

CPCPMS5010A Design steam generation and distribution systems

Modification History

Changes to unit title, descriptor, performance criteria, required skills and knowledge, range statement and critical aspects
Not equivalent to CPCPMS5000A

Unit Descriptor

This unit of competency specifies the outcomes required to design steam generation and distribution systems, including pipe and valve sizing, material selection, and the preparation and specification of documentation for steam distribution systems.

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

- | | | | |
|---|------------------------------------|-----|--|
| 1 | Evaluate design parameters. | 1.1 | <i>Scope of work</i> for steam generation and distribution systems is established. |
| | | 1.2 | <i>Design requirements</i> are determined from relevant Australian standards, codes, plans, specifications and client brief. |
| | | 1.3 | <i>Cost-benefit analysis</i> is conducted comparing a range of materials and system designs. |
| | | 1.4 | <i>Statutory and regulatory requirements and relevant Australian standards and codes</i> for the design of steam generation and distribution systems are analysed and applied. |
| | | 1.5 | <i>Manufacturer requirements</i> and trade and technical manuals are interpreted. |
| | | 1.6 | Additional research, including a <i>desktop study</i> , is conducted to outline design parameters. |
| | | 1.7 | Factors that contribute to quality, safety and time efficiency are determined. |
| | | 1.8 | <i>Performance requirements</i> are established, considering safety of system users or building occupants. |
| 2 | Plan and detail system components. | 2.1 | <i>Layout of pipework systems</i> and types of <i>fittings, valves</i> and controls are planned. |
| | | 2.2 | <i>Pipe size calculations</i> are performed for a range of applications. |
| | | 2.3 | <i>Steam appliances</i> are specified, steam consumption is calculated and <i>boilers</i> required are sized and specified. |
| | | 2.4 | <i>Steam circuits</i> are detailed and distribution pressures for a range of applications are specified. |
| | | 2.5 | <i>Steam trap types and their operation</i> are specified and detailed. |
| | | 2.6 | <i>Steam injection</i> systems are specified. |
| | | 2.7 | <i>Insulation</i> is specified. |

- 2.8 **Pipe supports** are designed for a range of applications.
- 2.9 Approved **materials, jointing methods** and **installation requirements** for steam generation and distribution systems are specified.
- 3 Design and size systems.
- 3.1 Steam distribution systems are **designed** for a range of applications.
- 3.2 Steam distribution systems are designed and sized using calculations and computer software packages.
- 3.3 **Sustainability principles and concepts** are applied throughout the design.
- 4 Prepare documentation.
- 4.1 **Plans** and **specifications** are prepared for a range of steam generation and distribution systems.
- 4.2 **Testing** and **commissioning schedule** is prepared.
- 4.3 **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, such as hand signals
- initiative and enterprise skills to develop creative and responsive approaches
- literacy skills to:
 - prepare written documentation, including:
 - operation and maintenance manual
 - plans, specifications and schedules
 - read and interpret:
 - manufacturer requirements and manuals
 - plans, specifications, drawings and design briefs
 - statutory and regulatory requirements and standards
- numeracy skills to apply measurements and calculations
- planning and organising skills to:
 - plan and set out work
 - research, collect, organise and understand information relating to the design of steam generation and distribution systems
 - take initiative and make decisions
- problem-solving skills to analyse requirements, consider options and design an appropriate system
- 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 prepare and specify steam distribution system plans
- technology skills to:
 - access and understand site-specific instructions in a variety of media
 - use mobile communication technology

Required knowledge

- common terminology and definitions used in design of steam generation and distribution systems for all classes of building, including industry terminology such as:
 - absolute pressure
 - enthalpy
 - enthalpy of evaporation and of saturated steam
 - enthalpy of saturated water
 - gauge pressure
 - heat and heat transfer
 - latent heat
 - specific enthalpy
 - specific heat capacity
- principles of technology in the design of steam generation and distribution systems
- requirements of commonwealth, state or territory regulatory authorities, relevant Australian standards, codes and manufacturer specifications, including hazards identified in relation to devices and systems used
- SI system of units related to steam
- terms, including relevant Australian standard and code definitions, manufacturer terms and naming conventions
- workplace safety requirements, including relevant statutory regulations, codes and standards

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.

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:

- apply sustainability principles and concepts throughout the design of the system
- design, size and document layout details, including a specification for a 100-bed three-storey hospital incorporating a laundry
- evaluate and document design parameters to relevant Australian standards, codes, regulations, and client and manufacturer requirements for a steam generation and distribution system
- design and size a steam generation and distribution system using appropriate software
- prepare testing and commissioning schedules
- produce operation and maintenance manuals
- 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 must include:

- barriers to heat transfer
- effects of air in a steam system
- heat transfer
- interpreting plans and specifications, and sizing and documenting layout of steam generation and distribution systems for residential, commercial and industrial applications for either new projects or an existing structure being renovated, extended, restored or maintained
- principles and properties of steam systems, including:
 - characteristics of condensation
 - methods of condensate removal
- steam applications, including commercial, manufacturing, institution and machinery and equipment operation
- working with types of steam and steam quality, including:
 - dry steam
 - flash steam
 - properties of steam at varying pressures
 - superheated steam
 - wet steam.

- Design requirements*** may include:
- architectural plans
 - builder specifications
 - boiler selection
 - fire safety requirements
 - flow requirements and sizing of pipework
 - owner requirements
 - pipework identification
 - ventilation requirements.
- Cost-benefit analysis:***
- compares the range of suitable materials and system choices available to enable cost-effective choices to be made without compromising integrity of the project
 - may include:
 - design styles
 - energy costs
 - expected design life
 - labour costs
 - material costs
 - safety factors
 - speed of installation
 - suitable materials.
- Statutory and regulatory requirements and relevant Australian standards and codes*** may include:
- Acts, regulations and commonwealth, state or territory, and local government requirements
 - National Construction Code
 - relevant Australian standards and codes.
- Manufacturer requirements*** may include:
- material specifications
 - recommended specific fixings for pipework
 - sizing tables
 - technical and trade manuals.
- Desktop study*** must include:
- architectural and building plans
 - developer plans
 - documents, including:
 - applications
 - brochures

- forms
- other reports as available
- manufacturer data
- policies.

Performance requirements may include:

- steam generation and consumption, and steam and pressure quality, established using relevant Australian standards, codes and manufacturer information.

Layout of pipework systems:

- must include:
 - principles of economy, serviceability, durability and fit for use
 - location of pipework (fire rating of enclosure)
- should not unduly affect building integrity and aesthetic appeal.

Fittings and valves may include:

- fittings:
 - bends
 - couplings
 - condensate traps
 - steam traps
 - steam headers
 - steam strainers
 - tees
 - unions
- valves:
 - isolating valves
 - pressure relief valves.

Pipe size calculations must include:

- energy
- pressure
- sizing
- storage
- volume.

Steam appliances:

- may include:
 - calorifiers

- industrial applications
- kitchen and laundry appliances
- sterilisers
- water heaters
- details must include:
 - components
 - construction
 - electronic controls
 - methods of temperature and pressure control.

Boilers:

- may include:
 - coal
 - electric
 - fire tube
 - gas
 - oil
 - packaged
 - solid fuel
 - water tube
- factors to be considered when selecting a boiler must include:
 - advantages and disadvantages of boiler types
 - capacity and size
 - designs based on anticipated use
 - energy sources
 - methods of reducing heat losses
 - pressure controls and components
 - storage requirement calculations
 - suitable time period between refilling
 - valves.

Steam circuits must include:

- condensate return
- feed pumps
- feed tanks
- headers
- steam distribution
- water treatment.

Steam trap types and their operation:

- types, which may include:
 - mechanical
 - thermodynamic
 - thermostatic
 - other applicable types
- operation, which must include:
 - installation
 - location.

Steam injection must include:

- noise control
- open ended pipe
- proprietary
- sparge pipe.

Insulation:

- may include:
 - fibreglass
 - rock wool
- insulation protection, including:
 - plastic
 - sheet metal.

Pipe supports may include:

- anchors
- bracket spacing
- corrosion protection
- hanging brackets
- manufacturer-recommended specific fixings
- material requirements
- provision for expansion.

Materials may include:

- copper
- steel
- other approved materials.

Jointing methods may include:

- brazing
- mechanical joints
- threading
- welding.

Installation requirements may include:

- pipe protection:
 - cover
 - corrosion
 - impact
- fire rating
- level of workmanship
- manufacturer-recommended specific fixings
- pipe support
- provision for expansion
- provision for drainage of condensation
- serviceability and access.

Designed may include:

- cost relating to performance, including:
 - milestones
 - standard procedures
 - standards of work
 - work schedules
- prescriptive designs, including detail relating to:
 - materials and quality of work
 - nominated subcontractors
 - provision of on-site facilities and site access
 - quality assurance.

Sustainability principles and concepts:

- cover the current and future social, economic and environmental use of resources
- may include:
 - selecting appropriate material to ensure minimal environmental impact
 - efficient energy usage
 - water usage
 - efficient use and recycling of material
 - disposing of waste material to ensure minimal environmental impact.

Plans:

- may include:
 - axonometrics
 - cross-sections

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

Specification may include:

- boiler selection
- fire safety
- flow requirements
- jointing
- manufacturer requirements
- materials
- residual pressures
- specialised components
- support
- testing
- valve selection
- workmanship
- work health and safety (WHS).

Testing may include:

- defect inspection
- flow
- inspection checklist
- leak
- pressure
- performance
- quality assurance (QA) audit.

Commissioning schedule may include:

- boiler
- check for foreign material
- containment
- leak check
- operation
- pump
- system certification
- system defects
- system functions as per design

- treatment system.

Operation and maintenance manual may include:

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

Unit Sector(s)

Functional area

Unit sector Plumbing and services

Custom Content Section

Not applicable.