

Unit of Competency CPCPCM5010

Design complex sanitary plumbing and drainage systems

Application

This unit specifies the skills and knowledge required to undertake the hydraulic engineering design of complex sanitary plumbing and drainage installation and to prepare specifications for a range of wide-span and high-rise building applications up to 25 metres, including basement for residential, commercial and industrial buildings.

The unit requires application of technical skills and knowledge to prepare plans, specifications and operating and maintenance manuals.

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 complex sanitary plumbing and drainage systems for wide-span and high-rise building projects.1.2 Determine design requirements from relevant Australian Standards, codes, plans, specifications and client brief.1.3 Interpret statutory and regulatory requirements for the design of complex sanitary plumbing and drainage systems.1.4 Analyse and apply Australian Standards and codes for the design of complex sanitary plumbing and drainage systems.1.5 Interpret manufacturer requirements and trade and technical manuals.1.6 Conduct additional research, including a desktop study to outline design parameters.1.7 Conduct a cost-benefit analysis comparing a range of pipe materials and system designs. |
| 2.Plan and detail system components. | <ul style="list-style-type: none">2.1 Plan layout of pipework systems, type and location of fittings and valves.2.2 Assess existing utilities services capacity and sizes.2.3 Calculate pipe sizes, pipe grades and trapping and ventilation requirements for a range of applications.2.4 Plan pipe support for a range of applications.2.5 Size and detail pump well, pump and pump control requirements.2.6 Specify approved materials, jointing methods and installation requirements for complex sanitary plumbing and drainage systems.2.7 Plan and detail acoustic performance of the sanitary plumbing and drainage |

| | |
|----------------------------|--|
| | system within the system design. |
| 3.Design and size systems. | 3.1 Design complex sanitary plumbing and drainage systems for a range of wide-span and high-rise building applications. 3.2 Design rising main systems. 3.3 Design and size a fully vented or fully vented modified system. 3.4 Design and size a reduced velocity aerator stack system. 3.5 Design and size complex sanitary plumbing and drainage systems using computer-aided design and drafting packages. |
| 4.Prepare documentation. | 4.1 Prepare client brief of the preferred design. 4.2 Prepare plans and specifications for a range of complex sanitary plumbing and drainage 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 CPCPCM5010A Design complex sanitary plumbing and drainage systems.

Links

Companion Volume Implementation Guide:

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

Assessment Requirements for CPCPCM5010

Design complex sanitary plumbing and drainage systems

Performance Evidence

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

- designing, sizing and documenting the layout details of complex sanitary systems for a 25-metre high-rise mixed development building inclusive of a basement, using two approved sanitary plumbing systems, including:
 - fixtures on each level
 - specification and plans which include:
 - inspection openings and drainage cleaning provisions
 - overflow relief provisions
 - proprietary air admittance and relief systems
 - proprietary velocity reduction fittings
 - sewerage pumping stations (wet wells)
 - piping systems
 - venting systems.

Knowledge Evidence

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

- common terminology and definitions used in design of complex sanitary plumbing and drainage systems for all classes of building
- National Construction Code (NCC)
- other relevant Australian standards, codes or standard operating procedures (SOPs)
- principles of technology in the design of hydraulic systems
- procedures for maintaining air balance within the systems
- workplace safety requirements, including relevant statutory regulations, codes and standards
- scope of work:
 - interpretation of plans and specifications
 - sizing and documenting layout of complex sanitary plumbing and drainage systems for applications, including residential, commercial and industrial
- design requirements:
 - architectural plans
 - building specifications
 - fire rating of penetrations

- o owner requirements
 - o pipework identification
 - o soil quality
 - o specialist waste applications
 - o unstable or water-charged ground
- cost-benefit analysis considerations
- Australian Standards, codes, statutory and regulatory requirements:
 - o NCC
 - o relevant Australian Standards and codes, including AS/NZS 3500 Plumbing and drainage set
 - o AS 2200 Design charts for water supply and sewerage
 - o local government and health department requirements
 - o state/territory government requirements
 - o preparation of documentation for authorities' approval
- requirements from manufacturers:
 - o material specifications
 - o pump tables
 - o sizing tables
 - o recommended specific fixings for pipework
 - o technical and trade manuals
- information gathered through desktop study:
 - o architectural and building plans
 - o developer plans
 - o manufacturers' data
 - o applications
 - o brochures
 - o forms
 - o policies
 - o other reports as available
- performance requirements, which must include flow, velocity, pressure and discharge requirements established using relevant Australian standards, codes and local authority plans
- layout of pipework systems based on principles of economy, serviceability, durability and fitness for use:
 - o drainage
 - o elevated pipework
 - o low pressure pump
 - o vacuum
 - o vented stack systems
- types of fittings and valves
- access chamber details:
 - o benching requirements
 - o flow

- gradient requirements
 - inlet and outlet connections
 - ladder access
 - lids
- cost-benefit analysis considerations
- gullies covering details such as size, location, bedding and concrete support:
 - boundary traps
 - disconnector gullies (DG)
 - floor waste (FW)
 - overflow relief gullies (ORG)
- types of calculations for complex sanitary plumbing and drainage systems:
 - determination of flow and fixture loadings
 - gradient calculations
 - interpretation of design charts and tables
 - pipe sizing calculations
 - reduced level calculations
 - self-cleaning velocities
- design elements of anchor blocks:
 - flow forces to be resisted
 - keying and anchorage points
 - sizes
 - soil characteristics
- types of pipe support:
 - anchors
 - bedding
 - bracket spacing
 - concrete support
 - corrosion protection
 - cover
 - hanging brackets
 - manufacturer-recommended specific fixings
 - material requirements
 - provision for expansion
 - saddles
 - wall and ceiling brackets.
- pump well, pump and pump control requirements:
 - access covers
 - automatic controls
 - capacity
 - chains
 - corrosion-resistant materials
 - detailing
 - emergency storage

- o high- and low-level water controls and alarms
 - o impeller sizing
 - o inlet and outlet design requirements
 - o installation and mounting requirements
 - o ladder access
 - o macerator requirements
 - o odour control
 - o pump selection
 - o pump sizing
 - o pump well sizing
 - o space requirements
 - o step irons
 - o valve requirements
 - o ventilation
 - o warning system
- sanitary and plumbing drainage system materials:
 - o cast iron (Fe)
 - o concrete
 - o copper (CU)
 - o vitrified clay pipe (VCP)
 - o high density polyethylene (HDPE)
 - o unplasticised polyvinyl chloride (uPVC)
 - o other approved material
 - o fittings and fixtures
 - o measures to prevent the spread of fire
 - o sound attenuation requirements.
- jointing methods:
 - o brazing and threading
 - o electrofusion welding
 - o mechanical joints
 - o rubber ring
 - o solvent cement welding
- installation requirements:
 - o bedding
 - o clipping
 - o concrete support
 - o fire rating of penetrations
 - o installation details
 - o jointing requirements
 - o level of workmanship
- elements of rising main systems:
 - o approved pressure pipe and fittings
 - o calculated rise and pump delivery requirements

- pipe velocities
 - pump sizing to meet calculated flow conditions
- ways to apply sustainability principles and concepts:
 - selecting appropriate material to ensure minimal environmental impact
 - efficient use of material
 - efficient energy usage/capital outlay comparison
 - effect on the environment due to overflow or leakage
 - water efficiency
 - consideration of the Green Building Council of Australia rating scheme
 - local environment consideration regarding overflow, disposal and reuse
- types of plans (computer-generated or hand-drawn):
 - axonometrics
 - cross-sections
 - details
 - elevations
 - isometrics
 - schematics
 - sections
- specification information:
 - bedding
 - commissioning
 - concrete support and detailing specialised components
 - jointing
 - access chambers (manholes)
 - manufacturer requirements
 - materials
 - pumps
 - work health and safety (WHS)
 - support
 - testing
 - workmanship
- testing:
 - air pressure
 - drainage inspection
 - hydrostatic
 - performance
 - quality assurance (QA) audit
- commissioning inclusions:
 - charging traps
 - checking leaks
 - checking for foreign material
 - checking for system defects
 - checking that system functions as per design

- o checking trap water seal retention
 - o cleaning grates
 - o system certification
- operation and maintenance manual inclusions:
 - o construction drawings
 - o results of commissioning test
 - o certification documentation
 - o maintenance schedules
 - o manufacturer brochures and technical information
 - o manufacturer warranties.

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

Companion Volume Implementation Guide:

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