



Australian Government

Department of Education, Employment and Workplace Relations

CPCPPS5010A Design pump systems

Release: 1

CPCPPS5010A Design pump systems

Modification History

Not Applicable

Unit Descriptor

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 hydraulic systems.
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Application of the Unit

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.
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Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units	Nil
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Employability Skills Information

Employability skills 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 performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate design parameters.	1.1. Scope of work is established for pump system requirements for wide span and high-rise building projects. 1.2. Pump duties are established. 1.3. Design requirements are determined from plans, specifications and client briefs. 1.4. Cost-benefit and life cycle analysis is conducted comparing a range of pump alternatives, materials and system designs. 1.5. Statutory and regulatory requirements and Australian and New Zealand standards for the design of pump systems are analysed, interpreted and applied. 1.6. Manufacturer requirements and trade, technical and sizing manuals are interpreted. 1.7. Additional research, including a desktop study, is conducted to outline design parameters. 1.8. Flow and pressure tests of hydraulic system are conducted. 1.9. Performance requirements are established.
2. Plan and detail system components.	2.1. Pump, pump controls and pumphoom requirements are sized and detailed. 2.2. Layout of pipework systems and type and location of fittings and valves are planned. 2.3. Pipe sizes, velocities, flows and pressures are calculated for a range of applications. 2.4. Energy sources are specified for a range of hydraulic pumping applications. 2.5. Pump plinths and pump mountings are designed for a range of applications. 2.6. Pump impellers are sized and detailed. 2.7. Approved materials, jointing methods and installation requirements are specified.
3. Design and size systems.	3.1. Pump systems are designed for a range of wide span and high-rise building applications. 3.2. Net positive suction head calculations are performed. 3.3. Design principles are applied for optimal performance of pump systems. 3.4. Range of delivery systems is designed.

ELEMENT	PERFORMANCE CRITERIA
4. Prepare documentation.	3.5. Pump systems are designed and sized using computer software packages.
	4.1. Plans and details are prepared for a range of pump systems.
	4.2. Specification for a pump system is prepared.
	4.3. Testing and commissioning schedule is prepared.
	4.4. Operation and maintenance manual is produced.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills

Required skills for this unit are:

- 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
 - read and interpret:
 - documents and resources identified through the literature review
 - plans, specifications and drawings
 - other relevant documentation
 - use language and concepts appropriate to cultural differences
 - use and interpret non-verbal communication, such as hand signals
- written skills to:
 - document analysis, including impacts and evaluation results
 - produce report to a professional standard
- designing associated piping and components for hydraulic systems
- innovation skills to develop creative and responsive approaches
- numeracy skills to apply measurements and calculations
- planning and organisational 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:

REQUIRED SKILLS AND KNOWLEDGE

- identify typical faults and action required to rectify problems
- analyse requirements, consider options and design an appropriate system
- research methods, report writing and publishing, including who to contact and how to publish reports
- specifying, selecting and sizing pumps
- technical skills, including the ability to apply design concepts and principles relating to hydraulic systems and undertake a literature review.

Required knowledge

Required knowledge for this unit is:

- nature of materials used and effects of performance under various conditions
- requirements of state regulatory authorities, Australian standards and manufacturer specifications
- terminology, definitions, installation methods and hazards identified in relation to devices and systems used according to:
 - AS/NZS3500 National plumbing and drainage set
 - AS2419 Fire hydrant installations - system design, installation and commission
 - AS/NZS1547 On-site domestic wastewater management
 - AS2200 Design charts for water supply and sewerage
 - Building Code of Australia (BCA)
 - other standards, codes or standard operating procedures
- workplace safety requirements, including relevant statutory regulations, codes and standards.

Evidence Guide

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 provide evidence of:

- evaluating and documenting design parameters, including client, regulatory, manufacturer and Australian and New Zealand standard requirements for a range of pump systems
- planning and detailing system components, including:
 - fittings
 - impeller sizing
 - mounting
 - piping systems
 - plinths
 - valves
- complying with OHS regulations applicable to workplace operations
- applying organisational quality procedures and processes
- designing and sizing a range of pump systems
- developing a cost-benefit, life cycle analysis for a range of pump systems
- preparing plans for a range of pump systems
- preparing a specification for a pump system
- preparing a testing and commissioning schedule
- preparing an operation and maintenance manual
- interactive communication with others to

EVIDENCE GUIDE

Context of and specific resources for assessment

ensure safe and effective work site operations.

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

EVIDENCE GUIDE

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

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

RANGE STATEMENT

regional contexts) may also be included.

- | | |
|---|---|
| Scope of work includes: | <ul style="list-style-type: none"> • interpretation of plans and specifications, and sizing and documenting layout of pump systems, for applications including residential, commercial and industrial and new projects or an existing structure being renovated, extended, restored or maintained. |
| Pump types may include: | <ul style="list-style-type: none"> • centrifugal pumps • circulating • constant flow variable speed pumps • macerator pumps • motor pumps • multiple impeller pumps • piston pumps • solid and semi-solid pumping systems • submersible pumps • vacuum and multi-stage pumps • variable speed pumps • warm and hot water. |
| Pump duties may include: | <ul style="list-style-type: none"> • delivery • flow • head • velocity. |
| Design requirements may include: | <ul style="list-style-type: none"> • architectural specifications • builder specifications • owner requirements • specialist water use applications. |
| Cost-benefit and life cycle analysis may include: | <ul style="list-style-type: none"> • balancing initial cost with durability, longevity maintenance and ongoing fuel and energy cost requirements • comparison of the range of suitable materials, pumps and system designs available to enable cost-effective choices to be made without compromising integrity of project. |
| Statutory and regulatory requirements may include: | <ul style="list-style-type: none"> • Acts and regulations • local and state government policies. |
| Australian and New Zealand standards may include: | <ul style="list-style-type: none"> • AS/NZS3500 National plumbing and drainage set • AS2419 Fire hydrant installations - system design, installation and commission |

RANGE STATEMENT

Manufacturer requirements include:

- AS/NZS1547 On-site domestic wastewater management
- AS2200 Design charts for water supply and sewerage
- BCA.
- material specifications
- pump tables
- sizing tables
- technical and trade manuals.

Desktop study can include collection and interpretation of existing data for design purposes from:

- architectural and building plans
- council plans
- developer plans
- other documents and reports as available.

Flow and pressure tests may include:

- interpretation of flow and pressure tests conducted by a contractor
- on-site measurement of flow (l and s), velocity (m and s) and pressure (kPa).

Performance requirements may include:

- flow, velocity, pressure and discharge requirements, established using Australian and New Zealand standards and local authority plans.

Pump, pump controls and pumphouse requirements may include:

- automatic controls
- impeller sizing
- inlet and outlet design requirements
- installation and mounting requirements
- pump sizing and selection
- space requirements
- valve requirements.

Layout of pipework systems may include:

- dual feed
- ring main
- single pipe.

Fittings and valves may include:

- fittings:
 - bends
 - tees
 - unions
- valves:
 - backflow prevention
 - excess pressure valves
 - isolating
 - pressure limiting

RANGE STATEMENT

- pressure reduction
 - strainers
 - vibration couplings.
- Energy sources*** may include:
- diesel and diesel-electric generator sets
 - petrol
 - single phase
 - three phase.
- Pump plinths*** may include:
- bases designed to resist forces exerted by pump
 - concrete
 - masonry
 - timber.
- Pump mountings*** may include:
- anchoring bolts
 - motor pump
 - pump mountings and adjustments
 - rubber and synthetic pump mounts
 - vibration couplings.
- Materials*** may include:
- acrilonitrile butadiene styrene (ABS)
 - composite pipework
 - copper
 - cross-linked polyethylene
 - fittings and fixtures
 - impeller materials
 - polybutylene
 - protective coatings
 - pump construction
 - steel.
- Jointing methods*** may include:
- brazing
 - compression
 - flaring
 - mechanical joints
 - soldering
 - threaded.
- Installation requirements*** include:
- clipping
 - installation details
 - jointing requirements
 - level of workmanship
 - mounting.
- Delivery systems*** may include:
- constant flow variable speed pump

RANGE STATEMENT

Plans may include:

- downfeed
- hydropneumatic
- pressure ratio
- upfeed.
- axonometrics
- cross-sections
- details
- elevations
- isometrics
- schematics, which may be produced using:
 - computer generation
 - Indian ink
 - pencil
 - pigment liner
- sections.

Specification may include:

- bedding
- clipping
- jointing
- manufacturer
- materials
- specialised components
- valve selection
- workmanship.

Testing may include:

- air pressure test
- defect inspection
- hydrostatic test
- mains pressure test
- quality assurance (QA) audit.

Commissioning schedule may include:

- flow test
- leak check
- pressure test
- system purge
- valve operation.

Operation and maintenance manual may include:

- leak detection
- pump maintenance
- valve maintenance
- water auditing
- yearly inspection
- yearly maintenance requirements.

Unit Sector(s)

Unit sector Plumbing and services

Co-requisite units

Co-requisite units Nil

Functional area

Functional area