



Australian Government

CPCPPS5030A Design pump systems

Release 1

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Modification History

Changes to unit descriptor, performance criteria, required skills and knowledge, range statement and critical aspects
Not equivalent to CPCPPS5010A

Unit Descriptor

This unit of competency specifies the outcomes required to undertake the specification, selection and sizing of pumps and the design of associated piping and components for inclusion in hydraulic 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. | <p>1.1 <i>Scope of work</i> is established for <i>pump</i> system requirements for wide span and high-rise building projects.</p> <p>1.2 <i>Pump duties</i> are established.</p> <p>1.3 <i>Design requirements</i> are determined from plans, specifications, system demands and client brief.</p> <p>1.4 <i>Cost-benefit and life cycle analysis</i> is conducted comparing a range of pump alternatives, materials and system designs.</p> <p>1.5 <i>Statutory and regulatory requirements</i> and <i>Australian standards and codes</i> for the design of pump systems are analysed, interpreted and applied.</p> <p>1.6 <i>Manufacturer requirements</i> and trade, technical and sizing manuals are interpreted.</p> <p>1.7 Additional research, including a <i>desktop study</i>, is conducted to outline design parameters.</p> <p>1.8 <i>Flow and pressure tests</i> of hydraulic system are conducted.</p> <p>1.9 <i>Performance requirements</i> are established, considering safety of system users or building occupants.</p> |
| 2 | Plan and detail system components. | <p>2.1 <i>Pump, controls and pumproom requirements</i> are sized and detailed.</p> <p>2.2 <i>Layout of pipework systems</i> and type and location of <i>fittings, valves</i> and controls are planned.</p> <p>2.3 Pipe sizes, velocities, flows and pressures are calculated for a range of applications.</p> <p>2.4 <i>Energy sources</i> are specified for a range of hydraulic pumping applications.</p> <p>2.5 <i>Pump plinths</i> and <i>pump mountings</i> are designed for a range of applications.</p> <p>2.6 Pump impellers are sized and selected.</p> |

- 2.7 Approved *materials, jointing methods* and *installation requirements* are specified.
 - 2.8 Allowance for vibration is provided.
- 3 **Design and size systems.**
 - 3.1 Pump systems are designed for a range of wide span and high-rise building applications.
 - 3.2 Pump acoustic performance is evaluated.
 - 3.3 Net positive suction head calculations are performed.
 - 3.4 Design principles are applied for optimal performance of pump systems.
 - 3.5 Range of *delivery systems* is designed.
 - 3.6 Pump systems are designed and sized using calculations and computer software packages.
 - 3.7 *Sustainability principles and concepts* are applied throughout the design process.
- 4 **Prepare documentation.**
 - 4.1 Client brief of the desired design is prepared.
 - 4.2 *Plans* and *specification* details are prepared for a range of pump systems.
 - 4.3 *Testing* and *commissioning schedule* is prepared.
 - 4.4 *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:
 - enable clear and direct communication, using questioning to identify and confirm requirements, share information, listen and understand
 - liaise with others to publish reports
 - use language and concepts appropriate to cultural differences
 - use and interpret non-verbal communication, such as hand signals
- literacy skills to:
 - apply design concepts and principles relating to hydraulic systems and undertake a literature review
 - produce report to a professional standard
 - read and interpret:
 - documents and resources identified through the literature review
 - plans, specifications and drawings
 - standards, manufacturer requirements and manuals
 - statutory and regulatory requirements
 - other relevant documentation
 - undertake document analysis, including impacts and evaluation results
- initiative and enterprise skills to develop creative and responsive approaches
- numeracy skills to apply measurements and calculations
- planning and organising skills to:
 - research, collect, organise and understand information relating to the design of pump systems
 - take initiative and make decisions
- problem-solving skills, including the ability to:
 - identify typical faults and action required to rectify problems
 - analyse requirements, consider options and design an appropriate system
- technical skills to:
 - design associated piping and components for hydraulic systems
 - specify, select and size pumps
- technology skills to:
 - access and understand site-specific instructions in a variety of media
 - use mobile communication technology

Required knowledge

- hazards associated with pumping equipment used in hydraulic systems
- key features of work plans and specifications
- approved installation methods for pump systems
- principles of technology in the design of pump installations for hydraulic systems
- relevant Australian standards, codes, manufacturer specifications, National Construction Code (NCC) and operating procedures relevant to the sector
- research methods, report writing and publishing, including who to contact and how to publish reports
- terminology and definitions used in pump installation
- work health and safety (WHS) 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:

- design, size and document required pumping systems for the hydraulic services installation required for a high-rise mixed development building to a minimum of 29 floors, inclusive of a basement, to include fixtures on each floor level (fixtures are included in the basement) and a wide span project (such as a school or industrial complex) to include:
 - applying sustainability principles and concepts throughout the design of pump system
 - evaluating and documenting design parameters to relevant Australian standards, codes, and hydraulic system client, regulatory and manufacturer requirements
 - planning and detailing system components, including:
 - ancillaries
 - control panel
 - fittings
 - flow switches
 - mounting
 - piping
 - plinths
 - pressure switches
 - pump duty
 - complying with WHS regulations applicable to workplace operations

- applying organisational quality procedures and processes
- using appropriate calculations and computer software
- developing a cost-benefit lifecycle analysis for a range of systems
- preparing plans and specification
- preparing a testing and commissioning schedule
- preparing an operation and maintenance manual
- communicating with others to ensure safe and effective work site operations
- producing safety and emergency procedures.

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, including design brief drawings, specifications, codes, design concepts and construction schedules
- tools and equipment appropriate to applying safe work practices, including computers, software and calculators
- workplace instructions relating to safe working 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:
 - interpretation of plans and specifications
 - sizing and documenting layout of pump systems for wide span and high-rise building projects
- may be for new projects or an existing structure being renovated, extended, restored or maintained.

Pump types may include:

- centrifugal
- circulating
- constant flow variable speed
- macerator
- multiple stage
- piston
- positive displacement
- submersible
- vacuum
- variable speed control.

Pump duties must include:

- constant pressure
- flow rate
- head
- velocity.

Design requirements may include:

- acoustic performance
- architectural plans
- available flow and pressure from authority's main
- building specifications
- fire safety
- owner's requirements
- pipework identification
- pump duty
- sizing of pipework
- ventilation
- vibration
- viscosity of fluids.

Cost-benefit and life cycle analysis:

- includes balancing initial cost with durability, longevity, maintenance and ongoing fuel and energy cost requirements
- compares the range of suitable materials, pumps and system designs available to enable cost-effective choices to be made without compromising integrity of project
- may include:
 - design
 - energy costs
 - expected design life
 - labour costs
 - material costs
 - safety factors
 - speed of installation
 - suitable materials.

Statutory and regulatory requirements may include:

- Acts and regulations, and commonwealth, state or territory, and local government requirements.

Australian standards and codes may include:

- AS/NZS3500 National plumbing and drainage
- AS2419 Fire hydrant installations – system design, installation and commission
- AS/NZS1547 On-site domestic wastewater management
- AS2200 Design charts for water supply and sewerage
- National Construction Code
- other relevant Australian standards.

Manufacturer requirements may include:

- material installation specifications
- pump tables
- pipe sizing
- recommended installation and fixings for pipework
- technical and trade manuals
- ventilation requirements.

Desktop study may include collection and interpretation of data

- architectural and building plans
- developer plans

for design purposes in:

- manufacturer data
- documents, which may include:
 - applications
 - brochures
 - forms
 - policies
 - other reports as available.

Flow and pressure tests may include:

- on-site measurement of flow (l/s), velocity (m/s) and pressure (kPa).

Performance requirements include:

- flow, velocity, pressure and discharge requirements, to satisfy the requirements of the hydraulic system.

Pump, controls and pumphouse requirements may include:

- acoustics
- ancillaries
- automatic controls
- inlet and outlet design
- installation and mounting
- plinths
- pump sizing and selection
- space
- ventilation
- vibration.

Layout of pipework systems may include:

- access
- identification
- insulation
- isolation
- maintenance
- principles of economy, serviceability, durability and fit for use
- replacement.

Fittings and valves may include:

- fittings:
 - bends
 - flanges
 - inlet and outlet pressure gauges

- tees
- unions
- valves:
 - air relief
 - excess pressure
 - isolating
 - non-return
 - pressure limiting
 - pressure reduction
 - strainers
 - vibration couplings.

Energy sources may include:

- diesel and diesel-electric generator sets
- electrical, single phase and three-phase
- petrol.

Pump plinth bases designed to resist forces exerted by pump may include:

- concrete
- masonry
- timber
- steel.

Pump mountings may include:

- anchoring bolts
- inertia pads
- rubber and synthetic
- spring loaded
- vibration mounts.

Materials:

- piping may include:
 - copper (Cu)
 - galvanised steel
 - stainless steel
 - polyethylene (PE)
 - polypropylene (PP)
 - polybutylene (PB)
 - other approved material
- pumps may include:
 - cast iron
 - bronze

- stainless steel
- other appropriate materials.

Jointing methods may include:

- brazing
- electrofusion welding
- mechanical joints
- other approved jointing method.

Installation requirements may include:

- pipe protection, which may include:
 - corrosion
 - impact
- fire rating
- level of workmanship.
- manufacturer-recommended specific fixings
- pipe support
- provision for vibration
- serviceability and access
- thrust brackets.

Delivery systems may include:

- circulation
- constant flow variable speed pump
- hydropneumatic
- lift
- pressure
- rising main
- vacuum.

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 use of material
 - efficient energy usage/capital outlay comparison
 - effect on the environment due to pump or pipe failure
 - pump efficiency.

Plans:

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

Specification may include:

- acoustic performance
- fire safety
- jointing
- manufacturer requirements
- materials
- pump duty
- residual pressures
- safety (WHS)
- specialised components
- support
- testing
- valve selection
- vibration control
- workmanship.

Testing may include:

- defect inspection
- hydrostatic
- performance
- quality assurance (QA) audit.

Commissioning schedule may include:

- system certification
- exhaust pipe check
- flow check
- leak check
- pressure check
- system purge
- system defects

- system functions as per design
- valve operation
- acoustic performance.

Operation and maintenance manual may include:

- as installed drawings
- results of commissioning test
- certification documentation
- emergency shut-down procedures
- maintenance schedules
- manufacturer brochures and technical information
- valve function.

Unit Sector(s)

Functional area

Unit sector Plumbing and services

Custom Content Section

Not applicable.