

Unit of Competency CPCPPS5033

Design vacuum drainage systems

Application

This unit specifies the skills and knowledge required to design vacuum drainage systems, determine installation details, and prepare specifications for 50 residential properties and industrial high-rise mixed development buildings with a minimum of 29 floors using proprietary components.

This unit relates to work in a consultancy or supervisory capacity in relation to plumbing services and hydraulics 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

CPCPDR3025 Plan layout and install vacuum drainage systems

Elements and Performance Criteria

1. Evaluate design parameters	<ul style="list-style-type: none">1.1 Establish scope of work for vacuum drainage systems designed for vacuum sewer infrastructure systems and high-rise building projects.1.2 Determine design requirements from relevant Australian Standards, codes, plans, specifications and client brief.1.3 Evaluate vacuum drainage system attributes and conduct a cost-benefit analysis comparing a range of pipe materials and system designs.1.4 Interpret, analyse and apply statutory and regulatory requirements, including relevant Australian Standards and codes for the design of vacuum drainage systems.1.5 Obtain trade and technical manuals and interpret manufacturer requirements for the design of vacuum sewer infrastructure systems.1.6 Conduct additional research including a desktop study to outline design parameters.1.7 Determine factors that contribute to quality, safety and time efficiency.1.8 Establish performance requirements considering safety of system users or building occupants.
2. Plan and detail system components	<ul style="list-style-type: none">2.1 Plan layout of pipework systems including the type and location of fittings, valves and controls.2.2 Calculate vacuum loading units (VLU) using equivalent population (EP) density for a residential development in excess of 50 dwellings in accordance with the National Construction Code (NCC) for a high-rise project with a minimum of 29 floors.2.3 Perform pipe size calculations for applications according to regulations and manufacturer requirements.2.4 Design pipe supports for applications.2.5 Size and detail vacuum pumping station and pump control requirements.2.6 Specify approved materials, jointing methods and installation requirements for vacuum drainage systems.2.7 Determine approved point of discharge to the authority's main.

	2.8 Identify acoustic performance of the system and document in the plan.
3. Design and size systems	3.1 Design vacuum drainage system for residential, commercial and industrial building applications. 3.2 Design and size vacuum drainage system using EP density calculations and in accordance with NCC. 3.3 Apply sustainability principles and concepts throughout the design process.
4. Prepare documentation	4.1 Prepare and document client brief of the desired design in accordance with workplace procedures. 4.2 Prepare plans and specifications vacuum drainage systems. 4.3 Prepare testing and commissioning schedule. 4.4 Produce operation and maintenance manual including information on how to properly and safely maintain the system.

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 CPCPPS5033A Design vacuum sewerage systems.

Links

Companion Volume Implementation Guide:

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

Assessment Requirements for CPCPPS5033 Design vacuum drainage systems

Performance Evidence

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

- designing, sizing and documenting the installation and layout details for a vacuum infrastructure sewer system for:
 - a residential development of 50 properties incorporating:
 - vacuum sewage collection chambers
 - vacuum sewer mains
 - vacuum pump station
 - pump rising main
 - ventilation
 - odour control
 - a high-rise mixed development building, to a minimum of 29 floors, inclusive of a basement, to include fixtures on each floor level, incorporating:
 - vacuum pump station
 - vacuum sanitary drainage system
 - pump rising main
 - ventilation
 - odour control
- applying sustainability principles and concepts throughout to achieve a star rating under the Green Building Council of Australia rating scheme
- evaluating and documenting design parameters, including client, regulatory and manufacturer requirements and relevant Australian Standards and codes complex sanitary plumbing and drainage systems
- evaluating health risks associated with the sanitary plumbing and drainage system
- selecting materials and components for compliance, fitness for purpose, durability, compatibility and cost-effectiveness.

Knowledge Evidence

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

- common terminology and definitions used in the design of vacuum drainage systems
- application of statutory and regulatory requirements and relevant Australian Standards and codes including:
 - Acts, regulations and Commonwealth, state or territory and local government policies
 - AS/NZ 3500 National plumbing and drainage
 - AS 2200 Design charts for water supply and sewerage
 - Environmental Protection Authority (EPA)

- o National Construction Code (NCC)
 - o Sewerage Code of Australia
 - o other relevant Australian Standards and codes
- scope of work requirements:
 - o interpreting plans and specifications
 - o sizing and documenting layout of vacuum drainage systems including residential, commercial and industrial
- design requirements:
 - o acoustic performance
 - o architectural plans
 - o building specifications
 - o fire safety requirements
 - o flow requirements and sizing of pipework
 - o odour control
 - o owner requirements
 - o pipework identification
 - o Sewerage Code of Australia
 - o vacuum pumping station
 - o ventilation requirements
- cost-benefit analysis comparing suitable materials and system choices available to enable cost-effective choices without compromising the integrity of the project
- nature of materials used and effects of performance under various conditions:
 - o copper (Cu)
 - o polyethylene (PE)
 - o polypropylene (PP)
 - o polyvinyl chloride (PVC)
 - o stainless steel
 - o other approved material
- manufacturer requirements:
 - o material specifications
 - o collection and storage systems
 - o design and installation
 - o equipment installation
 - o pump installation
 - o selection of compatible sanitary fixtures
 - o technical manuals
- manufacturer specifications, including hazards identified in relation to devices and systems used
- information required to conduct a desktop study to outline design parameters:
 - o architectural and building plans
 - o developer plans
 - o manufacturer data
 - o other documents relevant to designing vacuum sewerage systems
- characteristics and application of different jointing methods
- vacuum drainage system attributes:
 - o availability
 - o cost
 - o flexibility
 - o installation requirements

- o low water usage
 - o risks
 - o vacuum loading units (VLU)
 - o site conditions
- performance requirements of vacuum drainage system:
 - o discharge requirements
 - o durability
 - o emergency storage and/or power backup
 - o longevity
 - o self-cleaning ability
 - o sufficient capacity
- layout of pipework systems:
 - o sewer infrastructure systems:
 - cover
 - grade
 - location of vacuum pump station
 - location of vacuum sewage collection chambers
 - odour control
 - pipe access
 - ventilation
 - o high-rise building projects:
 - acoustic performance
 - amenity of the building
 - cladding and pipe support
 - location of pipework (fire rating of enclosure)
 - function of the building
 - impingement on floor heights
 - materials to be used
 - size of penetrations
 - type of building structure
 - o effect on building integrity and aesthetic appeal
 - o principles of economy, serviceability, durability and fit for use
- installation requirements:
 - o acoustic performance
 - o bedding
 - o pipe protection:
 - cover
 - corrosion
 - impact
 - o grade
 - o level of workmanship
 - o fire rating
 - o manufacturer-recommended specific fixings
 - o pipe support
 - o provision for pipe movement
 - o serviceability and access
- pipe size calculations including:
 - o determining flow and fixture loadings
 - o equivalent population (EP) density
 - o calculating gradient

- interpreting design charts and tables
 - determining self-cleaning velocities
 - manufacturer requirement
 - probable simultaneous demand
- uses and limitations for pipe supports:
 - bedding
 - bracket spacing
 - concrete support
 - corrosion protection
 - cover
 - hanging brackets
 - manufacturer-recommended specific fixings
 - material requirements
 - provision for expansion
 - thrust blocks
 - wall and ceiling brackets
- vacuum pumping station and pump control requirements:
 - access covers
 - automatic controls
 - capacity
 - corrosion-resistant materials
 - detailing
 - emergency storage
 - emergency power supply
 - high and low-level water controls and alarms
 - impeller sizing
 - inlet and outlet design requirements
 - installation and mounting requirements
 - macerator requirements
 - odour control
 - pneumatic control switch assembly
 - pump selection
 - pump sizing
 - pump well sizing
 - space requirements
 - vacuum pump systems
 - valve requirements
 - ventilation
 - warning system
- characteristics and application of different fittings, valves and controls:
 - fittings:
 - bends
 - elbows
 - inspection and maintenance access
 - tees
 - unions
 - valves:
 - backflow prevention
 - isolating
 - non-return

- strainers
 - vacuum diaphragm valve
 - controls:
 - pneumatic control switch assembly
 - vacuum pressure sensing
 - motorised actuated valves
 - vacuum management system
- the use and limitations of computer software packages including manufacturer and proprietary design software
- plans and specifications requirements:
 - plans:
 - axonometrics
 - cross-sections
 - details
 - elevations
 - isometrics
 - schematics
 - site
 - sections
 - specifications:
 - access chambers (manholes)
 - bedding
 - commissioning
 - concrete support and detailing specialised components
 - jointing
 - manufacturer requirements
 - materials
 - odour control
 - pump rising main
 - work health and safety (WHS)
 - selection of compatible vacuum sanitary fixtures
 - support
 - testing
 - vacuum pump station
 - vacuum drainage collection chambers
 - vacuum sewer mains
 - ventilation
 - workmanship
- testing methods:
 - compressed air test
 - flow testing
 - hydrostatic test
 - inspection checklist
 - performance
 - vacuum
 - quality assurance (QA) audit
- commissioning schedule requirements:
 - system certification
 - check for foreign material
 - leak check
 - emergency procedures

- o system defects
 - o system functions as per design
- operation and maintenance manual requirements:
 - o as installed drawings
 - o results of commissioning test
 - o certification documentation
 - o maintenance schedules
 - o manufacturer brochures and technical information
 - o operating procedures
- 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 positive effect on the environment in regard to no potential overflow or leakage
 - o water efficient
 - o consideration of the Green Building Council of Australia rating scheme
 - o local environment consideration overflow disposal/reuse.

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>