Australian Government

CPCPPS5027A Design irrigation systems

Release 1

INDUSTRY SKILLS COUNCILS
Creating Australia's Future

CPCPPS5027A Design irrigation systems

Modification History

Changes to unit descriptor, application, performance criteria, required skills and knowledge, range statement and critical aspects
Not equivalent to CPCPPS5007A

Unit Descriptor

This unit of competency specifies the outcomes required to design irrigation systems to relevant Australian standards, codes, the National Construction Code (NCC) and other relevant legislative requirements to meet occupier needs and industry standards.

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 the design of irrigation systems for residential, commercial, industrial, sporting and agricultural properties with or without connection to reticulated supply.

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 ***Scope of work*** for irrigation systems is established.

1.2 ***Design requirements*** are determined from relevant Australian standards, codes, plans, specifications and client brief.

1.3 ***Cost-benefit analysis*** is conducted comparing a range of pipe materials and system designs.

1.4 ***Statutory and regulatory requirements and relevant Australian standards and codes*** for the design of irrigation systems are interpreted, analysed and applied.

1.5 ***Manufacturer requirements*** and trade and technical manuals are interpreted.

1.6 Additional research, including a ***desktop study***, is conducted to outline design parameters.

1.7 ***Flow and pressure tests*** are conducted.

1.8 ***Water sources, volumes and areas to be irrigated*** are established.

1.9 ***Soil types*** are analysed and categorised, and impacts on irrigation systems are documented.

1.10 Factors that contribute to quality, safety and time efficiency are determined.

1.11 ***Performance requirements*** are established, considering safety of system users or building occupants.

2	**Plan and detail system components.**	2.1	***Layout of pipework systems*** and type and location of ***fittings, valves and controls*** are planned.
		2.2	Type, location and requirements for ***backflow prevention devices*** are detailed.
		2.3	Pipe sizes, velocities, flows and pressures are calculated for a range of applications.
		2.4	Approved ***materials*** and ***jointing methods*** for irrigation systems are specified.
		2.5	***Sections and components of the irrigation system*** are detailed.
		2.6	***Pipe supports*** are designed for a range of applications.
		2.7	***Pump enclosure and control requirements*** are sized and detailed.
		2.8	***Installation requirements*** are specified for irrigation management system.
		2.9	Water storage requirements are determined.
		2.10	Allowance for pipe movement is made.
3	**Design and size systems.**	3.1	Irrigation systems are designed for a range of residential, commercial, industrial, sporting and agricultural ***applications***.
		3.2	Range of ***delivery systems and layout*** are designed.
		3.3	Irrigation systems are designed and sized using calculations and computer software packages.
		3.4	Required water application is determined to establish and maintain plant life.
		3.5	***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 ***specifications*** are prepared for a range of irrigation systems.

4.3 ***Testing*** and ***commissioning schedule*** is prepared.

4.4 ***Operation and maintenance manual*** is produced.

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
- literacy skills to:
  - prepare written documentation, including:
    - operation and maintenance manual
    - plans, specifications and schedules
  - read and interpret:
    - plans, specifications, drawings and design briefs
    - standards and manufacturer requirements and manuals
    - statutory and regulatory requirements
- 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 irrigation 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 design irrigation systems to National Construction Code, relevant Australian standards, and other relevant legislative requirements
- technology skills to:
  - access and understand site-specific instructions in a variety of media
  - use mobile communication technology

Required knowledge

- application of National Construction Code or relevant Australian standards and codes,

manufacturer specifications, and operating procedures relevant to the sector
- common terminology and definitions used in the design of irrigation systems
- nature of materials used and effects of performance under various conditions
- principles of technology used in design of irrigation systems for a range of applications
- 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 layout details of an irrigation system, including a specification for a:
  - sports oval incorporating stormwater collection and use, with a mains pressure drinking water top-up and with chemical additives
  - a landscaped area for a mixed development site connected to a main pressure recycled (non-drinking) water main
- evaluate and document design parameters to relevant Australian standards and codes, and regulatory, client and manufacturer requirements.
- plan and detail system components that include:
  - backflow prevention devices
  - irrigation management-control system
  - pumping requirements
  - water delivery outlets
  - piping requirements
- design and size two irrigation systems, using appropriate calculations and computer software for specific applications
- prepare testing and commissioning schedules
- prepare operation and maintenance manuals
- apply sustainability principles and concepts throughout the design
- communicate with others to ensure safe and effective work site 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, 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 irrigation systems and documenting layout irrigation systems for applications, including residential, sporting and agricultural properties
- may be for new projects or an existing structure being renovated, extended, restored or maintained.

Design requirements must include:

- architectural plans
- backflow requirements
- interpretation and application of irrigation services, drawings and symbols
- irrigation management system
- owner requirements
- precipitation and evaporation rates
- pumping requirements
- required water application to establish and maintain plant life
- source of irrigation water
- sprinkler head spacings
- system requirements
- water storage 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 project
- may include:
  - design styles
  - expected design life
  - labour costs
  - material costs
  - required water application to establish and maintain plant life
  - safety factors
  - speed of installation
  - suitability of materials
  - system choices
  - use of recycled or alternative water.

Statutory and regulatory requirements and relevant Australian standards and codes may include:

- Acts, regulations and commonwealth, state or territory, and local government requirements
- AS/NZS3500 National plumbing and drainage
- AS2200 Design charts for water supply and sewerage
- National Construction Code
- state or territory health department requirements
- other relevant Australian standards or codes.

Manufacturer requirements may include:

- irrigation management system
- material specifications
- pump tables
- sprinkler head performance
- sub-surface irrigation
- technical and trade manuals.

Desktop study may include collection and interpretation of data for design purposes in:

- architectural and building plans
- site layout plans, which may include:
  - sports ovals
  - golf courses
  - residential, commercial, industrial and agricultural properties
  - local government parks
- manufacturer data
- documents, which may include:
  - applications
  - brochures
  - forms
  - policies
  - other reports as available.

Flow and pressure tests may include:

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

Water sources, volumes and areas to be irrigated may include:

- sources:
  - drinking water
  - non-drinking (recycled) water
  - rain water
  - grey water
  - creeks
  - dams
  - lakes
  - rivers
  - streams
  - tanks

- other approved water sources
- volumes and areas:
  - amount and duration of water supply
  - areas to be irrigated
  - number of control stations required
  - total amount and flow rate required for each control station.

Soil types may include:

- gravels
- light, medium and heavy clays
- loams
- rock
- sands.

Performance requirements may include:

- flow, velocity, pressure and discharge requirements, established using relevant Australian standards, codes and manufacturer information
- required water application to establish and maintain plant life.

Layout of pipework systems:

- may include:
  - distribution
  - dual feed systems
  - range pipes
  - ring main
  - single pipe
  - control stations
- should not unduly affect aesthetic appeal and building integrity
- should have principles of economy, serviceability, durability and fit for use applied.

Fittings, valves and controls may include:

- fittings:
  - bends
  - elbows
  - sprinkler heads
  - tees
  - unions
- valves:

- backflow prevention
- excess pressure
- isolating
- pressure limiting
- pressure reduction
- strainers

- controls:
  - irrigation management system
  - control stations
  - control wiring
  - nodes.

Backflow prevention devices may include:

- double-check valve assembly (DCV)
- dual-check valve with intermediate vent (DuCV)
- pressure type vacuum breaker (PVB)
- reduced pressure zone device (RPZD)
- registered air gap (RAG)
- registered break tank (RBT)
- reduced pressure detector assembly (RPDA)
- reduced pressure zone device (RPZD)
- other approved backflow prevention devices
- may be located as:
  - individual protection
  - zone protection
  - containment protection.

Materials may include:

- composite pipework
- copper (Cu)
- cross-linked polyethylene (PE-X)
- polypropylene (PP)
- polybutylene (PB)
- polyvinyl chloride (PVC)
- other relevant materials.

Jointing methods include:

- brazing
- compression
- electrofusion welding
- flaring
- mechanical joints

- rubber ring joints
- screwing
- soldering
- other approved jointing methods.

Sections and components of the irrigation system must include:

- irrigation stations:
  - number, size, area, volume of water required, delivery requirements, operation and activation of stations, sprinkler patterns, location and distribution of sprinkler heads, obstacle avoidance, water minimisation, waste minimisation and timing
- manifold systems:
  - manifolds to stations, headers, branches, timers, isolators, servo valves, electronics, power supplies and manual activation
- sensors:
  - moisture sensors, soil sensors, temperature sensors, humidity sensors, weather stations and computer automation
- automatic controls:
  - station controllers, servo valves, isolating valves, water tractors and timers
- sprinklers, drippers and irrigators:
  - sprinkler heads, sprinkler flows, impact sprinklers, gear-driven sprinklers, water tractors, water cannons, tape drippers, individual drippers, flow controlled drippers, in-ground irrigation tapes and root inhibitor systems
- sprinkler patterns:
  - head to head, square, triangular, circular, quarter overlap, half overlap, full overlap, double overlap and other overlap patterns.

Pipe supports may include:

- thrust blocks
- bedding
- bracket spacing
- corrosion protection
- cover
- manufacturer-recommended specific fixings
- material requirements
- provision for pipe movement.

Pump enclosure and control requirements may include:

- acoustic performance
- automatic change-over
- automatic controls
- dual-pump provision
- impeller sizing
- inlet and outlet design requirements
- installation and mounting requirements
- irrigation management control system
- pressure gauges
- pump contols
- pump selection
- pump sizing
- pump housing
- space requirements
- valve requirements
- variable speed control.

Installation requirements may include:

- pipe connection:
  - bedding and backfilling
  - corrosion
  - cover
  - ground stability
  - impact
- level of workmanship
- manufacturer recommendations
- pipe support
- provision for pipe movement
- serviceability and access.

Applications:

- may include:
  - agricultural crops
  - garden irrigation
  - golf courses
  - greenhouses
  - lawn watering
  - local government parks
  - nurseries
  - sports ovals

- should also cover:
  - individual crop water requirements
  - types of plants and their respective crop factors.

Delivery systems and layout may include:

- main delivery
- number and design of control stations
- design includes:
  - avoiding obstacles
  - irregular shapes
  - minimising water wastage
  - range of irrigation applications
- range pipes
- ring mains
- size and water delivery of sprinklers
- sprinkler head patterns and placement.

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
  - water efficiency
  - reuse of water, such as rainwater, grey water and recycled non-drinking water
  - consideration of the Green Building Council of Australia rating scheme.

Plans:

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

- drawing equipment.

Specification may include:

- bedding
- flow requirements
- irrigation management control system
- jointing
- manufacturer requirements
- materials
- pumps
- residual pressures
- safety (WHS)
- specialised components
- sprinkler head selection
- storage tanks
- support
- testing
- valve selection
- water treatment
- workmanship.

Testing may include:

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

Commissioning schedule may include:

- system certification
- flow test
- leak check
- pressure test
- system purge
- system defect
- system functions as per design
- valve and system operation.

Operation and maintenance manual includes:

- as installed drawings
- results of commissioning test
- certification documentation
- maintenance schedules

- manufacturer brochures and technical information
- operational procedures
- valve function.

Unit Sector(s)

Functional area

Unit sector Plumbing and services

Custom Content Section

Not applicable.