

Unit of Competency CPCPPS5030

Design pump systems

Application

This unit specifies the skills and knowledge required to undertake the specification, selection and sizing of pumps and the design of associated piping and components for inclusion in hydraulic systems in high-rise mixed development building to a minimum of 29 floors and wide span projects, such as schools.

The role involves interaction with architects, builders, suppliers, clients and relevant planning authorities and requires a sound understanding of applicable legislation, standards and codes.

The unit requirements are typically carried out by experienced people such as hydraulic design consultants, plumber or persons in a supervisory capacity in relation to plumbing services on a new or existing site.

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

Prerequisite Unit

Nil.

Elements and Performance Criteria

1 Evaluate design parameters.	<ul style="list-style-type: none">1.1 Establish scope of work for pump system requirements for wide span and high-rise building projects.1.2 Determine design requirements from plans, specifications, system demands and client brief.1.3 Identify statutory and regulatory requirements and Australian Standards and codes for the design of pump systems.1.4 Apply sustainability principles and concepts as part of the design process.1.5 Conduct flow and pressure tests of hydraulic system.1.6 Establish pump duties for the design application.1.7 Establish performance requirements considering safety of system users or building occupants.1.8 Interpret manufacturer requirements, trade, sizing and technical manuals.1.9 Conduct research to outline design parameters.1.10 Conduct cost-benefit and life cycle analysis to compare a range of pump alternatives, materials and system designs.
2. Plan and detail system components.	<ul style="list-style-type: none">2.1 Size and detail pump, controls and pump room requirements.2.2 Plan layout of pipework systems including type and location of fittings, valves and controls.2.3 Calculate pipe sizes, velocities, flows and pressures for applications.2.4 Specify energy sources for hydraulic pumping applications.2.5 Plan pump plinths and pump mountings for applications.2.6 Size and select pump impellers.2.7 Specify approved materials, jointing methods and installation requirements.2.8 Provide allowance for vibration.

3. Design and size systems.	3.1 Design pump systems for wide span and high-rise building applications. 3.2 Evaluate pump acoustic performance. 3.3 Perform wastewater pump dynamic suction head and flow rate calculations. 3.4 Apply design principles for optimal performance of pump systems. 3.5 Design delivery systems for the design application. 3.6 Design and size pump systems using calculations and computer software packages. 3.7 Perform domestic water pump flow rate and pressure head calculations. 3.8 Perform stormwater pump dynamic suction head and flow rate calculations.
4. Prepare documentation.	4.1 Prepare client brief of the preferred design. 4.2 Prepare plans and specification details for a range of pump systems. 4.3 Prepare testing and commissioning schedule. 4.4 Produce operation and maintenance manual.

Foundation skills

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Unit Mapping Information

Supersedes and is equivalent to CPCPPS5030A Design pump systems.

Links

Companion Volume Implementation Guide:

<https://vetnet.education.gov.au/Pages/TrainingDocs.aspx?q=7e15fa6a-68b8-4097-b099-030a5569b1ad>

Assessment Requirements for CPCPPS5030 Design pump systems

Performance Evidence

To demonstrate competency, a candidate must meet the performance criteria for this unit by:

- designing, sizing and documenting water and wastewater pumping systems required for the hydraulic services installation of:
 - a high-rise mixed development building to a minimum of 29 floors, including a basement with fixtures on all levels, and
 - a wide span project (such as a school or industrial complex)
- planning and detailing both system components and include:
 - ancillaries
 - control panel
 - fittings
 - flow switches
 - mounting
 - piping
 - plinths
 - pressure switches
 - pump duty.

Knowledge Evidence

To be competent in this unit, a candidate must demonstrate knowledge of:

- 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
- research methods
- terminology and definitions used in pump installation
- work health and safety (WHS) requirements, including relevant statutory regulations, codes and standards
- scope of work:
 - interpretation of plans and specifications
 - sizing and documenting layout of pump systems for wide span and high-rise building projects
- pump types:
 - centrifugal
 - circulating
 - constant flow variable speed
 - macerator
 - multiple stage

- o piston
 - o positive displacement
 - o submersible
 - o vacuum
 - o variable speed control
- pump duties:
 - o constant pressure
 - o flow rate
 - o head
 - o velocity
- design requirements:
 - o acoustic performance
 - o architectural plans
 - o available flow and pressure from authority's main
 - o building specifications
 - o fire safety
 - o owner's requirements
 - o pipework identification
 - o pump duty
 - o sizing of pipework
 - o ventilation
 - o vibration
 - o viscosity of fluids
- cost-benefit and life cycle analysis:
 - o balancing initial cost with durability, longevity, maintenance and ongoing fuel and energy cost requirements
 - o comparing the range of suitable materials, pumps and system designs available to enable cost-effective choices to be made without compromising integrity of project
- cost-benefit considerations:
 - o design
 - o energy costs
 - o expected design life
 - o labour costs
 - o material costs
 - o safety factors
 - o speed of installation
 - o suitable materials
- statutory and regulatory requirements which may include Acts and regulations
Commonwealth, state or territory and local government requirements
- Australian Standards and codes:
 - o AS/NZS 3500 Plumbing and drainage set
 - o AS 2419 Fire hydrant installations system design, installation and commission
 - o AS/NZS 1547 On-site domestic wastewater management
 - o AS 2200 Design charts for water supply and sewerage

- o National Construction Code (NCC)
 - o other relevant Australian Standards
- manufacturer requirements:
 - o material installation specifications
 - o pump tables
 - o pipe sizing
 - o recommended installation and fixings for pipework
 - o technical and trade manuals
 - o ventilation requirements
- information gathered during desktop study to support design research:
 - o architectural and building plans
 - o developer plans
 - o manufacturer data
 - o applications
 - o brochures
 - o forms
 - o policies
 - o reports
- flow and pressure tests which may include on-site measurement of flow (l/s), velocity (m/s) and pressure (kPa)
- performance requirements including flow, velocity, pressure and discharge requirements, to satisfy the requirements of the hydraulic system
- pump, controls and pump room requirements:
 - o acoustics
 - o ancillaries
 - o automatic controls
 - o inlet and outlet design
 - o installation and mounting
 - o plinths
 - o pump sizing and selection
 - o space
 - o ventilation
 - o vibration
- layout of pipework systems:
 - o access
 - o identification
 - o insulation
 - o isolation
 - o maintenance
 - o principles of economy, serviceability, durability and fit for use
 - o replacement
- fittings:
 - o bends
 - o flanges

- o inlet and outlet pressure gauges
 - o tees
 - o unions
- valves:
 - o air relief
 - o excess pressure
 - o isolating
 - o non-return
 - o pressure limiting
 - o pressure reduction
 - o strainers
 - o vibration couplings
- energy sources:
 - o diesel and diesel-electric generator sets
 - o electrical, single phase and three-phase
 - o petrol
- pump plinth bases designed to resist forces exerted by pump:
 - o concrete
 - o masonry
 - o timber
 - o steel
- pump mountings:
 - o anchoring bolts
 - o inertia pads
 - o rubber and synthetic
 - o spring loaded
 - o vibration mounts
- piping materials:
 - o copper (Cu)
 - o galvanised steel
 - o stainless steel
 - o polyethylene (PE)
 - o polypropylene (PP)
 - o polybutylene (PB)
 - o other approved material
- pump materials:
 - o cast iron
 - o bronze
 - o stainless steel
 - o other appropriate materials
- jointing methods:
 - o brazing
 - o electrofusion welding

- o mechanical joints
 - o other approved jointing method
- installation requirements:
 - o pipe protection:
 - corrosion
 - impact
 - fire rating
 - o level of workmanship
 - o manufacturer-recommended specific fixings
 - o pipe support
 - o provision for vibration
 - o serviceability and access
 - o thrust brackets
- delivery systems:
 - o circulation
 - o constant flow variable speed pump
 - o hydropneumatic
 - o lift
 - o pressure
 - o rising main
 - o vacuum
- methods of applying sustainability principles and concepts:
 - o selecting appropriate material to ensure minimal environmental impact
 - o efficient use of material
 - o efficient energy usage/capital outlay comparison
 - o effect on the environment due to pump or pipe failure
 - o pump efficiency
- types of plans:
 - o axonometrics
 - o cross-sections
 - o details
 - o elevations
 - o isometrics
 - o sections
 - o schematics produced using:
 - computer generation
 - drawing equipment
- specification:
 - o acoustic performance
 - o fire safety
 - o jointing
 - o manufacturer requirements
 - o materials

- o pump duty
- o residual pressures
- o WHS
- o specialised components
- o support
- o testing
- o valve selection
- o vibration control
- o workmanship
- testing of:
 - o defect inspection
 - o hydrostatic
 - o performance
 - o quality assurance (QA) audit
- commissioning schedule information:
 - o system certification
 - o exhaust pipe check
 - o flow check
 - o leak check
 - o pressure check
 - o system purge
 - o system defects
 - o system functions as per design
 - o valve operation
 - o acoustic performance
- operation and maintenance manual information:
 - o as installed drawings
 - o results of commissioning test
 - o certification documentation
 - o emergency shutdown procedures
 - o maintenance schedules
 - o manufacturer brochures and technical information
 - o valve function.

Assessment Conditions

Assessors must satisfy the requirements for assessors listed in the Standards for Registered Training Organisations.

This unit must be assessed in the workplace or a close simulation using realistic workplace conditions, materials, activities, responsibilities, procedures, safety requirements and environmental considerations.

Links

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