



Australian Government

Department of Education, Employment and Workplace Relations

CPCPPS5007A Design irrigation systems

Release: 1

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Modification History

Not Applicable

Unit Descriptor

Unit descriptor This unit of competency specifies the outcomes required to design irrigation systems to Australian and New Zealand standards, the Building Code of Australia (BCA) and other relevant legislative requirements to meet occupier needs and industry standards.

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

Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units Nil

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.	<p>1.1. <i>Design requirements</i> and <i>work scope</i> are determined from plans, specifications and client briefs.</p> <p>1.2. <i>Cost-benefit analysis</i> is conducted comparing a range of pipe materials and system designs.</p> <p>1.3. <i>Statutory and regulatory requirements and Australian and New Zealand standards</i> for the design of irrigation systems are interpreted, analysed and applied.</p> <p>1.4. <i>Manufacturer requirements</i> and trade and technical manuals are interpreted.</p> <p>1.5. Additional research, including a <i>desktop study</i>, is conducted to outline design parameters.</p> <p>1.6. <i>Flow and pressure tests</i> are conducted.</p> <p>1.7. <i>Water sources, volumes and areas to be irrigated</i> are established.</p> <p>1.8. <i>Soil types</i> are analysed and categorised, and impacts on irrigation systems are documented.</p> <p>1.9. <i>Performance requirements</i> are established.</p>
2. Plan and detail system components.	<p>2.1. <i>Layout of pipework systems</i> and type and location of <i>fittings and valves</i> are planned.</p> <p>2.2. Type, location and requirements for <i>backflow prevention devices</i> are detailed.</p> <p>2.3. Pipe sizes, velocities, flows and pressures are calculated for a range of applications.</p> <p>2.4. Approved <i>materials</i> and <i>jointing methods</i> for irrigation systems are specified.</p> <p>2.5. <i>Sections and components of the irrigation system</i> are detailed.</p> <p>2.6. <i>Pipe fixings</i> are designed for a range of applications.</p> <p>2.7. <i>Pump, pump controls and pumphouse requirements</i> are sized and detailed.</p> <p>2.8. <i>Installation requirements</i> are specified.</p>
3. Design and size systems.	<p>3.1. Irrigation systems are designed for a range of residential, commercial, industrial and agricultural <i>applications</i>.</p> <p>3.2. Range of <i>delivery systems and patterns</i> is designed.</p> <p>3.3. Irrigation systems are designed and sized using computer software packages.</p>

ELEMENT	PERFORMANCE CRITERIA
4. Prepare documentation.	4.1. <i>Plans</i> are prepared for a range of irrigation systems. 4.2. <i>Specification</i> for an irrigation system is prepared. 4.3. <i>Testing</i> and <i>commissioning schedule</i> is prepared. 4.4. <i>Operation and maintenance manual</i> 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:
 - 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
 - read and interpret:
 - plans, specifications, drawings and design briefs
 - standards and manufacturer requirements and manuals
 - statutory and regulatory requirements
 - use language and concepts appropriate to cultural differences
 - use and interpret non-verbal communication, such as hand signals
- written skills to prepare documentation, including:
 - operation and maintenance manual
 - plans, specifications and schedules
- designing irrigation systems to Australian and New Zealand standards, BCA and other relevant legislative requirements
- 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 irrigation systems
 - take initiative and make decisions
- problem solving skills to analyse requirements, consider options and design an appropriate system

REQUIRED SKILLS AND KNOWLEDGE

- 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.

Required knowledge

Required knowledge for this unit is:

- 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
- requirements of state regulatory authorities, Australian standards and manufacturer specifications, including hazards identified in relation to devices and systems used according to:
 - AS/NZS3500 National plumbing and drainage set
 - AS2200 Design charts for water supply and sewerage
 - 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 irrigation systems
- planning and detailing system components, including:
 - backflow prevention devices
 - manifold and piping systems
 - stations
- designing and sizing a range of irrigation systems for specific applications
- preparing plans for a range of irrigation systems
- preparing specifications for irrigation systems
- preparing testing and commissioning schedules
- preparing operation and maintenance manuals.

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:

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- 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

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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 regional contexts) may also be included.

Design requirements include:

- architectural specifications
- builder specifications
- owner requirements
- specialist water use applications.

Work scope:

- includes:
 - application of the irrigation project
 - interpretation of plans and specifications
 - sizing and documenting layout of irrigation

RANGE STATEMENT

- systems, for applications including residential, commercial, industrial and agricultural
- may be for new projects or an existing structure being renovated, extended, restored or maintained.
- Cost-benefit analysis*** includes:
- comparison of range of suitable materials and system choices available to enable cost-effective choices to be made without compromising integrity of project.
- Statutory and regulatory requirements and Australian and New Zealand standards*** include:
- Acts and regulations
 - Australian and New Zealand standards, including:
 - AS/NZS3500 National plumbing and drainage set
 - AS2200 Design charts for water supply and sewerage
 - BCA
 - local and state government policies.
- Manufacturer requirements*** include:
- material specifications
 - pump tables
 - sizing tables
 - technical and trade manuals.
- Desktop study*** includes collection and interpretation of existing data for design purposes from:
- building plans
 - council plans
 - developer plans
 - landscape and architectural plans
 - other documents and reports as available.
- Flow and pressure tests*** include:
- interpretation of flow and pressure tests conducted by a contractor
 - on-site measurement of flows (l and s), velocity (m and s) and pressure (kPa).
- Water sources, volumes and areas to be irrigated*** include:
- sources:
 - creeks
 - dams
 - lakes
 - mains supply
 - rivers
 - streams
 - tanks

RANGE STATEMENT

- volumes and areas:
 - amount and duration of water supply
 - areas to be irrigated
 - number of stations required
 - total amount and flow rate required at each station.

- Soil types* include:
 - gravels
 - light, medium and heavy clays
 - loams
 - rock
 - sands.

- Performance requirements* include:
 - flow, velocity, pressure and discharge requirements, established using Australian and New Zealand standards and local authority requirements.

- Layout of pipework systems:*
 - includes:
 - distribution
 - dual feed systems
 - range pipes
 - ring main
 - single pipe
 - station break-up
 - should not unduly affect aesthetic appeal and building integrity
 - should have principles of economy, serviceability, durability and fit for use applied.

- Fittings and valves* include:
 - fittings:
 - bends
 - elbows
 - tees
 - unions
 - valves:
 - backflow prevention
 - excess pressure
 - isolating
 - pressure limiting
 - pressure reduction
 - strainers.

RANGE STATEMENT

Backflow prevention devices include:

- break tanks
- individual protection
- property protection
- testable and non-testable devices
- zone protection.

Materials include:

- acrylonitrile butadiene styrene (ABS)
- composite pipework
- copper
- fittings and fixtures
- polybutylene
- polyethylene
- protective coatings
- steel.

Joining methods include:

- brazing
- compression
- flaring
- mechanical joints
- rubber ring joints
- soldering
- threading.

Sections and components of the irrigation system 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

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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 fixings include:

- anchors
- bedding
- bracket spacing
- corrosion protection
- cover
- hanging brackets
- material requirements
- saddles
- wall and ceiling brackets.

Pump, pump controls and pumphouse requirements include:

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

Installation requirements include:

- bedding
- clipping
- installation details
- jointing requirements
- level of workmanship.

Applications:

- include:
 - agricultural crops
 - garden irrigation
 - golf courses
 - greenhouses
 - lawn watering
 - nurseries
- should also cover:
 - individual crop water requirements

RANGE STATEMENT

- Delivery systems and patterns* include:
- types of plants and their respective crop factors.
 - main delivery
 - number and design of stations
 - design includes:
 - avoiding obstacles
 - irregular shapes
 - minimising water wastage
 - range of irrigation applications
 - range pipes
 - ring mains
 - size and delivery of sprinklers
 - sprinkler head placement
 - sprinkler patterns.
- Plans* include:
- axonometrics
 - cross-sections
 - details
 - elevations
 - isometrics
 - schematics, which may be produced using:
 - computer generation
 - Indian ink
 - pencil
 - pigment liner
 - sections.
- Specification* includes:
- bedding
 - clipping
 - jointing
 - manufacturer
 - materials
 - specialised components
 - valve selection
 - workmanship.
- Testing* includes:
- air pressure test
 - defect inspection
 - hydrostatic test
 - mains pressure test
 - quality assurance (QA) audit.
- Commissioning schedule*
- flow test

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includes:

- leak check
- pressure test
- system flush
- valve operation.
- leak detection
- pump maintenance
- valve maintenance
- water auditing
- yearly inspection
- yearly maintenance requirements.

Operation and maintenance manual includes:

Unit Sector(s)

Unit sector Plumbing and services

Co-requisite units

Co-requisite units Nil

Functional area

Functional area