Australian Government
Department of Education, Employment and Workplace Relations

CPSISC

BCP03 Plumbing and Services Training Package

Volume 3 of 3

Version Number: 3
Review Date: 30 November 2006

ISC INDUSTRY SKILLS COUNCILS
Creating Australia's Future

BCP03
Plumbing and Services Training Package

Volume 3 of 3
Plumbing and Services Training Package Volume 3

Competency Standards for BCP40106 Certificate IV in Plumbing and Services and BCP50106 Diploma of Plumbing and Services.

The material contained within this document refers only to the endorsed components of BCP03 Plumbing and Services Training Package. This volume is not to be used in isolation but must be used in conjunction with Volume I and II.

The Plumbing and Services Training Package (BCP03) is comprised of three volumes.

This Training Package was endorsed by NTQC in October 2003.

This Training Package is to be reviewed by November 2006.

BCP03 - Plumbing and Services Training Package

Disclaimer

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Version Modification History

The version details of this endorsed Training Package are in the table below. The latest information is at the top of the table.

Version	Release Date	Comments
3	24/08/06	Addition of new units of competency and qualifications at Certificate IV and Diploma levels. Packaging into qualifications of previously endorsed units (Version 2) used for licensing purposes.
2	22/10/04	Addition of Licensing Units and replacement mains piping unit BCPDR3004A Addition of nineteen competency standards for licensing purposes: BCPCM4001A Carry out work based risk control processes BCPCM4002A Estimate and cost work BCPDR4001A Plan, size and layout sanitary drainage systems BCPDR4002A Plan, size and layout stormwater drainage systems BCPDR4003A Plan, size and layout domestic treatment plant disposal systems BCPFS4001A Commission domestic and residential fire suppression sprinkler systems BCPFS4002A Commission and maintain special hazards fire suppression systems BCPFS4003A Commission fire system pump sets BCPFS4004A Design residential and domestic fire sprinkler systems BCPGS4001A Plan, size and layout consumer gas installations BCPGS4002A Service Type A gas appliances BCPMS4001A Plan, size and layout heating and cooling systems BCPMS4002A Commission air and water systems BCPRF4001A Plan, size and layout roof drainage systems BCPSN4001A Plan, size and layout sanitary pipework and fixtures BCPWT4001A Plan, size and layout hot and cold water services/systems BCPWT4002A Commission and maintain backflow prevention devices BCPWT4003A Commission and maintain hot water temperature control devices

Version	Release Date	Comments
		BSBSBM401A Establish business and legal requirements Note: There are no qualifications attached to these standards.
1	20/11/03	Initial Release of the Package

Forms control : All endorsed training packages will have a version number displayed on the imprint page of every volume constituting that training package. Every training package will display an up-to-date copy of this modification history form, to be placed immediately after the contents page of the first volume of the training package. Comments on changes will only show sufficient detail to enable a user to identify the nature and location of the change. Changes to training packages will generally be batched at quarterly intervals. This modification history form will be included within any displayed sample of that training package and will constitute all detail available to identify changes.

Qualifications Framework

The Australian Qualifications Framework

What is the Australian Qualifications Framework?

A brief overview of the Australian Qualifications Framework (AQF) follows. For a full explanation of the AQF, see the *AQF Implementation Handbook*. The 2007 version of the *AQF Implementation Handbook* is expected to be available on the Australian Qualifications Framework Advisory Board (AQFAB) website www.aqf.edu.au during September 2007, and in print in October 2007 (obtain the hard copy by contacting AQFAB on phone 03 9639 1606 or email at aqfab@curriculum.edu.au).

The AQF provides a comprehensive, nationally consistent framework for all qualifications in post-compulsory education and training in Australia. In the vocational education and training (VET) sector it assists national consistency for all trainees, learners, employers and providers by enabling national recognition of qualifications and Statements of Attainment.

Training Package qualifications in the VET sector must comply with the titles and guidelines of the AQF. Endorsed Training Packages provide a unique title for each AQF qualification which must always be reproduced accurately.

Qualifications

Training Packages can incorporate the following eight AQF qualifications.

- Certificate I in ...
- Certificate II in ...
- Certificate III in ...
- Certificate IV in ...
- Diploma of ...
- Advanced Diploma of ...
- Vocational Graduate Certificate of ...
- Vocational Graduate Diploma of ...

On completion of the requirements defined in the Training Package, a Registered Training Organisation (RTO) may issue a nationally recognised AQF qualification. Issuance of AQF qualifications must comply with the advice provided in the *AQF Implementation Handbook* and the AQTF 2007 *Essential Standards for Registration*.

Statement of Attainment

A Statement of Attainment is issued by a Registered Training Organisation when an individual has completed one or more units of competency from nationally recognised qualification(s)/courses(s). Issuance of Statements of Attainment must comply with the advice provided in the current *AQF Implementation Handbook* and the AQTF 2007 *Essential Standards for Registration*.

Under the AQTF 2007, RTOs must recognise the achievement of competencies as recorded on a qualification or Statement of Attainment issued by other RTOs. Given this, recognised competencies can progressively build towards a full AQF qualification.

AQF Guidelines and Learning Outcomes

The *AQF Implementation Handbook* provides a comprehensive guideline for each AQF qualification. A summary of the learning outcome characteristics and their distinguishing features for each VET related AQF qualification is provided below.

Certificate I

Characteristics of Learning Outcomes

Breadth, depth and complexity of knowledge and skills would prepare a person to perform a defined range of activities most of which may be routine and predictable.

Applications may include a variety of employment related skills including preparatory access and participation skills, broad-based induction skills and/or specific workplace skills. They may also include participation in a team or work group.

Distinguishing Features of Learning Outcomes

Do the competencies enable an individual with this qualification to:

- demonstrate knowledge by recall in a narrow range of areas;
- demonstrate basic practical skills, such as the use of relevant tools;
- perform a sequence of routine tasks given clear direction
- receive and pass on messages/information.

Certificate II

Characteristics of Learning Outcomes

Breadth, depth and complexity of knowledge and skills would prepare a person to perform in a range of varied activities or knowledge application where there is a clearly defined range of contexts in which the choice of actions required is usually clear and there is limited complexity in the range of operations to be applied.

Performance of a prescribed range of functions involving known routines and procedures and some accountability for the quality of outcomes.

Applications may include some complex or non-routine activities involving individual responsibility or autonomy and/or collaboration with others as part of a group or team.

Distinguishing Features of Learning Outcomes

Do the competencies enable an individual with this qualification to:

- demonstrate basic operational knowledge in a moderate range of areas;
- apply a defined range of skills;
- apply known solutions to a limited range of predictable problems;
- perform a range of tasks where choice between a limited range of options is required;
- assess and record information from varied sources;
- take limited responsibility for own outputs in work and learning.

Certificate III

Characteristics of Learning Outcomes

Breadth, depth and complexity of knowledge and competencies would cover selecting, adapting and transferring skills and knowledge to new environments and providing technical advice and some leadership in resolution of specified problems. This would be applied across a range of roles in a variety of contexts with some complexity in the extent and choice of options available.

Performance of a defined range of skilled operations, usually within a range of broader related activities involving known routines, methods and procedures, where some discretion and judgement is required in the section of equipment, services or contingency measures and within known time constraints.

Applications may involve some responsibility for others. Participation in teams including

group or team co-ordination may be involved.

Distinguishing Features of Learning Outcomes

Do the competencies enable an individual with this qualification to:

- demonstrate some relevant theoretical knowledge
- apply a range of well-developed skills
- apply known solutions to a variety of predictable problems
- perform processes that require a range of well-developed skills where some discretion and judgement is required
- interpret available information, using discretion and judgement
- take responsibility for own outputs in work and learning
- take limited responsibility for the output of others.

Certificate IV

Characteristics of Learning Outcomes

Breadth, depth and complexity of knowledge and competencies would cover a broad range of varied activities or application in a wider variety of contexts most of which are complex and non-routine. Leadership and guidance are involved when organising activities of self and others as well as contributing to technical solutions of a non-routine or contingency nature.

Performance of a broad range of skilled applications including the requirement to evaluate and analyse current practices, develop new criteria and procedures for performing current practices and provision of some leadership and guidance to others in the application and planning of the skills. Applications involve responsibility for, and limited organisation of, others.

Distinguishing Features of Learning Outcomes

Do the competencies enable an individual with this qualification to:

- demonstrate understanding of a broad knowledge base incorporating some theoretical concepts
- apply solutions to a defined range of unpredictable problems
- identify and apply skill and knowledge areas to a wide variety of contexts, with depth in some areas
- identify, analyse and evaluate information from a variety of sources
- take responsibility for own outputs in relation to specified quality standards
- take limited responsibility for the quantity and quality of the output of others.

Diploma

Characteristics of Learning Outcomes

Breadth, depth and complexity covering planning and initiation of alternative approaches to skills or knowledge applications across a broad range of technical and/or management requirements, evaluation and co-ordination.

The self directed application of knowledge and skills, with substantial depth in some areas where judgment is required in planning and selecting appropriate equipment, services and techniques for self and others.

Applications involve participation in development of strategic initiatives as well as personal responsibility and autonomy in performing complex technical operations or organising others. It may include participation in teams including teams concerned with planning and evaluation

functions. Group or team co-ordination may be involved.

The degree of emphasis on breadth as against depth of knowledge and skills may vary between qualifications granted at this level.

Distinguishing Features of Learning Outcomes

Do the competencies or learning outcomes enable an individual with this qualification to:

- demonstrate understanding of a broad knowledge base incorporating theoretical concepts, with substantial depth in some areas
- analyse and plan approaches to technical problems or management requirements
- transfer and apply theoretical concepts and/or technical or creative skills to a range of situations
- evaluate information, using it to forecast for planning or research purposes
- take responsibility for own outputs in relation to broad quantity and quality parameters
- take some responsibility for the achievement of group outcomes.

Advanced Diploma

Characteristics of Learning Outcomes

Breadth, depth and complexity involving analysis, design, planning, execution and evaluation across a range of technical and/or management functions including development of new criteria or applications or knowledge or procedures.

The application of a significant range of fundamental principles and complex techniques across a wide and often unpredictable variety of contexts in relation to either varied or highly specific functions. Contribution to the development of a broad plan, budget or strategy is involved and accountability and responsibility for self and others in achieving the outcomes is involved.

Applications involve significant judgement in planning, design, technical or leadership/guidance functions related to products, services, operations or procedures.

The degree of emphasis on breadth as against depth of knowledge and skills may vary between qualifications granted at this level.

Distinguishing Features of Learning Outcomes

Do the competencies or learning outcomes enable an individual with this qualification to:

- demonstrate understanding of specialised knowledge with depth in some areas
- analyse, diagnose, design and execute judgements across a broad range of technical or management functions
- generate ideas through the analysis of information and concepts at an abstract level
- demonstrate a command of wide-ranging, highly specialised technical, creative or conceptual skills
- demonstrate accountability for personal outputs within broad parameters
- demonstrate accountability for personal and group outcomes within broad parameters.

Vocational Graduate Certificate

Characteristics of competencies or learning outcomes

- The self-directed development and achievement of broad and specialised areas of knowledge and skills, building on prior knowledge and skills.
- Substantial breadth and complexity involving the initiation, analysis, design, planning, execution and evaluation of technical and management functions in highly varied and

highly specialised contexts.
- Applications involve making significant, high-level, independent judgements in major broad or planning, design, operational, technical and management functions in highly varied and specialised contexts. They may include responsibility and broad-ranging accountability for the structure, management and output of the work or functions of others.
- The degree of emphasis on breadth, as opposed to depth, of knowledge and skills may vary between qualifications granted at this level.

Distinguishing features of learning outcomes

- Demonstrate the self-directed development and achievement of broad and specialised areas of knowledge and skills, building on prior knowledge and skills.
- Initiate, analyse, design, plan, execute and evaluate major broad or technical and management functions in highly varied and highly specialised contexts.
- Generate and evaluate ideas through the analysis of information and concepts at an abstract level.
- Demonstrate a command of wide-ranging, highly specialised technical, creative or conceptual skills in complex contexts.
- Demonstrate responsibility and broad-ranging accountability for the structure, management and output of the work or functions of others.

Vocational Graduate Diploma

Characteristics of competencies or learning outcomes

- The self-directed development and achievement of broad and specialised areas of knowledge and skills, building on prior knowledge and skills.
- Substantial breadth, depth and complexity involving the initiation, analysis, design, planning, execution and evaluation of major functions, both broad and highly specialised, in highly varied and highly specialised contexts.
- Further specialisation within a systematic and coherent body of knowledge.
- Applications involve making high-level, fully independent, complex judgements in broad planning, design, operational, technical and management functions in highly varied and highly specialised contexts. They may include full responsibility and accountability for all aspects of work and functions of others, including planning, budgeting and strategy development.
- The degree of emphasis on breadth, as opposed to depth, of knowledge and skills may vary between qualifications granted at this level.

Distinguishing features of learning outcomes

- Demonstrate the self-directed development and achievement of broad and highly specialised areas of knowledge and skills, building on prior knowledge and skills.
- Initiate, analyse, design, plan, execute and evaluate major functions, both broad and within highly varied and highly specialised contexts.
- Generate and evaluate complex ideas through the analysis of information and concepts at an abstract level.
- Demonstrate an expert command of wide-ranging, highly specialised, technical, creative or conceptual skills in complex and highly specialised or varied contexts.
- Demonstrate full responsibility and accountability for personal outputs.
- Demonstrate full responsibility and accountability for all aspects of the work or functions of others, including planning, budgeting and strategy.

Qualification Pathways

The following pathways charts are provided to show the types of pathways into and from qualifications that are possible with this Training Package. For more information about qualifications and pathways contact Construction and Property Services Industry Skills Council (http://www.cpsisc.com.au).

Skill Sets

Definition

Skill sets are defined as single units of competency, or combinations of units of competency from an endorsed Training Package, which link to a licence or regulatory requirement, or defined industry need.

Wording on Statements of Attainment

Skill sets are a way of publicly identifying logical groupings of units of competency which meet an identified need or industry outcome. Skill sets are not qualifications.

Where skill sets are identified in a Training Package, the Statement of Attainment can set out the competencies a person has achieved in a way that is consistent and clear for employers and others. This is done by including the wording "these competencies meet [insert skill set title or identified industry area] need" on the Statement of Attainment. This wording applies only to skill sets that are formally identified as such in the endorsed Training Package. See the 2007 edition of the AQF Implementation Handbook for advice on wording on Statements of Attainmentthe updated version is expected to be available on the AQFAB website www.aqf.edu.au during September 2007 and in print in October 2007.

Skill Sets in this Training Package

Trade contracting skill set

This skill set addresses the skills used by experienced tradespeople operating as sole traders, or with limited staff, contracting their services to builders. The contractors may be in the early stages of developing and growing their newly-established businesses.

The intent of the skill set is to provide an initial set of business skills to support contractors' existing trade skills.

The completion of this skill set provides a pathway to a range of Certificate IV qualifications.

Trade contracting skill set	
Unit code	Unit title
BCGBC4004A	Identify and produce estimated costs for building and construction projects
BCGBC4024A	Resolve business disputes
BCGBC4034A	Apply codes and standards to building trade and services contracting
BSBCMN310A	Deliver and monitor a service to customers
BSBOHS403A	Identify hazards and assess OHS risks

BSBSBM401A	Establish business and legal requirements
BSBSBM406A	Manage finances

PLUS

one of the following units:

BCGBC4025A	Manage personal work priorities and professional development
BCGBC4031A	Process client requirements
BSBCMN420A	Write complex documents

Pathway	Completion of these units provides credit towards BCP40106 Certificate IV in Plumbing and Services.
Suggested form of words for Statement of Attainment	These units from BCP03 Plumbing and Services Training Package meet industry requirements for experienced tradespersons performing trade contracting work in the plumbing and services industry.

Plumbing and services team leader skill set

This skill set addresses the skills used by experienced tradespeople and operators who are moving into roles with additional responsibility and team leadership, typically in smaller businesses. The intent of the skill set is to identify the team leadership and other skills that will enable the development of staff under the supervision of an experienced site supervisor or other recognised industry figure. The completion of this skill set provides a pathway to a range of Certificate IV qualifications.

Plumbing and services team leader skill set	
Unit code	Unit title
BCGBC4002A	Manage occupational health and safety in the building and construction workplace
BCGBC4009A	Apply legal requirements to building and construction projects
BSBFLM404A	Lead work teams

Pathway	Completion of these units provides credit towards BCP40106 Certificate IV in Plumbing and Services.
Suggested form of words for Statement of Attainment	These units from BCP03 Plumbing and Services Training Package meet industry requirements for experienced tradespersons and operators working as plumbing and services team leaders in the construction industry.

Assessment Guidelines

Introduction

These Assessment Guidelines provide the endorsed framework for assessment of units of competency in this Training Package. They are designed to ensure that assessment is consistent with the AQTF 2007. Assessments against the units of competency in this Training Package must be carried out in accordance with these Assessment Guidelines.

Assessment System Overview

This section provides an overview of the requirements for assessment when using this Training Package, including a summary of the AQTF 2007 requirements; licensing/registration requirements; and assessment pathways.

Benchmarks for Assessment

Assessment within the National Skills Framework is the process of collecting evidence and making judgments about whether competency has been achieved to confirm whether an individual can perform to the standards expected in the workplace, as expressed in the relevant endorsed unit of competency.

In the areas of work covered by this Training Package, the endorsed units of competency are the benchmarks for assessment. As such, they provide the basis for nationally recognised Australian Qualifications Framework (AQF) qualifications and Statements of Attainment issued by Registered Training Organisations (RTOs).

Australian Quality Training Framework Assessment Requirements

Assessment leading to nationally recognised AQF qualifications and Statements of Attainment in the vocational education and training sector must meet the requirements of the AQTF as expressed in the AQTF 2007 *Essential Standards for Registration*.

The AQTF 2007 *Essential Standards for Registration* can be downloaded from < www.training.com.au/aqtf2007>. The following points summarise assessment requirements.

Registration of Training Organisations

Assessment must be conducted by, or on behalf of, an RTO formally registered by a State or Territory Registering/Course Accrediting Body in accordance with the AQTF 2007 *Essential Standards for Registration*. The RTO must have the specific units of competency and/or AQF qualifications on its scope of registration.

Quality Training and Assessment

Each RTO must provide quality training and assessment across all its operations. See the AQTF 2007 *Essential Standards for Registration*, Standard 1.

Assessor Competency Requirements

Each person involved in training, assessment or client service must be competent for the functions they perform. See the AQTF 2007 *Essential Standards for Registration*, Standard 1, for assessor (and trainer) competency requirements.

Assessment Requirements

The RTOs assessments, including RPL, must meet the requirements of the relevant endorsed Training Package. See the AQTF 2007 *Essential Standards for Registration*, Standard 1.

Assessment Strategies

Each RTO must have strategies for training and assessment that meet the requirements of the relevant Training Package or accredited course and are developed in consultation with industry stakeholders. See the AQTF 2007 *Essential Standards for Registration*, Standard 1.

National Recognition

Each RTO must recognise the AQF qualifications and Statements of Attainment issued by any other RTO. See the AQTF 2007 *Essential Standards for Registration*, Condition of Registration 7: Recognition of qualifications issued by other RTOs.

Access and Equity and Client Outcomes

Each RTO must adhere to the principles of access and equity and maximise outcomes for its clients. See the AQTF 2007 *Essential Standards for Registration*, Standard 2.

Monitoring Assessments

Training and/or assessment provided on behalf of the RTO must be monitored to ensure that it is in accordance with all aspects of the Essential Standards for Registration. See the AQTF 2007 *Essential Standards for Registration*, Standard 3.

Recording Assessment Outcomes

Each RTO must manage records to ensure their accuracy and integrity. See the AQTF 2007 *Essential Standards for Registration*, Standard 3.

Issuing AQF Qualifications and Statements of Attainment

Each RTO must issue AQF qualifications and Statements of Attainment that meet the requirements of the current AQF Implementation Handbook and the endorsed Training Packages within the scope of its registration. An AQF qualification is issued once the full requirements for a qualification, as specified in the nationally endorsed Training Package are met. A Statement of Attainment is issued when an individual has completed one or more units of competency from nationally recognised qualification(s)/courses(s). See the AQTF 2007 and the 2007 edition of the AQF Implementation Handbook-available on the AQFAB website < www.aqf.edu.au>.

Licensing/registration requirements

Licensing and registration requirements that apply to specific industries, and vocational education and training, vary between each State and Territory and can regularly change. The developers of this Training Package and DEST consider that the licensing/ registration requirements described in this section apply to RTOs, assessors or candidates with respect to this Training Package. While reasonable care has been taken in its preparation, the developers of this Training Package and DEST cannot guarantee that the list is definitive or accurate at the time of reading; the information in this section is provided in good faith on that basis.

A number of occupations and roles within the plumbing and services industry are regulated in some or all of the States and Territories.

The regulators for each jurisdiction are listed below:

Jurisdiction	Name of Regulatory Body	Address
Australian Capital Territory	Plumbing Compliance ACT Planning and Land Authority	Ground Floor North Dame Pattie Menzies House 16 Challis Street

		Dickson ACT 2601
New South Wales	Plumbing Policy, Standards and Regulations Sydney Water Corporation	Sydney Water Corporation 2nd Floor, Corner of Bigge and Moore Streets Liverpool NSW 2170
Northern Territory	Building Advisory Services Department of Planning & Infrastructure	First Floor Cavenagh House 38 Cavenagh Street Darwin NT 0800
Queensland	Plumbing Standards Building Codes Queensland	Level 25, 41 George Street Brisbane QLD 4000
South Australia	Plumbing Services South Australian Water Corporation	South Australian Water Corporation East Terrace Thebarton SA 5031
Tasmania	Building Standards and Regulation	30 Gordons Hill Road Rosny Park TAS 7018
Victoria	Plumbing Industry Commission	450 Burke Road Camberwell Vic 3124
West Australia	Western Australian Plumbers Licensing Board	Locked Bag 14 Cloisters Square WA 6850

When selecting a qualification, including the choice of electives, reference should be made to the requirement identified by the Australian and New Zealand Reciprocity Association that the following units must be completed for the range of plumbing specialisms and which are used within the States and Territories for licensing purposes:

ALL STREAMS

BCPCM4001A Carry out work based risk control processes

BCPCM4002A Estimate and cost work

BSBSBM401A Establish business and legal requirements

WATER SUPPLY

BCPWT4001A Plan, size and layout hot and cold water services/systems

BCPWT4002A Commission and maintain backflow prevention devices

BCPWT4003A Commission and maintain hot water temperature control devices

DRAINAGE

BCPDR4001A Plan, size and layout sanitary drainage systems

BCPDR4002A Plan, size and layout stormwater drainage systems

BCPDR4003A Plan, size and layout domestic treatment plant disposal systems

SANITARY

BCPSN4001A Plan, size and layout sanitary pipe work and fixtures

GASFITTING

BCPGS4001A Plan, size and layout consumer gas installations

BCPGS4002A Service Type A gas appliances

AIR CONDITIONING AND MECHANICAL SERVICES

BCPMS4001A Plan, size and layout heating and cooling systems

BCPMS4002A Commission air and water systems

ROOFING

BCPRF4001A Plan, size and layout roof drainage systems

FIRE SERVICES

BCPFS4001A Commission domestic and residential fire suppression sprinkler systems

BCPFS4002A Commission and maintain special hazards fire suppression systems

BCPFS4003A Commission fire system pump sets

BCPFS4004A Design residential and domestic fire sprinkler systems

It is of importance that RTOs and candidates make themselves familiar with the licensing and registration arrangements that apply in their jurisdiction.

Requirements for Assessors

Licensing and registration requirements that apply to specific industries, and vocational education and training, vary between each State and Territory and can regularly change. The developers of this Training Package and DEST consider that the licensing/ registration requirements described in this section apply to RTOs, assessors or candidates with respect to this Training Package. While reasonable care has been taken in its preparation, the developers of this Training Package and DEST cannot guarantee that the list is definitive or accurate at the time of reading; the information in this section is provided in good faith on that basis.

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ALL STREAMS

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BCPWT4002A Commission and maintain backflow prevention devices

BCPWT4003A Commission and maintain hot water temperature control devices

DRAINAGE

BCPDR4001A Plan, size and layout sanitary drainage systems

BCPDR4002A Plan, size and layout stormwater drainage systems

BCPDR4003A Plan, size and layout domestic treatment plant disposal systems

SANITARY

BCPSN4001A Plan, size and layout sanitary pipe work and fixtures

GASFITTING

BCPGS4001A Plan, size and layout consumer gas installations

BCPGS4002A Service Type A gas appliances

AIR CONDITIONING AND MECHANICAL SERVICES

BCPMS4001A Plan, size and layout heating and cooling systems

BCPMS4002A Commission air and water systems

ROOFING

BCPRF4001A Plan, size and layout roof drainage systems

FIRE SERVICES

BCPFS4001A Commission domestic and residential fire suppression sprinkler systems

BCPFS4002A Commission and maintain special hazards fire suppression systems

BCPFS4003A Commission fire system pump sets

BCPFS4004A Design residential and domestic fire sprinkler systems

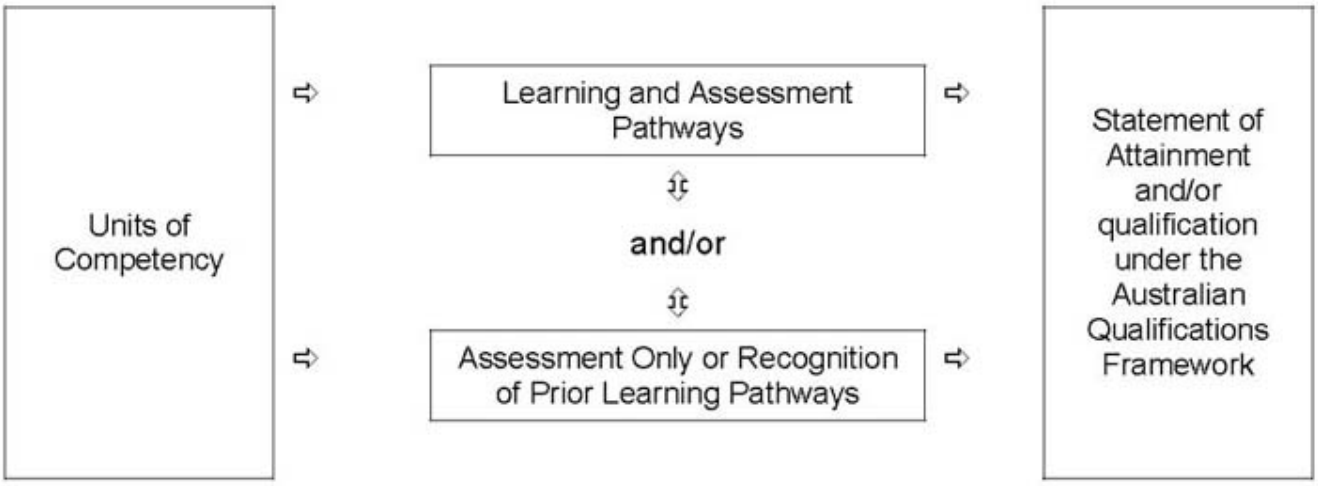
It is of importance that RTOs and candidates make themselves familiar with the licensing and registration arrangements that apply in their jurisdiction.

Pathways

The competencies in this Training Package may be attained in a number of ways including through:

- formal or informal education and training
- experiences in the workplace
- general life experience, and/or
- any combination of the above.

Assessment under this Training Package leading to an AQF qualification or Statement of Attainment may follow a learning and assessment pathway, an assessment-only or recognition pathway, or a combination of the two as illustrated in the following diagram.



Each of these assessment pathways leads to full recognition of competencies held - the critical issue is that the candidate is competent, not how the competency was acquired.

Assessment, by any pathway, must comply with the assessment requirements set out in the Assessment Guidelines of the Training Package and the AQTF 2007.

Learning and Assessment Pathways

Usually, learning and assessment are integrated, with assessment evidence being collected and feedback provided to the candidate at anytime throughout the learning and assessment process.

Learning and assessment pathways may include structured programs in a variety of contexts using a range of strategies to meet different learner needs. Structured learning and assessment programs could be: group-based, work-based, project-based, self-paced, action learning-based; conducted by distance or e-learning; and/or involve practice and experience in the workplace.

Learning and assessment pathways to suit Australian Apprenticeships have a mix of formal structured training and structured workplace experience with formative assessment activities through which candidates can acquire and demonstrate skills and knowledge from the relevant units of competency.

Assessment-Only or Recognition of Prior Learning Pathway

Competencies already held by individuals can be formally assessed against the units of competency in this Training Package, and should be recognised regardless of how, when or where they were achieved.

In an assessment-only or Recognition of Prior Learning (RPL) pathway, the candidate provides current, quality evidence of their competency against the relevant unit of competency. This process may be directed by the candidate and verified by the assessor, such as in the compilation of portfolios; or directed by the assessor, such as through observation of workplace performance and skills application, and oral and/or written assessment. Where the outcomes of this process indicate that the candidate is competent, structured training is not required. The RPL requirements of the AQTF 2007 must be met (Standard 1).

As with all assessment, the assessor must be confident that the evidence indicates that the candidate is currently competent against the endorsed unit of competency. This evidence may take a variety of forms and might include certification, references from past employers, testimonials from clients, and work samples. The onus is on candidates to provide sufficient evidence to satisfy assessors that they currently hold the relevant competencies. In judging evidence, the assessor must ensure that the evidence of prior learning is:

- authentic (the candidate"s own work)
- valid (directly related to the current version of the relevant endorsed unit of competency)
- reliable (shows that the candidate consistently meets the endorsed unit of competency)
- current (reflects the candidate"s current capacity to perform the aspect of the work covered by the endorsed unit of competency), and
- sufficient (covers the full range of elements in the relevant unit of competency and addresses the four dimensions of competency, namely task skills, task management skills, contingency management skills, and job/role environment skills).

The assessment only or recognition of prior learning pathway is likely to be most appropriate in the following scenarios:

- candidates enrolling in qualifications who want recognition for prior learning or current competencies
- existing workers
- individuals with overseas qualifications
- recent migrants with established work histories
- people returning to the workplace, and
- people with disabilities or injuries requiring a change in career.

Combination of Pathways

Where candidates for assessment have gained competencies through work and life experience and gaps in their competence are identified, or where they require training in new areas, a combination of pathways may be appropriate.

In such situations, the candidate may undertake an initial assessment to determine their current competency. Once current competency is identified, a structured learning and assessment program ensures that the candidate acquires the required additional competencies identified as gaps.

Assessor Requirements

This section identifies the mandatory competencies for assessors, and clarifies how others may contribute to the assessment process where one person alone does not hold all the required competencies.

Assessor Competencies

The AQTF 2007 specifies mandatory competency requirements for assessors. For information, Standard 1, Element 1.4 from the AQTF 2007 *Essential Standards for Registration* follows:

1.4		*Training and assessment is delivered by trainers and assessors who:*
	a)	*have the necessary training and assessment competencies as determined by the National Quality Council or its successors*
	b)	*have the relevant vocational competencies at least to the level being delivered or assessed*
	c)	*continue developing their vocational and training and assessment competencies to support continuous improvements in the delivery of the RTO"s services.*

Designing Assessment Tools

This section provides an overview on the use and development of assessment tools.

Use of Assessment Tools

Assessment tools provide a means of collecting the evidence that assessors use in making judgments about whether candidates have achieved competency.

There is no set format or process for the design, production or development of assessment tools. Assessors may use prepared assessment tools, such as those specifically developed to support this Training Package, or they may develop their own.

Using Prepared Assessment Tools

If using prepared assessment tools, assessors should ensure these are benchmarked, or mapped, against the current version of the relevant unit of competency. This can be done by checking that the materials are listed on the National Training Information Service < www.ntis.gov.au>. Materials on the list have been noted by the National Quality Council as meeting their quality criteria for Training Package support materials.

Developing Assessment Tools

When developing assessment tools, assessors must ensure that they:

- are benchmarked against the relevant unit or units of competency
- are reviewed as part of the continuous improvement of assessment strategies as required under Standard 1 of the AQTF 2007
- meet the assessment requirements expressed in Standard 1 of the AQTF 2007.

A key reference for assessors developing assessment tools is TAA04 Training and Assessment Training Package and the unit of competency TAAASS403A *Develop assessment tools*. There is no set format or process for the design, production or development of assessment materials.

Conducting Assessment

This section details the mandatory assessment requirements and provides information on equity in assessment including reasonable adjustment.

Assessment Requirements

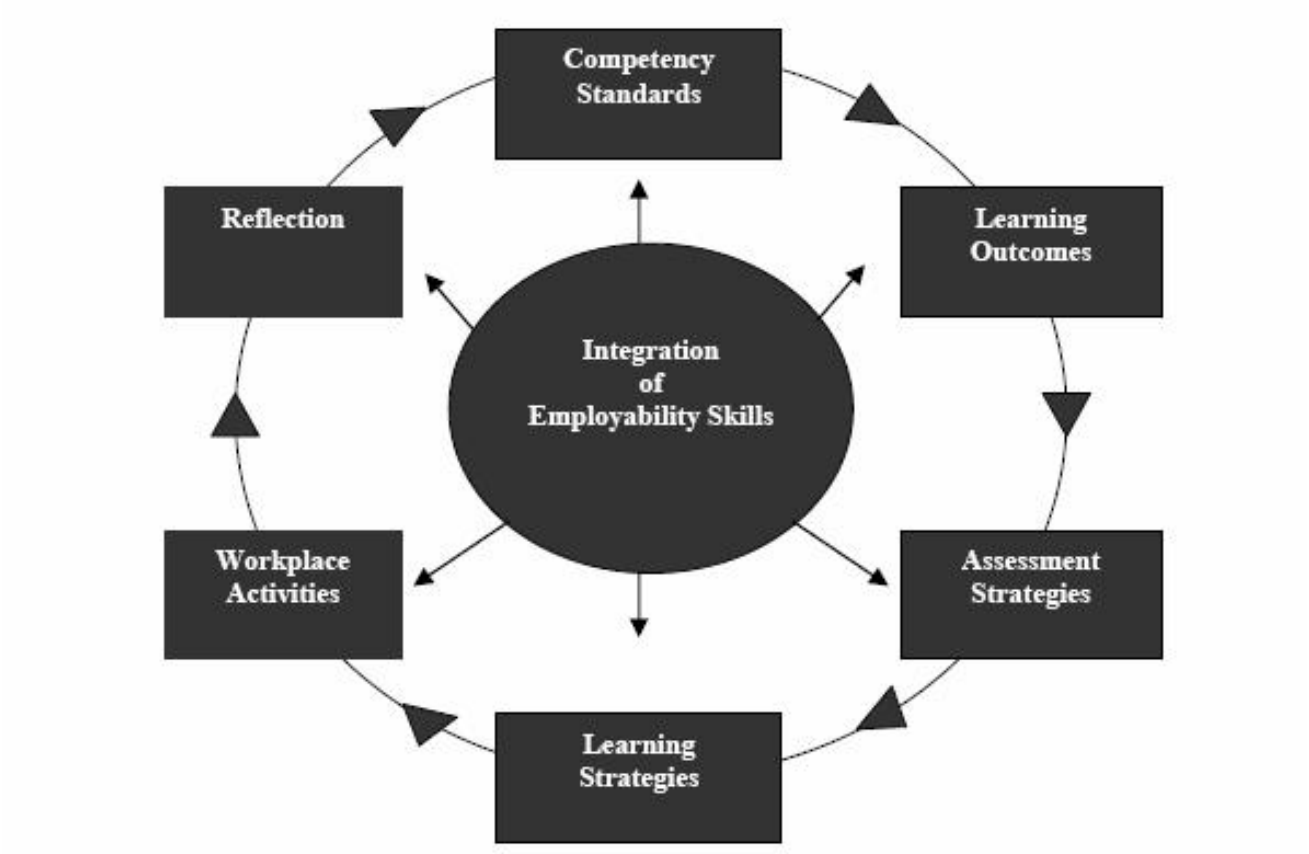
Assessments must meet the criteria set out in the AQTF 2007 Essential Standards for Registration.

For information, the mandatory assessment requirements from Standard 1 from the AQTF 2007 *Essential Standards for Registration* are as follows:

1.5		*Assessment, including Recognition of Prior Learning:*
	a)	*meets the requirements of the relevant Training Package or accredited course,*
	b)	*is conducted in accordance with the principles of assessment and the rules of evidence, and*
	c)	*meets workplace and, where relevant, regulatory requirements.*

Assessment of Employability Skills

Employability Skills are integral to workplace competency. As such they must be considered in the design, customisation, delivery and assessment of vocational education and training programs in an integrated and holistic way, as represented diagrammatically below.



Employability Skills are embedded and explicit within each unit of competency. Training providers must use Employability Skills information in order to design valid and reliable training and assessment strategies. This analysis could include:

- reviewing units of competency to locate relevant Employability Skills and determine how they are applied within the unit
- analysing the Employability Skills Summary for the qualification in which the unit or units are packaged to help clarify relevant industry and workplace contexts and the application of Employability Skills at that qualification outcome
- designing training and assessment to address Employability Skills requirements.

For more information on Employability Skills in Construction and Property Services Industry Skills Council Training Packages go to the Construction and Property Services Industry Skills Council website at http://www.cpsisc.com.au.

Access and Equity

An individual"s access to the assessment process should not be adversely affected by restrictions placed on the location or context of assessment beyond the requirements specified in this Training Package: training and assessment must be bias-free.

Under the rules for their development, Training Packages must reflect and cater for the increasing diversity of Australia"s VET clients and Australia"s current and future workforce. The flexibilities offered by Training Packages should enhance opportunities and potential outcomes for all people so that we can all benefit from a wider national skills base and a shared contribution to Australia"s economic development and social and cultural life.

Reasonable adjustments

It is important that education providers take meaningful, transparent and reasonable steps to consult, consider and implement reasonable adjustments for students with disability.

Under the *Disability Standards for Education 2005*, education providers must make reasonable adjustments for people with disability to the maximum extent that those adjustments do not cause that provider unjustifiable hardship. While "reasonable adjustment" and "unjustifiable hardship" are different concepts and involve different considerations, they both seek to strike a balance between the interests of education providers and the interests of students with and without disability.

An adjustment is any measure or action that a student requires because of their disability, and which has the effect of assisting the student to access and participate in education and training on the same basis as students without a disability. An adjustment is reasonable if it achieves this purpose while taking into account factors such as the nature of the student"s disability, the views of the student, the potential effect of the adjustment on the student and others who might be affected, and the costs and benefits of making the adjustment.

An education provider is also entitled to maintain the academic integrity of a course or program and to consider the requirements or components that are inherent or essential to its nature when assessing whether an adjustment is reasonable. There may be more than one adjustment that is reasonable in a given set of circumstances; education providers are required to make adjustments that are reasonable and that do not cause them unjustifiable hardship.

See Part 4, Chapter 2 of the *Training Package Development Handbook* (DEST, September 2007) for more information on reasonable adjustment, including examples of adjustments.

Industry Assessment Contextualisation 2

Assessment in the Plumbing and Services Industry

The Plumbing and Services Industry places premium on skills and knowledge that can be demonstrated in a real workplace environment. Whilst assessment of some of the Unit(s) of Competency in the Plumbing and Services Training Package can be carried out in a simulated work environment, the industry strongly recommends that assessment is conducted in the workplace, wherever possible.

Assessment of competency requires the collection of evidence and this should be conducted over a period of time. This assessment approach may include demonstration at the workplace and/or a simulated work environment to ensure that the demonstration of competency is valid and reliable. The individual being assessed needs to be aware that the collection of evidence is ongoing and needs to be part of the planning, conduct and review of the assessment process.

Supporting Integrated Training Delivery and Assessment

As a general principle, the Plumbing and Services Industry supports the integration of Unit(s) of Competency for assessment, where practical, as this reflects real work practices. An integrated approach to assessment brings together a number of Unit(s) of Competency, which reflect actual workplace requirements. For example, an employee working on a plumbing work site would complete a number of interrelated installation and occupational, health and safety tasks together, not simply one individual task at a time.

An integrated assessment activity would be designed to collect evidence for a number of units together rather than designing one assessment activity for each individual element of performance criteria.

Where both training and assessment are required the industry supports an approach which provides for off-the-job training combined with assessment of the application of skills and knowledge in a real work situation.

The Plumbing and Services Training Package defines on-the-job assessment as that assessment which occurs in the workplace as part of the normal operation of the business. The Plumbing and Services Training Package defines off-the-job assessment as that which occurs away from the normal operation of the business including, for example, assessment which may occur in the workplace but not under normal industry working conditions. The industry considers it important that candidates should have the opportunity to develop competency in structured learning programs which includes assessing in the workplace whenever possible.

It would be expected that where an integrated competency assessment approach is implemented that several integrated competency assessments would be necessary to cover the breadth and complexity of the qualification, at Certificates II and III. The context of the assessment, the role of the candidate and the complexity of the task will influence how many Unit(s) of Competency will be integrated.

Further Sources of Information

The section provides a listing of useful contacts and resources to assist assessors in planning, designing, conducting and reviewing of assessments against this Training Package.

Contacts

Contacts

Contacts

Construction and Property Services Industry Skills Council (CPSISC)

PO Box 151 Belconnen ACT 2616

Tel: (02) 6253 0002

Email: info@cpsisc.com.au

Website: www.cpsisc.com.au

Contact details for the National Network of Building and Construction Industry Training Advisory Bodies are as follows:

State or Territory	Organisation	Contact Details
New South Wales	Construction Industry Advisory Board (NSW) PO Box 1925 Hornsby Westfield NSW 1635	Chief Executive Officer Tel: (02) 9987 4027 Email: douglasg@citab.com.au
Queensland	Construction Training Queensland PO Box 28 Salisbury QLD 4107	Operations Manager Tel: (07) 3274 7999 Email: info@ctq.com.au
Northern Territory	Major Industry Training Advisory Council	Executive Officer Tel: (08) 8981 0077

	GPO Box 1610 Darwin NT 0801	Email: tim@mitac.org.au
Western Australia	Building and Construction Industry Training Council 1st Floor 1152 Hay Street West Perth WA 6005	Executive Officer Tel: (08) 9381 3900 Email: bcitcwa@bcitcwa.com.au
South Australia	Construction Industry Training Board (SA) PO Box 1227 Unley SA 5034	Chief Executive Officer Tel: (08) 8172 9500 Email: citb@citb.org.au
Tasmania	Tasmania Building and Construction Industry Board PO Box 105 Sandy Bay TAS 7006	Executive Director Tel: (03) 6223 7804 Email: email@tbcitb.com.au
Australian Capital Territory	ACT Building and Construction Industry Training Council PO Box 882 Dickson ACT 2602	Executive Officer Tel: (02) 6241 3977 Email: citc@iimetro.com.au
National	Construction and Property Services Industry Skills Council (CPSISC) PO Box 151 Belconnen ACT 2616	Chief Executive Officer Tel: (02) 6253 0002 Email: info@cpsisc.com.au

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Fax: +61 3 9832 8198

Email: sales@tvetaustralia.com.au

Web: www.tvetaustralia.com.au

For information on the TAA04 Training and Assessment Training Package contact:

Innovation & Business Skills Australia

Level 2, Building B, 192 Burwood Road

HAWTHORN VIC 3122

Telephone: (03) 9815 7000

Facsimile: (03) 9815 7001

Web: www.ibsa.org.au

Email: virtual@ibsa.org.au

General Resources

Refer to http://antapubs.dest.gov.au/publications/search.asp to locate the following ANTA publications.

AQF Implementation Handbook, third Edition. Australian Qualifications Framework Advisory Board, 2002, aqf.edu.au

Australian Quality Training Framework 2007 (AQTF 2007) - for information and resources go to < www.training.com.au/aqtf2007>

AQTF 2007 *Essential Standards for Registration*. Training organisations must meet these standards in order to deliver and assess nationally recognised training and issue nationally recognised qualifications. They include three standards, a requirement for registered training organisations to gather information on their performance against three quality indicators, and nine conditions of registration

AQTF 2007 *User"s Guide to the Essential Standards for Registration*. A Users" Guide for training organisations who must meet these standards in order to deliver and assess nationally recognised training and issue nationally recognised qualifications.

AQTF 2007 *Standards for Accredited Courses*. State and Territory accrediting bodies are responsible for accrediting courses. This standard provides a national operating framework and template for the accreditation of courses.

TAA04 *Training and Assessment Training Package*. This is available from the Innovation and Innovation & Business Skills Australia (IBSA) Industry Skills Council and can be viewed, and components downloaded, from the National Training Information Service (NTIS).

National Training Information Service, an electronic database providing comprehensive information about RTOs, Training Packages and accredited courses - www.ntis.gov.au

Training Package Development Handbook (DEST, August 2007). Can be downloaded from www.dest.gov.au

Assessment Resources

Training Package Assessment Guides - a range of resources to assist RTOs in developing Training Package assessment materials (originally developed by ANTA with funding from the Department of Education, Training and Youth Affairs) and made up of 10 separate titles, as described at the publications page of www.dest.gov.au. Go to www.resourcegenerator.gov.au/loadpage.asp?TPAG.htm

Printed and/or CD ROM versions of the Guides can be purchased from Technical and Vocational Education and Training (TVET) Australia Limited. The resource includes the following guides:

- Training Package Assessment Materials Kit
- Assessing Competencies in Higher Qualifications
- Recognition Resource
- Kit to Support Assessor Training
- Candidates Kit: Guide to Assessment in New Apprenticeships
- Assessment Approaches for Small Workplaces
- Assessment Using Partnership Arrangements
- Strategies for ensuring Consistency in Assessment
- Networking for Assessors
- Quality Assurance Guide for Assessment

An additional guide "Delivery and Assessment Strategies" has been developed to complement these resources.

Assessment Tool Design and Conducting Assessment

VETASSESS & Western Australian Department of Training and Employment 2000, *Designing Tests - Guidelines for designing knowledge based tests for Training Packages*.

Vocational Education and Assessment Centre 1997, Designing Workplace Assessment Tools, *A self-directed learning program*, NSW TAFE.

Manufacturing Learning Australia 2000, *Assessment Solutions*, Australian Training Products, Melbourne.

Rumsey, David 1994, *Assessment practical guide*, Australian Government Publishing Service, Canberra.

Assessor Training

Australian Committee on Training Curriculum (ACTRAC) 1994, *Assessor training program - learning materials*, Australian Training Products, Melbourne.

Australian National Training Authority, *A Guide for Professional Development*, ANTA, Brisbane.

Australian Training Products Ltd *Assessment and Workplace Training, Training Package - Toolbox*, ATPL Melbourne (available from TVET).

Green, M, et al. 1997, *Key competencies professional development Package*, Department for Education and Children"s Services, South Australia.

Victorian TAFE Association 2000, *The professional development CD: A learning tool*, VTA, Melbourne.

Assessment System Design and Management

Office of Training and Further Education 1998, *Demonstrating best practice in VET project - assessment systems and processes*, OTFE (now OTTE) Victoria.

Toop, L., Gibb, J. & Worsnop, P. *Assessment system designs*, Australian Government Publishing Service, Canberra.

BCPCM4003A Produce 2-D architectural drawings using CAD software

Unit Descriptor

This unit of competency specifies the outcomes required to produce two-dimensional (2-D) architectural drawings using computer-aided design (CAD) software under limited supervision.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the needs of project managers, site managers, estimators, forepersons and other plumbing and services and building and construction industry personnel who have a responsibility for preparing architectural drawings from project briefs, sketches, drawings and plans for residential and commercial construction projects. The drawings produced and notations included should conform to Australian standards and drawing protocols.

Unit Sector Common Units

ELEMENT	PERFORMANCE CRITERIA
1. Create a drawing template file.	1.1 The basic drawing environment is set up. 1.2 A suitable layering strategy is created. 1.3 A suitable architectural library is created. 1.4 Suitable text and dimension styles are created.
2. Produce architectural drawings to relevant Australian standards.	2.1 The ***drawing requirements*** are clarified and confirmed. 2.2 Drawings are produced using appropriate layers. 2.3 Notation that complies with Australian standards and ***drawing protocols*** is added to the drawings as required. 2.4 Dimensions, using appropriate scales in accordance with Australian standards and drawing protocols, are added to the drawings as required.
3. Edit drawing components.	3.1 Elements that are not required are deleted from an existing drawing. 3.2 Editing commands are used to modify drawing elements and existing text.
4. Plot CAD drawings.	4.1 The page layout for the drawing file is set to suit plotting requirements. 4.2 The print parameters for the plotter are set. 4.3 The drawings are plotted on the correct media.
5. Save and backup files.	5.1 Suitable file directories are created for the drawing project. 5.2 Drawing files are saved and backed up correctly to specified drives or directories. 5.3 Saved files are retrieved, renamed and edited as required.
6. Import files.	6.1 Drawing files are inserted correctly into other software applications. 6.2 Text files are imported into CAD drawings from other software applications.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- communication skills, including active listening and questioning skills to seek clarification
- creative design, drawing and drafting skills, including use of drafting equipment
- planning and organisational skills to ensure coordinated development of sketches and drawings
- reading skills, including the interpretation of a range of documents such as design briefs, sketches, drawings and plans.

Required knowledge:

- building materials and techniques
- building services
- construction technology
- document controls
- drafting and drawing protocols
- relevant industry standards and codes of practice
- general occupational health and safety principles and responsibilities

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Drawing requirements include:	• details: general notes, construction notes, area analysis, services and location of neighbouring buildings • types of drawing: site plans, floor plans, sections, elevations or projections.
Drawing protocols include:	• commonly used symbols, lettering standards, standard units of measurement, paper size, scale, numbering, legends and abbreviations.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment	• This unit of competency could be assessed on its own or as part of an integrated assessment activity involving preparation of CAD drawings, including construction detailing and material identification, for a range of typical Building Code of Australia (BCA) Type C structures (reference: Table C1.1 BCA).

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:
  - correctly identifying dimensions, symbols, abbreviations and key features of architectural drawings
  - correctly identifying styles, characteristics, technologies and decorative styles
  - correctly identifying particular styles of architecture, including period and type of materials used
  - sound understanding of the structural function of elements
  - correctly identifying the relationship between architectural styles and structures
  - applying CAD software.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environment
  - a suitable venue, with appropriate hardware and software
  - client files, including relevant drawing requests.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPCM5000A Design complex sanitary plumbing and drainage systems

Unit Descriptor

This unit of competency specifies the outcomes required to undertake the hydraulic engineering design of complex sanitary plumbing and drainage installation and to prepare specifications, for a range of residential, commercial and industrial buildings.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the attainment of skills and knowledge required for competent workplace performance in a consultancy or supervisory capacity in relation to plumbing services and construction hydraulics.

Unit Sector Common Units

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate design parameters.	1.1 ***Scope of work*** is established for complex sanitary plumbing and drainage systems for wide span and high-rise building projects. 1.2 ***Design requirements*** are determined from plans, specifications and client briefs. 1.3 ***Cost-benefit analysis*** is conducted comparing a range of pipe materials and system designs. 1.4 ***Statutory and regulatory requirements*** for the design of complex sanitary plumbing and drainage systems are interpreted. 1.5 ***Australian and New Zealand standards*** for the design of complex sanitary plumbing and drainage systems are analysed and applied. 1.6 ***Manufacturer requirements*** and trade and technical manuals are interpreted. 1.7 Additional research including a desktop study is conducted. 1.8 ***Performance requirements*** are established.
2. Plan and detail system components.	2.1 ***Layout of pipework systems*** and type and location of ***fittings and valves*** are planned. 2.2 ***Manholes*** and ***gullies*** are designed and detailed. 2.3 Pipe sizes, pipe grades, and trapping and ventilation requirements are ***calculated*** for a range of applications. 2.4 ***Anchor blocks*** are designed for a range of applications. 2.5 ***Pipe fixings*** are designed for a range of applications. 2.6 ***Pumpwell, pump and pump control requirements*** are sized and detailed. 2.7 Approved ***materials,jointing methods*** and all ***installation requirements*** for complex sanitary plumbing and drainage systems are specified.

3.	Design and size systems.	3.1 Complex sanitary plumbing and drainage systems are designed for a range of wide span and high-rise building applications. 3.2 ***Rising main systems*** are designed. 3.3 Complex sanitary plumbing and drainage systems are designed and sized using computer software packages.
4.	Prepare documentation.	4.1 ***Plans*** are prepared for a range of complex sanitary plumbing and drainage systems. 4.2 A ***specification*** for complex sanitary plumbing and drainage systems is prepared. 4.3 A ***testing*** and ***commissioning schedule*** is prepared. 4.4 An ***operation and maintenance manual*** is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- mathematical and numeracy skills to be able to apply measurements and calculations
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources
- teamwork skills to be able to coordinate and action tasks relevant to the design of complex sanitary plumbing and drainage systems.

Required knowledge:

- 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
- common terminology and definitions used in design of complex sanitary plumbing and drainage systems for all classes of building
- principles of technology in the design of hydraulic systems
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Scope of work:	• includes interpretation of plans and specifications • includes sizing and documenting layout of complex sanitary plumbing and drainage systems for applications including residential, commercial and industrial • may be for new projects or an existing structure being renovated, extended, restored or maintained.
Design requirements may include:	• owner requirements • architectural specifications • builder specifications • specialist water use applications.
Cost-benefit analysis may include:	• comparison of range of suitable materials and system choices available to enable cost-effective choices to be made without compromising the integrity of the project.
Statutory and regulatory requirements may include:	• acts and regulations • local and state government policies.
Australian and New Zealand standards may include:	• AS/NZS3500 National plumbing and drainage set Parts 1.1 and 1.2 • AS2200 Design charts for water supply and sewerage • Building Code of Australia.
Manufacturer requirements may include:	• material specifications • sizing tables • pump tables • technical and trade manuals.
Performance requirements include:	• flow, velocity, pressure and discharge requirements, established using Australian and New Zealand standards and local authority plans.
Layout of pipework systems may include:	• ring main • single pipe • dual feed.

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

Manhole details may include:	• inspection chambers • sizing • connections to and from • open and closed channel • benching requirements • lids • flow • gradient requirements.
Gullies may include details such as size, location, bedding and concrete support, and also include:	• overflow relief gullies (ORG) • disconnector gullies (DG) • boundary traps.
Calculations for complex sanitary plumbing and drainage systems may include:	• reduced level calculations • gradient calculations • pipe sizing calculations • determination of flow and fixture loadings • interpretation of design charts and tables.
Design elements of ***anchor blocks*** may include:	• sizes • keying and anchorage points • soil characteristics • flow forces to be resisted.
Pipe fixings may include:	• wall and ceiling brackets • saddles • hanging brackets • anchors • material requirements • corrosion protection • bracket spacing • bedding • concrete support • cover.

Pumpwell, pump and pump control requirements may include:

- pumpwell sizing
- detailing
- ladder access
- step irons
- chains
- capacity
- warning system
- automatic controls
- high and low-level water controls and alarms
- corrosion-resistant materials
- macerator requirements
- pump selection
- pump sizing
- impeller sizing
- installation and mounting requirements
- valve requirements
- inlet and outlet design requirements
- space requirements.

Materials should include:

- copper
- unplasticised polyvinyl chloride (uPVC)
- earthenware
- cast iron
- high density polyethylene (HDPE)
- concrete
- fittings and fixtures, including:
  - sound attenuation requirements
  - measures to prevent the spread of fire.

Jointing methods may include:

- rubber ring
- mechanical joints
- gluing
- solvent cement welding
- brazing and threading.

Installation requirements include:

- jointing requirements, level of workmanship, clipping, bedding, concrete support and installation details.

Rising main systems may include:

- approved pressure pipe and fittings
- calculated rise and pump delivery requirements
- pump sizing to meet calculated flow conditions.

Plans:	• may include:
	  • elevations
	  • sections
	  • details
	  • cross-sections
	  • isometrics
	  • axonometrics
	  • schematics
	• may be produced using:
	  • pencil
	  • Indian ink
	  • pigment liner
	  • computer generation.

Specification may include:	• materials • workmanship • jointing • manholes • manufacturer requirements • clipping • bedding • concrete support and detailing specialised components.
Testing may include:	• hydrostatic test • air pressure test • drainage inspection • quality assurance (QA) audit.
Commissioning schedule may include:	• cleaning grates • charging traps • checking leaks.
Operation and maintenance manual may include:	• yearly inspection • leak detection • check for blockages • water auditing • yearly maintenance requirements • pump maintenance.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment

- This unit of competency could be assessed on its own or as part of an integrated assessment activity involving carrying out the effective performance and application of drainage principles and detailing system components used in the drainage industry.

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 complex sanitary plumbing and drainage systems
  - planning and detailing system components, including:
    - manholes
    - gullies
    - anchorage blocks
    - pumpwells
    - piping systems
  - designing and sizing a complex sanitary plumbing and drainage system
  - applying drainage principles in the design and sizing of a complex elevated pipe system
  - designing and sizing a rising main
  - designing and sizing a fully vented or fully vented modified system
  - designing and sizing a single stack or single stack modified system
  - preparing plans to industry standards for a range of complex sanitary plumbing and drainage systems
  - preparing a specification for a complex sanitary plumbing and drainage system
  - preparing a testing and commissioning schedule
  - preparing an operation and maintenance manual
  - complying with OHS regulations applicable to workplace operations
  - interactive communication with others to ensure safe and effective workplace operations.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environments appropriate to a range of situations and activities
  - computers and software
  - materials appropriate to application activities
  - appropriate documentation and data related to tasks, including plans and specifications of an appropriate building
  - tools and equipment relevant to planning processes, including calculators.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPCM5001A Design complex cold water systems

Unit Descriptor

This unit of competency specifies the outcomes required to design complex cold water distribution systems including upfeed, downfeed, pumped systems and storage regulations, in multistorey buildings.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the attainment of skills and knowledge required for competent workplace performance in a consultancy or supervisory capacity in relation to plumbing services and construction hydraulics. Application of the unit is relevant to multistorey residential, commercial and industrial buildings with or without connection to reticulated water supply.

Unit Sector Common Units

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate design parameters.	1.1 ***Scope of work*** is established for the distribution of complex cold water systems for wide span and high-rise building projects. 1.2 ***Design requirements*** are determined from plans, specifications and client briefs. 1.3 ***Cost-benefit analysis*** is conducted comparing a range of pipe materials and system designs. 1.4 ***Statutory and regulatory requirements*** for the design of complex cold water distribution systems are interpreted. 1.5 ***Australian and New Zealand standards*** for the design of complex cold water distribution systems are analysed and applied. 1.6 ***Manufacturer requirements*** and trade and technical manuals are interpreted. 1.7 Additional research including a ***desktop study*** is conducted to outline design parameters. 1.8 ***Flow and pressure tests*** are conducted. 1.9 ***Performance requirements*** are established.
2. Plan and detail system components.	2.1 ***Layout of pipework systems*** and type and location of ***fittings and valves*** are planned. 2.2 Type, location and requirements for ***backflow prevention devices*** are detailed. 2.3 ***Flush valve system types*** and operation are specified. 2.4 Pipe sizes, velocities, flows and pressures are calculated for a range of applications. 2.5 ***Cold water system components*** are detailed or designed. 2.6 ***Pump, pump controls and pumproom requirements*** are sized and detailed. 2.7 Approved ***materials, jointing methods and installation requirements*** for complex cold water distribution systems are specified.

3. Design and size systems.	3.1 Complex cold water distribution systems are designed for a range of wide span and high-rise building applications. 3.2 Flush valve distribution systems are designed. 3.3 A range of ***delivery systems*** is designed. 3.4 Complex cold water distribution systems are designed and sized using computer software packages.
4. Prepare documentation.	4.1 Plans are prepared for a range of complex cold water distribution systems. 4.2 A specification for a cold water distribution system is prepared. 4.3 A testing and commissioning schedule is prepared. 4.4 An operation and maintenance manual is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources
- teamwork skills to be able to coordinate and action tasks relevant to the design of complex cold water systems.

Required knowledge:

- 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
- common terminology and definitions used in design of cold water reticulation systems
- nature of materials used and effects of performance under various conditions
- principles of technology used in design of cold water reticulation and hydrant/hose reel systems for all classes of building
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Scope of work :	• includes interpretation of plans and specifications • includes sizing and documenting layout of complex cold water systems for applications including residential, commercial and industrial • may be for new projects or an existing structure being renovated, extended, restored or maintained.
Design requirements may include:	• owner requirements • architectural specifications • builder specifications • specialist water use applications.
Cost-benefit analysis may include:	• comparison of range of suitable materials and system choices available to enable cost-effective choices to be made without compromising the integrity of the project.
Statutory and regulatory requirements may include:	• acts and regulations • local and state government policies.
Australian and New Zealand standards may include:	• AS/NZS3500 National plumbing and drainage set Parts 1.1 and 1.2 • AS2200 Design charts for water supply and sewerage • Building Code of Australia.
Manufacturer requirements may include:	• material specifications • sizing tables • pump tables • technical and trade manuals.
Desktop study may include collection and interpretation of existing data for design purposes from:	• council plans • developer plans • architectural and building plans • other documents and reports as available.
Flow and pressure tests include:	• on-site measurement of flow (l/s), velocity (m/s) and pressure (Kpa) • interpretation of flow and pressure tests conducted by a contractor.

Performance requirements may include:	• flow, velocity, pressure and discharge requirements, established using Australian and New Zealand standards and local authority plans.
Layout of pipework systems may include:	• ring main • single pipe • dual feed.
Fittings and valves may include:	• fittings: • tees • elbows • bends • unions • valves: • isolating • pressure reduction • pressure limiting • backflow prevention • excess pressure • strainers.
Backflow prevention devices may include:	• testable and non-testable devices • break tanks • zone protection • property and individual protection.
Flush valve system types may include:	• gravity • mains pressure • storage requirements • pipe sizing requirements • backflow prevention requirements.

Cold water system components include:

- meter assemblies, including:
- direct and indirect
- inferential
- magnetic
- electronic
- thrust blocks and their design elements, including:
- sizes
- keying and anchorage points
- soil characteristics
- velocity and flow forces to be resisted
- design details for tees, elbows, valves and meter assemblies
- pipe fixings, including:
- wall and ceiling brackets
- bracket spacing
- saddles
- hanging brackets
- anchors
- material requirements
- corrosion protection
- bedding
- cover
- water storage systems, including:
- tank sizes
- inlet valve design and sizing
- overflow requirements
- automatic controls
- safe tray requirements
- outlet sizing.

Pump, pump controls and pumproom requirements may include:

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

Materials should include:

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

Jointing methods may include:	• compression • brazing • screwing • flaring • soldering • mechanical joints • rubber ring joints.
Installation requirements include:	• jointing requirements • level of workmanship • clipping • bedding • installation details.
Delivery systems may include:	• upfeed • downfeed • pressure ratio • hydropneumatic • constant flow variable speed pumps.
Plans may include:	• elevations • sections • details • cross-sections • isometrics • axonometrics • schematics.
Specification may include:	• materials • workmanship • jointing • valve selection • manufacturer • clipping • bedding • specialised components.
Testing may include:	• hydrostatic test • air pressure test • mains pressure test • defect inspection • quality assurance (QA) audit.
Commissioning schedule may include:	• flow test • pressure test • valve operation • leak check • system purge.

Operation and maintenance manual may include:

- valve maintenance
- yearly inspection
- leak detection
- water auditing
- yearly maintenance requirements
- pump maintenance.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment

- This unit of competency could be assessed on its own or as part of an integrated assessment activity involving effective performance and application of drainage principles and detailing of systems components used in the drainage industry.

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 in accordance with job requirements
  - applying regulatory, manufacturer and Australian and New Zealand requirements for a range of complex cold water distribution systems
  - planning and detailing system components, including:
    - flush valves
    - backflow prevention devices
    - meter assemblies
    - thrust blocks
    - piping systems
  - complying with occupational health and safety regulations applicable to workplace operations
  - applying organisational quality procedures and processes
  - designing and sizing a range of cold water distribution and delivery systems
  - designing and sizing a range of flush valve systems
  - preparing plans for a range of complex cold water distribution systems
  - preparing a specification for a cold water distribution system
  - preparing a testing and commissioning schedule
  - preparing an operation and maintenance manual
  - applying correct design principles and techniques
  - identifying typical faults and problems that occur and taking action necessary to rectify
  - interactive communication with others to ensure safe and effective workplace operations.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environments appropriate to a range of situations and activities
  - computers and software
  - materials appropriate to application activities
  - appropriate documentation and data related to tasks, including plans and specifications of an appropriate building
  - tools and equipment relevant to planning processes, including calculators.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPCM5002A Design complex stormwater and roof drainage systems

Unit Descriptor

This unit of competency specifies the outcomes required to design complex stormwater and roof drainage systems for commercial, industrial and residential properties.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the needs of experienced plumbers specialising in hydraulics.

Unit Sector Common Units

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate the design parameters.	1.1 ***Client*** requirements are determined from plans, specifications and client briefs. 1.2 ***Local government, Environment Protection Authority*** (EPA), ***and Australian and New Zealand standards*** for the design of complex stormwater and roof drainage systems are interpreted. 1.3 Regulatory requirements for the design of complex stormwater and roof drainage systems are analysed and applied. 1.4 ***Other documentation relevant to the design*** is researched, evaluated and applied.
2. Plan the system components.	2.1 Layout of ***system components*** is planned according to design parameters and site limitations and coordinated with other services. 2.2 Stormwater diversion valve systems and first-flush stormwater systems are planned and evaluated. 2.3 The most suitable methods of preventing backflow of subsoil and stormwater into buildings are determined and specified. 2.4 The ***treatment and disposal options for stormwater discharge*** are evaluated and planned.

3.	Design and size systems.	3.1 ***Rainfall intensities are determined*** and volumes of water are estimated using measurements of different ***catchment areas*** . 3.2 Methods of collection and disposal of surface run-off water are specified. 3.3 Strategies for the harvesting and re-use of rainwater are identified and evaluated. 3.4 Subsoil water types are determined and ***stormwater drainage systems*** are designed, sized and detailed using appropriate software applications. 3.5 System components are selected, designed, sized and detailed using appropriate software applications and appropriate ***approved materials*** are analysed and selected. 3.6 ***Stormwater systems requiring pumping*** are identified and designed using appropriate software applications, with pump and discharge pipe sizes calculated and specified. 3.7 Correct installation, laying and jointing procedures for materials and components are specified.
4.	Prepare documentation.	4.1 ***Plans*** are prepared for a range of complex stormwater and roof drainage systems. 4.2 A ***specification*** for a complex stormwater and roof drainage system is prepared. 4.3 A testing and commissioning schedule is prepared. 4.4 An operation and maintenance manual is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- ability to apply design concepts and principles
- effective oral and written communication skills, including voice and hand signals, two-way radio and communication of graphical representations and plans
- mathematical and numeracy skills to be able to apply measurements and calculations
- reading and interpretation skills to interpret:
  - regulatory requirements
  - signage
  - work schedules and plans
  - job drawings
  - work bulletins
  - charts and hand drawings
  - memos
  - material safety data sheets
  - manufacturer specifications and instructions
  - organisational work specifications
  - requirements and instructions issued by authorised organisational or external personnel.

Required knowledge:

- relevant Australian and New Zealand standards, including:
  - AS/NZS3500 National plumbing and drainage set
  - Building Code of Australia
  - manufacturer specifications
  - other applicable codes or standard operating procedures relevant to the sector
- terminology and definitions used in hydraulic design
- installation methods used in hydraulic systems
- hazards associated with devices and systems used in the hydraulic sector
- environmental requirements, including:
  - water quality management
  - waste management
  - stormwater protection
  - clean-up protection
- quality assurance requirements, including:
  - International Standards Organisation
  - internal company quality assurance policy and risk management strategies
  - EPA
  - site safety plan
  - workplace operations and procedures
- regulatory and legislative requirements, particularly those pertaining to:
  - plumbing regulations
  - building codes
  - occupational health and safety
  - environmental requirements
- safe work procedures relating to planning, sizing and documenting layout of pipework and fixtures.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Clients may include:

- property owners
- architects
- builders
- statutory bodies.

Local government, Environment Protection Authority and Australian and New Zealand standards requirements include:

- local government requirements, including:
  - urban design manuals
  - town planning requirements
  - Integrated Planning Act (IPA)
  - other regulatory requirements
  - standard drawings and details
- treatment requirements, such as:
  - silt traps
  - solid removal systems
  - screens
- environmental requirements to cover water quality management, including:
  - waste management
  - stormwater protection
  - clean-up protection
- Australian and New Zealand standards, including:
  - AS/NZS3500 National plumbing and drainage set
  - 3.1 Stormwater drainage - performance criteria
  - 3.2 Stormwater drainage - acceptable solutions
  - AS2200 Design charts for water supply and sewerage.

Other documentation relevant to the design includes:

- plans, drawings, manuals and reports regarding:
  - surveys
  - existing services
  - buildings
  - site plans
  - civil drawings
  - reduced levels
  - contour levels
  - manufacturer requirements and specifications
  - stormwater design.

System components include:

- guttering
- downpipes
- piping
- pits
- gullies
- manholes
- inspection chambers
- culverts
- kerbs
- channels
- grated pits
- access chambers
- inspection openings.

Treatment and disposal options for stormwater discharge include:

- treatment options:
  - screens
  - traps
  - ponds
  - lagoons
  - grass and rock swales
  - momentum diffusers
  - silt traps
  - other solid removal systems as determined
- disposal options:
  - kerb and street channels
  - manholes
  - connection to stormwater mains
  - rivers
  - creeks
  - lakes
  - streams
  - rainwater collection systems, including tanks and dams.

Rainfall intensities are determined by:

- roof, surface and subsurface calculations
- time and concentration
- average rainfall intervals.

Catchment areas include:

- land surface catchment areas, including a variety of surface conditions such as grassed and paved areas
- roof catchment areas.

Stormwater drainage systems include:

- grade of drains
- holding pits
- collection sumps
- detention basins
- manholes.

Approved materials include:

- piping materials:
  - polyvinyl chloride (PVC)
  - fibre cement (FRC)
  - concrete
  - earthenware
  - other composite materials
- fittings:
  - junctions
  - bends
  - non-return valves
  - grates
  - gullies.

Stormwater systems requiring pumping include:

- subsurface water drainage systems
- building basements
- rising main installations.

Plans include:

- long sections
- cross-sections
- detail drawings.

Specification (and user manuals) include:

- materials
- valves
- fittings
- pumps
- installation
- components
- maintenance
- commissioning
- testing.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment

- This unit of competency could be assessed on its own or as part of an integrated assessment activity involving production of designs, plans, specifications and supporting documentation for a complex stormwater and roof drainage system.

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:
- collecting, analysing and evaluating research, including:
  - survey plans
  - existing services
  - building plans
  - site plans
  - civil drawings
  - reduced levels
  - contour levels
- preparing a plan coordinated with other services for the layout of piping, pits, gullies and other system components in accordance with design parameters and site limitations
- calculating stormwater detention basins' sizes and capacities
- calculating roof catchment areas and surface run-off volumes
- determining specifications for guttering requirements and size of downpipes
- designing subsoil drainage systems, including sizing for collection, containment and discharge
- creating detail drawings, including long sections and cross-sections
- creating a design including size and detail for complex stormwater and roof drainage systems, including:
  - grade of drains
  - holding pits
  - collection sumps
  - detention basins
  - manholes
  - other system components
- applying appropriate software in order to design, size and detail selected stormwater systems
- preparing plans for a range of complex stormwater and roof drainage systems
- preparing a specification for a complex stormwater and roof drainage system
- preparing a testing and commissioning schedule
- preparing an operation and maintenance manual.

Context of and specific resources for assessment

- The following resources should be made available as appropriate:
  - workplace or simulated environment
  - tools and equipment appropriate to the planning process
  - computers and software
  - calculators
  - support materials appropriate to activity
  - plans and specifications of an appropriate building
  - research resources, including systems literature and data.
- Validity and sufficiency of evidence requires that:
  - competency will need to be demonstrated over a period of time reflecting the scope of the role
  - 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be current and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPCM5003A Design complex (non-solar) hot water systems

Unit Descriptor

This unit of competency specifies the outcomes required for the design and specification of complex (non-solar) hot water supply and distribution systems for residential, commercial and industrial applications. The unit includes circulating systems, fuel and energy loads and system selection.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the attainment of skills and knowledge required for competent workplace performance in a consultancy or supervisory capacity in relation to plumbing services and hydraulics.

Unit Sector Common Units

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate design parameters.	1.1 ***Scope of work*** is established for hot water supply and distribution systems for wide span and high-rise building projects. 1.2 ***Design requirements*** are determined from plans, specifications and client briefs. 1.3 ***Cost-benefit analysis*** is conducted comparing a range of pipe materials and system designs. 1.4 ***Statutory and regulatory requirements*** for the design of complex (non-solar) hot water supply and distribution systems are analysed and applied. 1.5 ***Manufacturer requirements*** and trade and technical manuals are interpreted. 1.6 Additional research including a ***desktop study*** is conducted. 1.7 ***Performance requirements*** are established.

2. Plan and detail system components.	2.1 ***Layout of pipework systems*** and type and location of ***fittings and valves*** are planned. 2.2 ***Thermostatic mixing valves, tempering valves*** and valve trains are detailed for a range of applications and appropriate symbols are used. 2.3 ***Circulating hot water supply systems*** are designed and detailed. 2.4 ***Heat trace systems*** are designed and detailed. 2.5 Warm water systems are designed and detailed and disinfection and biocontrol measures are specified. 2.6 ***Calculations for sizing water heaters*** are conducted and ***methods for the control of expansion*** are detailed. 2.7 Pipe sizes are calculated and ***pipe fixings*** designed for a range of applications. 2.8 ***Manifolding hot water units*** are detailed for a range of ***water heaters*** and ***safe trays and overflows*** are specified. 2.9 Approved ***materials*** and join ***ting methods, insulation materials*** and ***installation requirements*** for a range of water heaters and hot water systems are specified.
3. Design and size systems.	3.1 Complex (non-solar) hot water supply and distribution systems are designed for a range of wide span and high-rise building applications. 3.2 ***Circulating systems*** are designed and detailed. 3.3 Complex (non-solar) hot water supply and distribution systems are designed and sized using computer software packages.
4. Prepare documentation.	4.1 ***Plans*** are prepared for a range of complex (non-solar) hot water supply and distribution systems. 4.2 A ***specification*** for a hot water supply and distribution system is prepared. 4.3 A ***testing*** and ***commissioning schedule*** is prepared. 4.4 An ***operation and maintenance manual*** is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources
- technical skills, including the ability to apply design concepts and principles
- teamwork skills to be able to coordinate and action tasks relevant to the design of complex hot water systems.

Required knowledge:

- application of Australian and New Zealand standards and manufacturer specifications
- installation methods and hazards identified in relation to devices and systems used according to Australian and New Zealand standards and other codes or standard operating procedures
- common terminology and definitions used in design of complex (non-solar) hot water systems
- nature of materials used and effects of performance under various conditions
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Scope of work:	• includes interpretation of plans and specifications • includes sizing and documenting layout of hot water supply and distribution systems for applications including residential, commercial and industrial • may be for new projects or an existing structure being renovated, extended, restored or maintained.
Design requirements may include:	• owner requirements • architectural specifications • builder specifications • specialist hot water use applications.

Cost-benefit analysis refers to comparison of a range of factors to enable cost-effective choices to be made without compromising the integrity of the project. Factors may include:

- suitable materials
- system choices
- design styles
- labour costs
- material costs
- safety factors
- energy costs
- speed of installation
- durability and available design life.

Statutory and regulatory requirements may include:

- acts and regulations
- local and state government policies, including group and strata titling
- Australian and New Zealand standards, including:
  - AS/NZS3500 National plumbing and drainage set Parts 4.1 and 4.2
- Building Code of Australia.

Manufacturer requirements may include:

- material specifications
- sizing tables
- pump tables
- technical and trade manuals.

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

- council plans
- developer plans
- architectural and building plans
- other documents, including:
  - forms
  - applications
  - sewer detail maps
  - other reports as available.

Performance requirements include:

- those established using Australian and New Zealand standards and local authority plans.

Layout of pipework systems may include:

- pumped systems
- thermo convection systems
- dead leg systems.

Fittings and valves may include:

- fittings:
  - tees
  - bends
  - unions
  - valve trains
- valves:
  - pressure limiting
  - backflow prevention
  - non-return, including high pressure non return
  - pressure relief
  - strainers
  - cold water expansion
  - isolating.

Thermostatic mixing valves and tempering valves may include:

- wax capsule
- alcohol
- bimetallic types.

Circulating hot water (flow and return) ***supply system*** details may include:

- pipework
- dead leg minimisation
- thermal convection circulating systems
- speed of circulation
- circulating pump specification.

Heat trace systems may include:

- installation requirements
- cost.

Calculations for sizing water heaters may include:

- size and quantity of hot water required
- daily flows
- peak demand
- recovery times
- energy calculations
- heat loss calculations
- water expansion calculations
- standby versus continual flow
- tariff calculations
- mixed temperature calculations
- coefficient of expansion.

Methods for the control of expansion may include:

- lyre loops and full loops
- proprietary expansion control devices
- offsets
- bends.

Pipe fixings may include:

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

Manifolding hot water units may include:

- balanced flow conditions and valves
- pressure relief requirements.

Water heaters may include:

- storage
- continuous flow
- low pressure
- high pressure
- vented atmospheric pressure systems
- heat transfer
- gas
- electric
- solar
- other fuel sources.

Safe trays and overflows may include:

- above habitable areas
- sizes
- heights
- space requirements
- materials.

Materials may include:

- copper
- polybutylene
- composite pipe materials and other pipe materials as specified
- fittings and fixtures.

Jointing methods may include:

- compression
- mechanical joints
- brazing
- threading
- flaring.

Insulation materials may include:

- thickness
- density
- diameter
- heat transmission processes
- heat losses
- fibre glass
- rock wool
- foam
- felt.

Installation requirements may include:	• jointing requirements • level of workmanship • clipping • installation details.
Circulating systems may include:	• approved pressure pipes and fittings • calculated rise and pump delivery requirements • pump sizing to meet calculated flow conditions.

Plans:	• may include:
	  • elevations
	  • sections
	  • details
	  • cross-sections
	  • isometrics
	  • axonometrics
	  • schematics
	• may be produced using:
	  • pencil
	  • Indian ink
	  • pigment liner
	  • computer generation.

Specification may include:	• materials • workmanship • jointing • manholes • manufacturer requirements • clipping • bedding • concrete support.
Testing may include:	• hydrostatic test • air pressure test • quality assurance (QA) audit.
Commissioning schedule may include:	• balancing the system • temperature setting • checking and flushing the system.
Operation and maintenance manual may include:	• yearly inspection • leak detection • check for blockages • water auditing • yearly maintenance requirements • pump maintenance.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment

- This unit of competency could be assessed on its own or as part of an integrated assessment activity involving effective performance and application of principles used to design complex (non solar) hot water systems.

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 hot water supply and distribution systems
  - planning and detailing system components, including:
    - tempering valves
    - manifolding systems
    - insulation requirements
    - flow and return systems
- complying with occupational health and safety regulations applicable to workplace operations
- applying organisational quality procedures and processes within context of designing complex hot water systems
- designing and sizing a range of hot water supply and distribution systems
- designing and sizing a range of circulating systems
- sound preparation of plans for a range of hot water supply and distribution systems
- sound preparation of a specification for a hot water supply and distribution system
- sound preparation of a testing and commissioning schedule
- preparing an operation and maintenance manual
- interactive communication with others to ensure safe and effective work site operations.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environments appropriate to a range of situations and activities
  - computers and software
  - materials appropriate to application activities
  - appropriate documentation and data related to tasks, including:
    - design brief drawings
    - specifications
    - codes
    - design concepts
    - construction schedule
    - other necessary supporting documents
  - relevant tools and equipment, including calculators
  - research resources, including systems literature and data
  - access to relevant legislation, regulations and codes of practice.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work

being performed.

BCPCM5004A Design sewer systems

Unit Descriptor

This unit of competency specifies the outcomes required to design and document sewer systems, including specifying responsibilities, procedures and safety standards for sewerage equipment, construction, soil classification, pipelaying techniques and trench protection; analysing factors relating to pumping and tunnelling; and supervising the installation of a sewer system.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the attainment of skills and knowledge required for competent workplace performance in a consultancy or supervisory capacity in relation to plumbing services and hydraulics.

Unit Sector Common Units

ELEMENT	PERFORMANCE CRITERIA
1. Prepare and implement sewer contracts.	1.1 ***Sewer contracting procedures*** are implemented. 1.2 Required qualifications, and roles and responsibilities of local authority personnel and contracted parties, are negotiated and documented.
2. Evaluate design parameters.	2.1 ***Scope of work*** is established for sewer systems. 2.2 ***Design requirements*** are determined from plans, specifications and client briefs. 2.3 ***Cost-benefit analysis*** is conducted comparing a range of pipe materials and system designs. 2.4 ***Statutory and regulatory requirements and Australian and New Zealand standards*** for the design of sewer systems are analysed and applied. 2.5 ***Manufacturer requirements*** and trade and technical manuals are interpreted. 2.6 Additional research including a ***desktop study*** is conducted to outline design parameters. 2.7 ***Safety procedures and regulations for trench safety*** are specified. 2.8 ***Performance requirements*** are established.

3. Plan and detail system components.	3.1 Soils are tested and classified and the characteristics of soil types are analysed. 3.2 ***Trenching safety procedures*** are detailed and backfilling and compaction methods are specified. 3.3 ***Layout of pipework systems*** and type and location of ***fittings and valves*** are planned. 3.4 ***Pipelaying*** , dewatering and testing procedures for pipework of varying sizes are specified. 3.5 ***Pipe size, pipe grade and ventilation requirement calculations*** are performed for a range of applications. 3.6 Sewer connections, ***manholes*** , bedding material and concrete support are detailed. 3.7 ***Pump station, pump and pump control requirements*** are sized and detailed. 3.8 Approved ***materials, jointing methods*** and all ***installation requirements*** for sewer systems are specified.
4. Design and size systems.	4.1 Sewer systems are designed for a range of applications. 4.2 Sewer long sections are designed and detailed. 4.3 ***Rising main systems*** are designed. 4.4 Pump stations are designed. 4.5 Sewer systems are designed and sized using ***computer software packages*** .
5. Prepare documentation.	5.1 ***Plans*** are prepared for a range of sewer systems. 5.2 A ***specification*** for a sewer system is prepared. 5.3 A ***testing and commissioning schedule*** is prepared. 5.4 An ***operation and maintenance manual*** is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources.

Required knowledge:

- requirements of state regulatory authorities, Australian standards and manufacturer specifications, including hazards identified in relation to devices and systems used
- common terminology and definitions used in the design of sewer systems for all classes of building
- drafting principles
- nature of materials used and effects of performance under various conditions
- principles of technology in the design of sewer systems
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Sewer contracting procedures include:	• initial survey • preparation of plans • documentation • invitation to tender • contract administration • acceptance of work.
Scope of work :	• includes interpretation of plans and specifications • includes sizing and documenting layout of sewer systems for residential, commercial and industrial applications • may be for either new projects or existing sewer mains being renovated, extended, restored or maintained.
Design requirements include:	• owner requirements • architectural specifications • builder specifications • specialist applications.
Cost-benefit analysis includes:	• comparison of range of suitable materials and system choices available to enable cost-effective choices to be made without compromising the integrity of the project.
Statutory and regulatory requirements and Australian and New Zealand standards include:	• acts, regulations and local and state government policies, including group and strata titling • AS/NZS3500 National plumbing and drainage set Parts 2.1 and 2.2 • AS2200 Design charts for water supply and sewerage • Building Code of Australia.
Manufacturer requirements include:	• material specifications • sizing tables • pump tables • technical and trade manuals.

Desktop study includes:

- collecting and interpreting existing data for design purposes, from:
  - council plans
  - developer plans
  - architectural and building plans
  - other documents, including:
    - forms
    - applications
    - sewer detail maps
    - other reports as available.

Safety procedures and regulations for trench safety include:

- defining methods of trench installation
- defining procedures for trench rescue
- analysing factors that determine tunnelling
- assessing and identifying types of soil requiring tunnel excavation and shoring procedures
- specifying safety procedures with reference to:
  - Occupational Health and Safety Act
  - occupational health and safety regulations
  - compliance standards
  - advisory standards
  - industry standards
  - other acts, codes or regulations relating to trench protection.

Performance requirements are established using Australian and New Zealand standards and local authority plans and may include:

- sufficient capacity
- self-cleaning ability
- durability
- longevity
- discharge requirements.

Trenching safety procedures include:

- conditions affecting trench stability
- condition of soils disturbed by previous excavations
- effect of water on excavations
- effects of moisture content on excavated trenches
- traffic and vibrations
- confined space safety requirements e.g. for exhaust emissions
- prevention of trench collapse
- trench collapse procedures
- trench inspection procedures
- trench excavation methods used for different:
- types
- depth
- slope
- support systems
- bedding methods
- backfilling methods.

Layout of pipework systems :	• includes:
	  • gravity systems
	  • pumped and rising mains
	• should not unduly affect building integrity and aesthetic appeal
	• should have principles of economy, serviceability, durability and fit for use applied.

Fittings and valves include:	• junctions • bends • access openings.
Pipelaying includes:	• laying procedures for pipework of varying sizes • methods of dewatering trenches before and during pipelaying • methods of grading and maintaining pipe direction and reduced levels • methods of placing bedding materials, encasing pipes, backfilling and compacting • methods of testing sewer and branch sewer drains • jointing methods and procedures for each material • fittings used for sewerage work • cutting, handling and storage procedures for each pipe material.
Pipe size, pipe grade and ventilation requirement calculations include:	• projected flows • stormwater infiltration reduced level calculations • gradient calculations • pipe sizing calculations • determination of flow and loadings • interpretation of design charts and tables.
Manhole details include:	• inspection chambers • sizing • connections to and from • open and closed channel • benching requirements • lids • flow and gradient requirements.

Pump station, pump and pump control requirements include:	• pump station sizing • detailing • ladder access • step irons • chains • capacity • warning system • automatic controls • high and low-level water controls and alarms • corrosion-resistant materials • macerator requirements • pump selection • pump sizing • impeller sizing • installation and mounting requirements • valve requirements • inlet and outlet design requirements • space requirements.
Materials include:	• unplasticised polyvinyl chloride (uPVC) • earthenware • cast iron • high density polyethylene (HDPE) • concrete.
Jointing methods include:	• rubber ring • mechanical joints • gluing • solvent cement welding • threading.
Installation requirements include:	• jointing requirements • level of workmanship • clipping • bedding • concrete support • installation details.
Rising main systems include:	• approved pressure pipe and fittings • calculated rise and pump delivery requirements • pump sizing to meet calculated flow conditions.
Computer software packages include:	• proprietary design software • manufacturers' software.

Plans :

- may include:
  - elevations
  - sections
  - details
  - cross-sections
  - isometrics
  - axonometrics
  - schematics
- produced to industry standards and in accordance with regulatory and manufacturer requirements using:
  - pencil
  - Indian ink
  - pigment liner
  - computer generation.

Specification includes:

- descriptions
- materials
- workmanship
- manholes
- jointing
- manufacturer requirements
- clipping
- bedding
- concrete support
- details of specialised components.

Testing includes:

- hydrostatic test
- air pressure test
- visual/site inspection
- quality assurance (QA) audit.

Commissioning schedule includes:

- flushing
- checking leaks.

Operation and maintenance manual includes:

- yearly inspection
- leak detection
- check for blockages
- water auditing
- yearly maintenance requirements
- pump maintenance.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment

- This unit of competency could be assessed on its own or as part of an integrated assessment activity involving preparation of designs for two sewer systems for different applications, including plans, specifications and all associated documentation.

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 sewer systems
  - specifying soil identification and trench safety procedures
  - planning and detailing sewer system components, including:
    - manholes
    - pump stations
    - piping systems
  - designing and sizing a range of sewer systems
  - designing and sizing a rising main
  - designing a sewer long section
  - preparing plans for a range of sewer systems to industry standards
  - preparing specifications for sewer systems
  - preparing testing and commissioning schedules
  - preparing operation and maintenance manuals.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environments appropriate to a range of situations and activities
  - computers and software
  - materials appropriate to application activities
  - appropriate documentation and data related to tasks, including plans and specifications of an appropriate building
  - tools and equipment relevant to planning processes, including calculators.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPFS4005A Commission fire alarm and detection systems

Unit Descriptor

This unit of competency specifies the outcomes required to commission fire alarm and detection systems. It covers the preparation for the work, the identification and confirmation of system specifications and requirements, the physical testing and commissioning of the systems, and work finalisation processes including records and documentation.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the needs of experienced tradespeople with responsibility for testing and commissioning fire alarm and detection systems.

Unit Sector Fire protection service

ELEMENT	PERFORMANCE CRITERIA
1. Prepare for work.	1.1 Drawings and specifications are obtained. 1.2 ***OHS requirements*** associated with the workplace environment and commissioning fire alarm and detection systems are adhered to throughout the work. 1.3 ***Quality assurance requirements*** are identified and adhered to in accordance with workplace requirements. 1.4 Tasks are planned and sequenced in conjunction with others involved in or affected by the work. 1.5 ***Tools and equipment*** for commissioning fire alarm and detection systems, including personal protective equipment, are selected and checked for serviceability. 1.6 Work area is prepared to support the efficient commissioning process.
2. Identify system requirements.	2.1 System design requirements are identified and confirmed from job specifications and in accordance with ***relevant standards*** . 2.2 Requirements of fire alarm and detection systems commissioning are identified in accordance with relevant Australian standards, ***authorities' requirements*** and job specifications.
3. Test and commission system.	3.1 Fire alarm and detection systems are checked to ensure type and installation conform to the relevant Australian standard, job specifications, manufacturer recommendations and authorities' requirements. 3.2 Operation of system is tested in accordance with job specifications, manufacturer recommendations and authorities' requirements and adjusted as required. 3.3 System is commissioned and maintained to ensure correct operation in accordance with relevant standards, and manufacturer and job specifications.

4. Clean up work area.	4.1 Work area is cleared and materials disposed of or recycled in accordance with federal, state and territory legislation and workplace procedures. 4.2 Tools and equipment are cleaned, checked, maintained and stored in accordance with manufacturer recommendations and workplace procedures. 4.3 Documentation is completed in accordance with workplace requirements.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources.

Required knowledge:

- components and materials of fire alarm and detection systems
- job safety analyses and safe work method statements
- process of installing, testing and commissioning fire alarm and detection systems
- properties of water, including pressure and flow rates
- relevant statutory and authority requirements related to the commissioning of fire alarm and detection systems, including automatic smoke/heat venting systems, air handling systems, and emergency warning and intercommunication systems
- SI system of units
- sources of information and processes for the calculation of material requirements
- standards applicable to the service
- systems operations and procedures
- workplace and equipment safety

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.

Context for the commission of fire alarm and detection systems includes:

- testing and commissioning fire alarm and detection systems, including:
  - heat and smoke detectors
  - audible, visible and combination alarms
  - zone alarms
  - alarm volume
  - tactile alarm appliances for people with disabilities
  - coordination of alarm signals with other services
  - controls
  - annunciators
  - signal transmission
  - despatching systems
  - public reporting systems
- location for work application may be a new work site or an existing structure being renovated, extended, restored or maintained.

OHS requirements include:

- federal, state and territory legislation and regulations, including:
  - use of tools and equipment
  - workplace environment and safety
  - handling of materials, including hazardous materials and substances
  - use of firefighting equipment
  - use of first aid equipment
  - hazard control
- use of personal protective equipment including that prescribed under legislation, regulations and workplace policies and practices
- safe operating procedures, including recognising and preventing hazards associated with:
  - use of tools and equipment
  - trip hazards
  - underground services
  - surrounding structure and facilities
  - hazardous materials
  - other machines
  - working at heights
  - working in proximity to others
  - work site visitors
  - the public
  - working in confined spaces.

Quality assurance requirements include:	• International Standards Organisation • internal company quality assurance policy and risk management strategy • Environment Protection Authority • site safety plan • workplace operations and procedures.
Tools and equipment include:	• test equipment • hand and power tools.
Relevant standards include:	• AS1670 Fire detection, warning, control and intercom systems - system design, installation and commissioning • AS2220 Emergency warning and intercommunication systems in buildings • AS4428 Fire detection, warning, control and intercom systems - control and indicating equipment.
Authorities'requirements include:	• local council regulations • Building Code of Australia.

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 on its own or as part of an integrated assessment activity involving preparing, planning and conducting the system commissioning procedures for one fire alarm and detection system and completing all associated documentation.

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:
  - locating, interpreting and applying relevant information, standards and specifications to the commissioning of fire alarm and detection systems
  - applying safety requirements throughout the work sequence, including the use of personal protective clothing and equipment
  - commissioning one fire alarm and detection system, including:
    - one smoke and one heat detector
    - actuator and control and indicating panel
    - ensuring correct identification of the location, design specification and details of the system
  - correctly selecting and using appropriate processes, tools and equipment
  - completing all work to specification
  - complying with regulations, standards and organisational quality procedures and processes.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environment
  - tools and equipment appropriate to the commissioning process
  - calculators
  - support materials appropriate to the activity
  - specifications in the form of a job or work order
  - research resources, including systems literature and data.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPFS4006A Commission firefighting appliances

Unit Descriptor

This unit of competency specifies the outcomes required to commission firefighting appliances. It covers the preparation for the work, the identification and confirmation of system specifications and requirements, the physical testing and commissioning of the appliances and work finalisation processes including records and documentation.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the needs of experienced tradespeople with a responsibility for testing and commissioning firefighting appliances.

Unit Sector Fire protection service

ELEMENT	PERFORMANCE CRITERIA
1. Prepare for work.	1.1 Drawings and specifications are obtained. 1.2 ***OHS requirements*** associated with the workplace environment and commissioning firefighting appliances are adhered to throughout the work. 1.3 ***Quality assurance requirements*** are identified and adhered to in accordance with workplace requirements. 1.4 Tasks are planned and sequenced in conjunction with others involved in or affected by the work. 1.5 ***Tools and equipment*** for commissioning firefighting appliances, including personal protective equipment, are selected and checked for serviceability. 1.6 Work area is prepared to support the efficient commissioning process.
2. Identify system requirements.	2.1 Equipment requirements are identified and confirmed from job specifications and in accordance with ***relevant standards*** . 2.2 Requirements of firefighting appliance commissioning are identified in accordance with standards, ***authorities' requirements*** and job specifications.
3. Test and commission system.	3.1 Firefighting appliances are checked to ensure type and installation conforms to standards, job specifications, manufacturer recommendations and authorities' requirements. 3.2 Operation of appliances is tested in accordance with standards, job specifications, manufacturer recommendations and authorities' requirements and adjusted as required. 3.3 Appliances are commissioned and maintained to ensure correct operation in accordance with standards, and manufacturer and job specifications.

4. Clean up work area.	4.1 Work area is cleared and materials disposed of or recycled in accordance with federal, state and territory legislation and workplace procedures. 4.2 Tools and equipment are cleaned, checked, maintained and stored in accordance with manufacturer recommendations and workplace procedures. 4.3 Documentation is completed in accordance with workplace requirements.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources.

Required knowledge:

- Australian standards applicable to the relevant appliances
- components and materials of firefighting equipment and appliances
- job safety analyses and safe work method statements
- pressure requirements of hose reel systems
- process of installing, testing and commissioning firefighting equipment and appliances
- relevant statutory and authority requirements related to the commissioning of firefighting equipment and appliances
- SI system of units
- sources of information and processes for the calculation of requirements
- workplace and equipment safety requirements.

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.

Context for commissioning firefighting appliances includes:	• testing and commissioning firefighting appliances, including:
	  • portable fire appliances
	  • wheeled fire extinguishers
	  • delivery lay flat fire hose
	  • fire hose reel systems
	  • fire blankets
	• location for work application may be a new work site or an existing structure being renovated, extended, restored or maintained.

OHS requirements include:

- federal, state and territory legislation and regulations, including:
  - use of tools and equipment
  - workplace environment and safety
  - handling of materials, including hazardous materials and substances
  - use of firefighting equipment
  - use of first aid equipment
  - hazard control
- use of personal protective equipment, including that prescribed under legislation, regulations and workplace policies and practices
- safe operating procedures, including recognising and preventing hazards associated with:
  - use of tools and equipment
  - trip hazards
  - underground services
  - surrounding structure and facilities
  - hazardous materials
  - other machines
  - working at heights
  - working in proximity to others
  - work site visitors
  - the public
  - working in confined spaces.

Quality assurance requirements include:

- test equipment
- hand and power tools.

Relevant standards include:

- AS/NZS1841 Portable fire extinguishers - general requirements
- AS/NZS1850 Portable fire extinguishers - classification, rating and performance testing
- AS1851 Maintenance of fire protection systems and equipment
- AS2441 Installation of fire hose reels
- AS2444 Portable fire extinguishers and blankets - selection and location
- AS/NZS3504 Fire blankets
- AS3565 Meters for water supply
- AS4077 Fire protection - fire extinguishing media: halogenated hydrocarbons
- AS4078 Fire protection - fire extinguishing media: carbon dioxide
- AS4265 Wheeled fire extinguishers
- AS/NZS4353 Portable fire extinguishers - aerosol type.

Authorities'requirements include:

- Building Code of Australia
- local council regulations.

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 on its own or as part of an integrated assessment activity involving preparing, planning and conducting commissioning procedures for firefighting appliances for a residential building of four storeys and completing all associated documentation.

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:
  - locating, interpreting and applying relevant information, standards and specifications to the commissioning of firefighting appliances
  - applying safety requirements throughout the work sequence, including the use of personal protective clothing and equipment
  - commissioning firefighting appliances, including portable fire appliances, wheeled fire extinguishers, delivery lay flat hose and fire hose reel systems ensuring:
    - correct identification of the location, design specification and details of the system
    - correct selection and use of appropriate processes, tools and equipment
    - completion of all work to specification
    - compliance with regulations, standards and organisational quality procedures and processes.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environment
  - tools and equipment appropriate to the commissioning process
  - calculators
  - support materials appropriate to the activity
  - specifications in the form of a job or work order
  - research resources, including systems literature and data.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate ' s competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPFS5000A Design fire-compliant hydraulic services

Unit Descriptor

This unit of competency specifies the outcomes required to design fire protection systems for hydraulic services in wide span and high-rise buildings. The fire protection systems should ensure that hydraulic services maintain integrity, insulation and structural adequacy in case of fire.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the attainment of skills and knowledge required for competent workplace performance of experienced tradespeople in a consultancy or supervisory capacity in relation to fire-compliant hydraulic service design.

Unit Sector Fire protection service

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate design parameters.	1.1 Fire and non-fire rated compartments of buildings are evaluated and the application of evaluation to hydraulic services is specified. 1.2 ***Design requirements*** are determined from plans, specifications and client briefs. 1.3 ***Cost-benefit analysis*** is conducted comparing a range of pipe materials, system designs and penetration protection systems. 1.4 ***Statutory, regulatory, Australian and New Zealand standards and relevant building code requirements*** for the design of fire-compliant hydraulic services are interpreted and applied. 1.5 ***Manufacturer requirements*** and trade and technical manuals are interpreted and applied. 1.6 Additional research including a ***desktop study*** is conducted and ***performance requirements*** are established.
2. Plan and detail system components.	2.1 ***Layout of pipework systems*** and type and location of ***fire check collars*** are planned. 2.2 Approved ***fire-rated materials, penetration techniques, insulation and filler materials*** are specified to the appropriate ***fire-resistance level*** . 2.3 ***Pipe fixings*** are designed for a range of applications. 2.4 Pipework for sprinklered and non-sprinklered areas is designed for a range of applications. 2.5 ***Installation requirements*** are specified. 2.6 ***Compliance inspection*** is conducted.

3. Design and size systems.	3.1 Fire-compliant hydraulic services are designed for a range of wide span and high-rise building applications. 3.2 A range of ***fire-compliant duct systems*** is designed using ***fire-rated building materials*** . 3.3 Hydraulic services using non-fire rated materials are designed to comply with building fire ratings. 3.4 Fire-compliant hydraulic distribution systems are designed and sized using computer software packages.
4. Prepare documentation.	4.1 ***Plans*** are prepared and detailed for a range of fire-compliant hydraulic services. 4.2 A ***specification*** for fire-compliant hydraulic services is prepared. 4.3 A ***compliance report*** is prepared. 4.4 An ***operation and maintenance manual*** is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- ability to use tools and equipment, including:
  - drawing instruments
  - measuring equipment
  - computer-aided design software
- application of design principles relating to hydraulic systems
- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources, including:
  - plumbing regulations
  - Australian standards
  - building codes
  - occupational health and safety and environmental requirements
- teamwork skills to be able to coordinate and action tasks relevant to the design of fire-compliant hydraulic services.

Required knowledge:

- requirements of state regulatory authorities, Australian standards and manufacturer specifications
- application of terminology, definitions, installation methods and hazards identified in relation to devices and systems used, according to:
  - AS/NZS3500 National plumbing and drainage set
  - manual of authorisation procedures for plumbing and drainage products (MP52)
  - other standards, codes or standard operating procedures
- environmental requirements
- quality assurance requirements, including:
  - International Standards Organisation
  - internal company quality assurance policy and risk management strategy
  - Environment Protection Authority
  - site safety plan
  - workplace operations and procedures
- nature of materials used and effects of performance under various conditions
- variety of applications of technology principles in design of fire-compliant hydraulic services for all classes of building
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Unit scope :

- interpretation of plans and specifications and the design, detailing and documentation of fire-compliant hydraulic services for applications including residential, commercial and industrial
- may be for new projects or an existing structure being renovated, extended, restored or maintained
- design of fire-compliant hydraulic services should ensure that hydraulic services maintain the integrity, insulation and s tructural adequacy of a building in case of fire.

Design requirements include:

- owner requirements
- architectural specifications
- builder specifications
- specialist design applications.

Cost-benefit analysis includes:

- comparison of range of suitable materials and system choices available to enable cost-effective choices to be made without compromising the integrity of the project.

Statutory, regulatory, Australian and New Zealand standards and relevant building code requirements include:

- relevant acts, regulations and local and state government policies
- AS/NZS3500 National plumbing and drainage set
- manual of authorisation procedures for plumbing and drainage products (MP52)
- material and authorisation standards specified by:
  - statutory plumbing authority
  - local authority
  - Building Code of Australia (BCA).

Manufacturer requirements include:

- material specifications
- technical and trade manuals.

Desktop study includes collection and interpretation of existing data for design purposes from:

- council requirements
- developer requirements
- architectural and building plans
- regulatory requirements
- other documents and reports as available.

Performance requirements include:	• BCA requirements • Australian and New Zealand standards • local authority performance requirements • site and application specific performance requirements.

Layout of pipework systems :	• includes:
	  • duct systems
	  • car park systems
	  • exposed pipework
	  • concealed pipework
	  • sprinklered and non-sprinklered areas
	  • fire-rated pipework
	  • non-fire rated pipework
	• should not unduly affect building integrity and aesthetic appeal
	• should have principles of economy, serviceability, durability and fit for use applied.

Fire check collars include:	• range of intumescent collars available.
Fire-rated materials include:	• pipework • fittings • valves.
Penetration techniques include:	• concrete floors • pre-cast flooring systems • ply formwork systems • galvanised decking systems • post and pre-tensioned concrete flooring systems.
Insulation and fill materials include:	• proprietary fill materials • rock wool • fibreglass • foams • caulking compounds.
Fire-resistance level includes:	• insulation • integrity • structural adequacy.

Pipe fixings include:

- fire-rated:
  - wall and ceiling brackets
  - saddles
  - hanging brackets
  - anchors
  - material requirements
  - corrosion protection
  - bracket spacing.

Installation requirements include:

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

Compliance inspection includes checking that:

- approved materials appropriate to fire-rated compartments and required fire-resistance level are used
- clipping and insulation comply with regulatory requirements
- installation is appropriate for the fire-resistance level
- fire compartments are not compromised by hydraulic services.

Fire-compliant duct systems include:

- plasterboard
- brick
- masonry
- concrete.

Fire-rated building materials include:

- plasterboard
- brick
- masonry
- concrete
- other building materials as applicable.

Plans :

- may include:
  - elevations
  - sections
  - details
  - cross-sections
  - isometrics
  - axonometrics
  - schematics
- may be produced using:
  - pencil
  - Indian ink
  - pigment liner
  - computer generation.

Specification includes:	• materials • workmanship • jointing • valve selection • manufacturer • clipping and specialised components.
Compliance report includes:	• documentation of the compliance inspection • evaluation of findings • conclusions • recommendations.
Operation and maintenance manual includes:	• yearly inspection requirements • maintenance requirements.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment	• This unit of competency could be assessed on its own or as part of an integrated assessment activity involving preparing designs and associated documentation for fire-compliant hydraulic services for two different categories of wide span and high-rise buildings.

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, BCA and Australian and New Zealand standard requirements for a range of fire-compliant hydraulic services
	  • planning and detailing system components, including:
	  • penetrations
	  • ducts
	  • fire check collars
	  • insulation and filler materials
	  • conducting a compliance inspection
	  • designing fire-compliant hydraulic systems
	  • designing fire-compliant systems for non-fire-rated materials
	  • designing fire-compliant systems for fire-rated materials
	  • preparing a specification for fire-compliant hydraulic services
	  • preparing a compliance report
	  • preparing an operation and maintenance manual.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environment
  - tools and equipment appropriate to the planning process, including calculators
  - computers and software
  - support materials appropriate to activity
  - plans and specifications of an appropriate building
  - research resources, including systems literature and data.
- Validity and sufficiency of evidence requires that:
  - competency will need to be demonstrated over a period of time reflecting the scope of the role
  - 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be current and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPFS5001A Design fire sprinkler systems

Unit Descriptor

This unit of competency specifies the outcomes required to design and size fire sprinkler systems and to detail and specify the layout, materials, components, water storage requirements, and flow and pressure requirements for fire sprinkler systems in buildings.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the needs of experienced tradespeople responsible for designing fire sprinkler systems.

Unit Sector Fire protection service

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate design parameters.	1.1 ***Scope of work*** is established for the design of fire sprinkler systems for wide span and high-rise building projects. 1.2 ***Design requirements*** are determined from plans, specifications and client briefs. 1.3 ***Cost-benefit analysis*** is conducted comparing a range of pipe materials and system designs. 1.4 ***Fire department, statutory, regulatory, Australian and New Zealand standards and relevant building code requirements*** for the design of fire sprinkler systems are interpreted and applied. 1.5 ***Manufacturer requirements*** and trade and technical manuals are interpreted and applied. 1.6 Flow and pressure requirements are established, ***flow and pressure tests*** are conducted and council main flows and pressures are established. 1.7 Additional research including a ***desktop study*** is conducted and ***performance requirements*** are established.
2. Plan and detail system components.	2.1 ***Layout of pipework systems*** and type and location of ***fittings and valves*** are planned. 2.2 Type, location and requirements for ***backflow prevention devices*** and ***alarm and valve assemblies*** are detailed. 2.3 Pipe sizes, velocities, flows and pressures are ***calculated*** for a range of applications. 2.4 Approved ***materials, jointing methods*** and sprinkler heads for fire sprinkler systems are specified. 2.5 Smoke alarm systems, ***booster assemblies*** , booster relay and jacking pumps are designed and detailed. 2.6 ***Pipe fixings*** are designed for a range of applications. 2.7 ***Water storage systems*** and ***pump, pump controls and pumproom requirements*** are sized and detailed. 2.8 ***Test points and associated drainage systems*** are designed and sized. 2.9 ***Installation requirements*** are specified, including exit signage.

3. Design and size systems.	3.1 Fire sprinkler systems are designed for a range of wide span and high-rise building applications. 3.2 Combined water supply/fire hydrant/hose reel/sprinkler systems are designed for a range of wide span and high-rise building applications. 3.3 Sprinkler systems for Grades 1, 2 and 3 water supplies are designed. 3.4 A range of ***sprinkler system configurations*** is designed. 3.5 Fire sprinkler systems are designed and sized using computer software packages.
4. Prepare documentation.	4.1 ***Plans*** are prepared and detailed for a range of fire sprinkler systems. 4.2 A ***specification*** for a fire sprinkler system is prepared. 4.3 A ***testing*** and ***commissioning schedule*** is prepared. 4.4 An ***operation and maintenance manual*** is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- ability to apply design principles relating to hydraulic systems
- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources, including:
  - plumbing regulations
  - Australian standards
  - building codes
  - occupational health and safety and environmental requirements
- teamwork skills to be able to coordinate and action tasks relevant to the design of fire sprinkler systems.
- ability to use tools and equipment, including drawing instruments, measuring equipment and computer-aided design software.

Required knowledge:

- requirements of state regulatory authorities, Australian standards and manufacturer specifications, including:
  - AS/NZS3500 National plumbing and drainage set
  - AS/NZS2118 Automatic fire sprinkler systems - general requirements
  - AS2200 Design charts for water supply and sewerage
  - other standards, codes or standard operating procedures
- terminology and definitions used in hydraulic design
- installation methods used in hydraulic systems
- hazards associated with devices and systems used in the hydraulic sector
- environmental requirements
- quality assurance requirements, including:
  - International Standards Organisation
  - internal company quality assurance policy and risk management strategy
  - Environment Protection Authority
  - site safety plan
  - workplace operations and procedures
- nature of materials used and effects of performance under various conditions
- variety of applications of technology principles in design of fire sprinkler, hydrant and hose reel systems for all classes of building
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Scope of work :

- includes interpretation of plans and specifications
- includes sizing and documenting layout of fire sprinkler systems for applications including residential, commercial and industrial
- may be for new projects or an existing structure being renovated, extended, restored or maintained.

Design requirements include:

- owner requirements
- architectural specifications
- builder specifications
- specialist design applications.

Cost-benefit analysis includes:

- comparison of range of suitable materials and system choices available to enable cost-effective choices to be made without compromising the integrity of the project.

Fire department, statutory, regulatory, Australian and New Zealand standards and relevant building code requirements include:

- relevant acts, regulations and local and state government policies
- AS2200 Design charts for water supply and sewerage
- AS/NZS2118 Automatic fire sprinkler systems - general requirements
- AS2419 Fire hydrant installations - system design, installation and commission
- material and authorisation standards specified by:
  - statutory plumbing authority
  - local authority
  - Building Code of Australia (BCA).

Manufacturer requirements include:

- material specifications
- sizing tables
- pump tables
- technical and trade manuals.

Flow and pressure tests include:

- on-site measurement of flow (l/s), velocity (m/s) and pressure (Kpa)
- interpretation of flow and pressure tests conducted by a contractor.

Desktop study includes collection and interpretation of existing data for design purposes from:	• council requirements • developer requirements • architectural and building plans • regulatory requirements • other documents and reports as available.
Performance requirements include:	• flow, velocity, pressure and discharge requirements, established using Australian and New Zealand standards and local authority plans.

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

Fittings and valves may include:	• fittings:
	  • tees
	  • elbows
	  • bends
	  • unions
	• valves:
	  • isolating
	  • pressure reduction
	  • pressure limiting
	  • backflow prevention
	  • excessive pressure
	  • strainers.

Backflow prevention devices include:	• testable and non-testable devices • break tanks • zone protection • property protection • individual protection.
Alarm and valve assemblies include:	• clapper valves • excess flow valves • manual and electrical alarms.
Calculations include:	• pressure • velocity • rate of discharge • volume • temperature.

Materials include:

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

Jointing methods include:

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

Booster assemblies include:

- single and double types
- fire appliance access
- cabinet and block plans
- pressure gauges
- check and isolating valves.

Pipe fixings include:

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

Water storage systems include:

- tank sizes
- inlet valve design and sizing
- overflow requirements
- automatic controls
- safe tray requirements
- vortex plates
- outlet sizing.

Pump, pump controls and pumproom requirements include:

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

Test points and associated drainage systems include:	• design and sizing of collection points and tundishes to prevent spillage, overflow and damage to building finishes • design and sizing of drainage systems to cater for maximum flow conditions • specification of materials for systems including copper, polyvinyl chloride (PVC), galvanised piping and other materials.
Installation requirements include:	• jointing requirements • level of workmanship • clipping • insulation • installation details.
Sprinkler system configurations include:	• layout and distribution of range pipes • room shape and height configurations • wall and ceiling wetting systems • deluge systems • sprinkler head placement • obstacle avoidance • wet pipe and dry pipe systems.

Plans :	• may include:
	  • elevations
	  • sections
	  • details
	  • cross-sections
	  • isometrics
	  • axonometrics
	  • schematics
	• may be produced using:
	  • pencil
	  • Indian ink
	  • pigment liner
	  • computer generation.

Specification includes:	• materials • workmanship • jointing • valve selection • manufacturer • clipping and specialised components.
Testing includes:	• hydrostatic test • air pressure test • mains pressure test • defect inspection • quality assurance (QA) audit.

Commissioning schedule includes:	• flow test • pressure test • valve operation • leak check • system purge.
Operation and maintenance manual includes:	• valve maintenance • yearly inspection • leak detection • water auditing • yearly maintenance requirements • pump maintenance.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment

- This unit of competency could be assessed on its own or as part of an integrated assessment activity involving preparing designs and associated documentation for fire sprinkler systems for two different categories of wide span and high-rise buildings.

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, fire authority, regulatory, manufacturer, BCA and Australian and New Zealand standard requirements for a range of fire sprinkler systems
  - planning and detailing system components, including:
    - alarm and valve assemblies
    - sprinkler heads
    - water storage systems
  - preparing plans for a range of fire sprinkler systems
  - preparing a specification for a fire sprinkler system
  - preparing a testing and commissioning schedule
  - preparing an operation and maintenance manual.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environment
  - tools and equipment appropriate to the planning process, including calculators
  - computers and software
  - support materials appropriate to activity
  - plans and specifications of an appropriate building
  - research resources, including systems literature and data.
- Validity and sufficiency of evidence requires that:
  - competency will need to be demonstrated over a period of time reflecting the scope of the role
  - 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be current and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPFS5002A Design fire hydrant and hose reel systems

Unit Descriptor

This unit of competency specifies the outcomes required to design fire hydrant, hose reel and storage systems to Australian and New Zealand standards, the Building Code of Australia (BCA) and other relevant legislative requirements in order to meet fire protection standards.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the attainment of skills and knowledge required for competent workplace performance in a consultancy or supervisory capacity in relation to plumbing services and construction hydraulics.

Unit Sector Fire protection service

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate design parameters.	1.1 ***Scope of work*** is established for fire hydrants, hose reels and distribution systems for wide span and high-rise building projects. 1.2 ***Design requirements*** are determined from plans, specifications and client briefs. 1.3 ***Cost-benefit analysis*** is conducted comparing a range of pipe materials and system designs. 1.4 Fire department, ***statutory and regulatory requirements*** and ***Australian and New Zealand standards*** for the design of fire hydrants, hose reels and distribution systems are analysed, interpreted and applied. 1.5 ***Manufacturer requirements*** and trade, technical and sizing 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 ***Performance requirements*** are established.
2. Plan and detail system components.	2.1 ***Layout of pipework*** and type and location of ***fittings and valves*** 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, jointing methods and installation requirements*** are specified. 2.5 Hydrant ***booster, standpipe and hose reel assemblies*** are detailed. 2.6 ***Thrust blocks*** are designed for a range of applications. 2.7 ***Pipe fixings*** are designed for a range of applications. 2.8 ***Pump, pump controls and pumproom requirements*** are sized and detailed. 2.9 ***Water storage systems*** are designed and detailed.

3. Design and size systems.	3.1 Fire hydrant and hose reel systems are designed for a range of wide span and high-rise building applications. 3.2 Combined water supply, fire hydrant, hose reel and sprinkler systems are designed for a range of wide span and high-rise building applications. 3.3 A range of ***delivery systems*** is designed. 3.4 Fire hydrant and hose reel systems are designed and sized using computer software packages.
4. Prepare documentation.	4.1 ***Plans*** are prepared for a range of fire hydrant and hose reel systems. 4.2 A block plan is prepared for the booster cabinet in accordance with Australian and New Zealand standards. 4.3 A ***specification*** for a fire hydrant and hose reel system is prepared. 4.4 A ***testing*** and ***commissioning schedule*** is prepared. 4.5 An ***operation and maintenance manual*** is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- problem-solving skills, including the ability to identify typical faults and action required to rectify problems
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources
- teamwork skills to be able to coordinate and action tasks relevant to the design of fire hydrant and hose reel systems
- technical skills, including the ability to apply design concepts and principles relating to hydraulic systems.

Required knowledge:

- Australian and New Zealand standards, manufacturer specifications, BCA and other applicable codes or standard operating procedures relevant to the sector
- terminology and definitions used in hydraulic design
- installation methods used in hydraulic systems
- hazards associated with devices and systems used in the hydraulic sector
- nature of materials used and effects of performance under various conditions
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Scope of work :

- includes interpretation of plans and specifications
- includes sizing and documenting layout of fire hydrant and hose reel systems, including:
  - emergency egress
  - separate hydrant and hose reel systems
  - combined hydrant and hose reel systems
  - combined domestic fire hydrant and hose reel systems
  - equipment
- may be for residential, commercial and industrial projects and for a new or an existing structure being renovated, extended, restored or maintained.

Design requirements may include:

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

Cost-benefit analysis may include:

- comparison of range of suitable materials and system choices available to enable cost-effective choices to be made without compromising the integrity of the project.

Statutory and regulatory requirements may include:

- acts and regulations
- local and state government policies.

Australian and New Zealand standards may include:

- AS/NZS3500 National plumbing and drainage set Parts 1.1 and 1.2
- AS2419 Fire hydrant installations - system design, installation and commission
- AS/NZS1221 Fire hose reels
- AS/NZS2118 Automatic fire sprinkler systems - general requirements
- AS2200 Design charts for water supply and sewerage
- BCA.

Manufacturer requirements may include:

- material specifications
- sizing tables
- pump tables
- technical and trade manuals.

Desktop study may include collection and interpretation of existing data for design purposes from:	• council plans • developer plans • architectural and building plans • other documents and reports as available.
Flow and pressure tests may include:	• on-site measurement of flow (l/s), velocity (m/s) and pressure (Kpa) • interpretation of flow and pressure tests conducted by a contractor.
Performance requirements include:	• flow, velocity, pressure and discharge requirements, established using Australian and New Zealand standards and local authority plans.
Layout of pipework systems may include:	• ring main • single pipe • dual feed.

Fittings and valves may include:	• fittings:
	  • tees
	  • bends
	  • elbows
	  • valve trains
	  • unions
	• valves:
	  • isolating
	  • pressure reduction
	  • pressure limiting
	  • backflow prevention
	  • excess pressure valves
	  • strainers.

Materials may include:	• copper • polybutylene • composite pipe materials and other pipe materials as specified • fittings and fixtures.
Jointing methods may include:	• compression • brazing • screwing • flaring • soldering • mechanical joints • rubber ring joints.

Installation requirements may include:

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

Booster and standpipe assemblies may include:

- valves and fittings
- configuration of valves and hydrants
- suction and delivery outlets
- non-return valves
- pressure gauges
- testing points
- block plan.

Hose reel assemblies may include:

- cabinet
- space requirements for valves and fittings
- configuration of valves and hose reels
- non-return and backflow prevention valves
- pipe sizes
- location and number of hose reels required.

Thrust blocks design elements may include:

- sizes
- keying and anchorage points
- soil characteristics
- velocity and flow forces to be resisted
- design details for tees, elbows, valves and meter assemblies.

Pipe fixings may include:

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

Pump, pump controls and pumproom requirements may include:

- installation and mounting requirements
- valve requirements
- inlet and outlet design requirements
- automatic controls
- space requirements.

Water storage systems may include:	• tank sizes • location • number of hours of firefighting supply required • access • inlet valve design and sizing • overflow requirements • automatic controls • safe tray requirements • outlet sizing.
Delivery systems may include:	• upfeed • downfeed • pressure ratio • hydropneumatic • constant flow variable speed pump.

Plans :	• may include:
	  • elevations
	  • sections
	  • details
	  • cross-sections
	  • isometrics
	  • axonometrics
	  • schematics
	• may be produced using:
	  • pencil
	  • Indian ink
	  • pigment liner
	  • computer generation.

Specification may include:	• materials • workmanship • jointing • manholes • manufacturer requirements • clipping • bedding • concrete support.
Testing may include:	• hydrostatic test • air pressure test • quality assurance (QA) audit.
Commissioning schedule may include:	• balancing the system • temperature setting • checking and flushing the system.

Operation and maintenance manual may include:	• yearly inspection • leak detection • check for blockages • water auditing • yearly maintenance requirements • pump maintenance.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment	• This unit of competency could be assessed on its own or as part of an integrated assessment activity involving effective performance and application of principles used to design fire hydrant and hose reel systems.

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:
	  • establishing and evaluating design parameters for a range of fire hydrant and hose reel systems
	  • planning system components for a range of fire hydrant and hose reel systems, including:
	  • storage tanks
	  • booster assemblies
	  • hydrants
	  • hose reels
	  • thrust blocks
	  • complying with occupational health and safety regulations applicable to workplace operations
	  • applying organisational quality procedures and processes within context of restoring plastered surfaces to conservation requirements
	  • designing and sizing a range of fire hydrant and hose reel systems
	  • developing a checklist with all information and formulae required to carry out flow and pressure tests
	  • preparing plans for a range of fire hydrant and hose reel systems
	  • preparing a specification for a fire hydrant and hose reel system
	  • preparing a testing and commissioning schedule
	  • producing an operation and maintenance manual
	  • interactive communication and teamwork with others to ensure safe and effective work site operations.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environments appropriate to a range of situations and activities
  - computers and software
  - materials appropriate to application activities
  - appropriate documentation and data related to tasks, including plans and specifications of an appropriate building
  - tools and equipment relevant to planning processes, including calculators.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPGS4003A Install, commission and service Type B gas appliances

Unit Descriptor

This unit of competency specifies the outcomes required to install, commission and service Type B gas appliances, from the gas isolation valve and electrical isolation switch to the flue spigot on the appliance, in accordance with current and relevant standards

Employability Skills This unit has employability skills.

Application of the Unit

This unit of competency supports the needs of experienced plumbers with a responsibility for interpreting and applying pre-existing design specifications; gaining approvals from authorities; preparing for work; installing gas system components and associated electrical or electronic components and controls; testing, adjusting, commissioning and servicing Type B gas appliances; and completing work finalisation processes including formal recording and reporting requirements.

Before satisfying this unit, the candidate requires a restricted electrical licence or equivalent to connect and disconnect appliances in accordance with the requirements of the particular State or Territory.

Unit Sector Gas fitting service

ELEMENT	PERFORMANCE CRITERIA
1. Obtain authority to undertake work on Type B gas appliances.	1.1 ***Design specification*** for the ***Type B gas appliance*** to be installed and commissioned is accessed, analysed, interpreted and confirmed through a detailed site inspection. 1.2 Design specification matters requiring clarification are resolved through liaison with the designer and/or gas authorities. 1.3 Formal authority to proceed with the installation and commissioning is obtained before the commencement of work in accordance with ***regulatory and code of practice requirements***. 1.4 Regulatory and code of practice recording and reporting requirements are satisfied at appropriate times throughout the work sequence.

2. Prepare for work.	2.1 ***Occupational health and safety*** (OHS) ***requirements*** associated with the workplace environment and the installation, commissioning and servicing of Type B gas appliances are accessed, interpreted and followed throughout the work. 2.2 Gas system components, electrical or electronic components and controls and other required installation materials are identified from the design specification and obtained for the work. 2.3 Component specifications and manufacturer servicing manuals are obtained for planned work activity. 2.4 Tasks are planned in conjunction with others involved in or affected by the work. 2.5 ***Tools and equipment*** are selected consistent with installation, commissioning and servicing needs, checked for serviceability and any faults are rectified or reported. 2.6 ***Quality assurance requirements*** for the work sequences are identified and followed. 2.7 Work area is prepared to support efficient installation, commissioning and servicing of Type B gas appliance. 2.8 Gas system and electrical safety checks and isolation procedures are completed and recorded to manufacturer and other authority requirements before any work is commenced.
3. Install Type B gas appliances.	3.1 Appliance components, including ***valve trains, burners*** and associated pipework and flue systems, are installed in accordance with approved design specification. 3.2 Ventilation systems are installed in accordance with approved design specification. 3.3 Electrical components, including terminations, are installed in accordance with design specification and regulatory requirements. 3.4 Electrical wiring and wiring enclosures are installed in accordance with design specification and regulatory requirements. 3.5 Installations are visually inspected at each stage of the work to ensure compliance with specification and absence of damaged or faulty equipment and materials
4. Commission and test Type B appliances.	4.1 Testing equipment appropriate to the requirement is selected, checked and prepared for use. 4.2 Gas and electrical safety checks and isolation procedures, including purging, are completed and recorded to manufacturer and other authority requirements before any testing and commissioning is commenced. 4.3 ***Operational parameters of individual components*** are tested and adjusted to conform to specification. 4.4 Appliance operations are tested first without and then with fuel, adjustments are completed as necessary and results recorded in accordance with approving authority requirements. 4.5 Flue gases are analysed in accordance with recognised industry practice and other authority requirements.

5. Service Type B gas appliances.	5.1 Nature and possible cause of faults or out of specification performance are identified from defect reports or operational records. 5.2 Electrical and gas safety checks and isolation procedures are completed and recorded to manufacturer and other authority requirements before any servicing work is commenced. 5.3 Plans and diagrams are read and correctly interpreted to identify potential gas system and/or electrical fault pathways and locations. 5.4 Appropriate testing techniques, procedures and equipment are selected and applied to diagnose system faults or discrepancies. 5.5 Cause of fault or out of specification performance is identified and confirmed. 5.6 Options for correction are thoroughly analysed and most appropriate corrective action is selected. 5.7 Repair, replacement or adjustment is made in accordance with manufacturer specifications or service manuals. 5.8 Appliance is assessed to ensure compliance with relevant standards and manufacturer specifications prior to recommissioning and returning to service.
6. Clean up work area.	6.1 Work area is cleared and materials disposed of or recycled in accordance with federal, state and territory legislation and workplace procedures. 6.2 Tools and equipment are cleaned, checked, serviced and stored in accordance with manufacturer recommendations and workplace procedures. 6.3 Documentation is completed in accordance with workplace requirements.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- reading, interpretation and oral and written communication skills to facilitate:
  - communication with state or territory and local regulatory authorities to inform them of the work, obtain and submit work notices and ensure compliance with requirements
  - interpretation of information, including verbal or written and graphical instructions, signage, work schedules, manufacturer specifications and instructions, organisation work specifications and requirements, instructions issued by authorised organisational or external personnel, plans and specifications, job drawings, work bulletins, charts and hand drawings, memos, maps, material safety data sheets, diagrams or sketches and graphics
  - workplace communication, including the use of two-way radios and hand signals
- following safe work procedures relating to the installation, commissioning and servicing of Type B appliances.

Required knowledge:

- Australian standards, including the use of tables:
  - AS3814 (AG501) Industrial and commercial gas appliances
  - AS5601 (AG601) Gas installation
  - relevant aspects of AS1375 Industrial fuel fired appliances, AS2593 Boilers - unattended and limited attendance and AS/NZS3000 Electrical installations
- basic electrical theory, including:
  - Ohm's law
  - current flow
  - conduction
  - insulation
  - ignition systems
  - characteristics of fuses, circuit breakers, residual current devices and earthing systems
  - characteristics of electromotive force (EMF)
- electrical safety, including isolation procedures and requisite precautions
- electrical terminology and conventional symbols
- flue gas analysis techniques and processes
- gas terminology and conventional symbols
- gas safety, including:
  - isolation procedures
  - combustion characteristics and effects
- job safety analyses and safe work method statements
- programmable logic controller (PLC) systems, including remedial programming techniques
- purging requirements, techniques and critical calculation processes
- SI system of units
- sources of information and processes for the calculation of material requirements
- types and properties of fuel gas, including pressure and flow rates
- types, characteristics, uses and limitations of electrical and electronic componentry and control systems
- types, characteristics, uses and limitations of Type B gas appliance components
- ventilation techniques and calculation processes
- workplace and equipment safety requirements.

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 specification includes:

- materials
- combustion air blowers
- gas valve trains
- manual shut off valves
- gas pressure regulation
- over pressure protection systems
- safety shut off valve systems
- air controls
- process controls
- flame safe guards
- markings and instructions.

Type B gas appliances include:

- those above 10 megajoules with no Australian Gas Association (AGA) approval scheme and no specific standards to cover type and scope of operation
- Type B appliances may use town gas, natural gas, simulated natural gas, liquefied petroleum gas, tempered liquefied petroleum gas and combination fuels
- Type B appliances with special requirements for design and operation include:
  - high input gas fired appliances
  - air gas mixing machines and mixing blowers
  - atmosphere generators and special atmospheres
  - after burners - process
  - steam and hot water boilers
  - direct gas fired air heaters
  - stationary gas engines and turbines
  - incinerators and generators
  - ovens - direct fired
  - smoke ovens - direct fired
  - water heaters
  - multi-fuel firing systems
- Type B appliance operation specifications will include:
  - operation of gas appliance and burners
  - start gas rates
  - flame establishment periods
  - interlocks
  - operational sequences
- planning installation of a Type B gas appliance will include determination of site suitability and confirmation of the appropriateness of:
  - gas supply and sizing
  - electrical supply
  - proposed foundation and supports
  - proposed appliance security and lighting measures
  - proposed component handling and positioning measures
- commissioning procedure for a Type B appliance includes:
  - preliminary inspection
  - activation run without fuel
  - activation run with fuel
  - operation and completion stages
- testing and servicing of Type B gas appliances will require the use of a hand-held programmer to monitor circuit conditions and to edit program (to make minor changes)
- materials are to comply with appropriate standards for the maintenance of Type A gas appliances.

Regulatory and code of practice requirements include:

- statutory/regulatory authority requirements that may include:
  - statutory plumbing authority
  - statutory gas fitting authority
  - state or territory and local statutory authority
- regulatory and legislative requirements, particularly those pertaining to plumbing and gas fitting regulations, building codes, OHS and environmental requirements
- environmental regulatory requirements may include:
  - air pollution
  - waste management
  - clean-up protection
- relevant Australian standards, including:
  - AS1375 Industrial fuel fired appliances
  - AS2593 Boilers - unattended and limited attendance
  - AS/NZS3000 Electrical installations
  - AS/NZS4836 Safe working on low-voltage electrical installations
  - AS5601 (AG601) Gas installation
  - AS3814 (AG501) Industrial and commercial gas appliances.

OHS requirements include:

- federal, state and territory legislation and regulations, including:
  - use of tools and equipment
  - workplace environment and safety
  - handling of materials, including hazardous materials and substances
  - use of firefighting equipment
  - use of first aid equipment
  - hazard control
- personal protective equipment including that prescribed under legislation, regulations and workplace policies and practices
- safe operating procedures, including recognising and preventing hazards associated with:
  - gas fires and explosions
  - electrical components and safety
  - use of tools and equipment
  - trip hazards
  - service lines
  - surrounding structures and facilities
  - hazardous materials
  - working at heights
  - working in proximity to others
  - work site visitors
  - the public.

Tools and equipment may include:

- measuring equipment
- test equipment and instruments, including:
  - manometer
  - multi-meter
  - dual probe voltage tester
  - flue gas analysis equipment
  - hand pump pressure kit
  - Pitot tube
  - megohm meter
  - power point tester
  - neon tester
  - volt stick
- power tools and hand tools, such as wrenches and spanners
- lifting and load shifting equipment, including:
  - hand trolleys
  - rollers
  - forklifts
  - chain blocks
  - hoists
  - jacks.

Quality assurance requirements include:

- International Standards Organisation
- internal company quality assurance policy and risk management strategy
- Environment Protection Authority
- AGA requirements
- site safety plan
- workplace operations and procedures.

Valve trains include:

- manual isolation valves
- gas pressure regulators and controllers
- safety shut offs
- flow and ratio controls.

Burners include:

- atmospheric
- pre-mix
- nozzle
- oxygen enhanced
- packed power.

Operational parameters of individual components include:

- gas rates
- purge times
- air flows
- combustion conditions
- all safety and operating controls.

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 on its own or as part of an integrated assessment activity involving planning and conducting the installation of at least one significant Type B gas appliance.

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:
  - locating interpreting and applying relevant information, standards and specifications to determine requirements of and maintain Type B appliances
  - applying safety requirements throughout the work sequence, including:
    - use of personal protective clothing and equipment
    - isolation of appliances from gas and electrical services
  - planning and conducting the installation of at least one significant Type B appliance, including:
    - obtaining required authorities
    - planning work
    - installing gas, ventilation and electrical componentry
    - installing electrical control system
    - completing all required tests and sequences
    - commissioning the appliance
    - completing all required documentation
    - communicating and working effectively and safely with others.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environment
  - appropriate Type B appliance installation and commissioning requirement
  - gas and electrical system componentry
  - tools and equipment appropriate to the work
  - hand-held programmers and calculators
  - support materials appropriate to activity
  - a detailed design specification
  - research resources, including systems literature and data.
- Validity and sufficiency of evidence requires that:
  - competency will need to be demonstrated over a period of time reflecting the scope of the role
  - 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be current and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPMS5000A Design steam distribution systems

Unit Descriptor

This unit of competency specifies the outcomes required to design steam distribution systems, including sizing, material selection, and preparation and specification of steam distribution system plans.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the attainment of skills and knowledge required for competent workplace performance in a consultancy or supervisory capacity in relation to plumbing services and hydraulics.

Unit Sector Mechanical services

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate design parameters.	1.1 ***Scope of work*** is established for steam distribution systems. 1.2 ***Design requirements*** are determined from plans, specifications and client briefs. 1.3 ***Cost-benefit analysis*** is conducted comparing a range of materials and system designs. 1.4 ***Statutory and regulatory requirements and Australian and New Zealand standards*** for the design of steam distribution systems are 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 ***Performance requirements*** are established.
2. Plan and detail system components.	2.1 ***Layout of pipework systems*** and type and location of ***fittings and valves*** are planned. 2.2 ***Pipe size calculations*** are performed for a range of applications. 2.3 ***Steam appliances*** are specified, steam consumption is calculated and ***boilers*** required are sized and specified. 2.4 ***Steam circuits*** are detailed and distribution pressures for a range of applications are specified. 2.5 ***Steam trap types and their operation*** are specified and detailed. 2.6 ***Steam injection*** systems are specified. 2.7 ***Insulation*** is specified. 2.8 ***Pipe fixings*** are designed for a range of applications. 2.9 Approved ***materials, jointing methods*** and all ***installation requirements*** for steam distribution systems are specified.
3. Design and size systems.	3.1 Steam distribution systems and steam circuits are ***designed*** for a range of applications. 3.2 Steam distribution systems are designed and sized using computer software packages.

4. Prepare documentation.	4.1 ***Plans*** are prepared for a range of steam distribution systems. 4.2 A ***specification*** for a steam distribution system is prepared. 4.3 A ***testing*** and ***commissioning schedule*** is prepared. 4.4 An ***operation and maintenance manual*** is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources
- teamwork skills to be able to coordinate and action tasks relevant to the design of steam distribution systems.

Required knowledge:

- requirements of state regulatory authorities, Australian standards and manufacturer specifications, including hazards identified in relation to devices and systems used
- common terminology and definitions used in design of steam distribution systems for all classes of building
- principles of technology in the design of steam distribution systems
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Scope of work includes:

- interpretation of plans and specifications, and sizing and documenting layout of steam distribution systems for residential, commercial and industrial applications for either new projects or an existing structure being renovated, extended, restored or maintained
- principles and properties of steam systems, including:
  - characteristics of condensation
  - methods of condensate removal
  - effects of air in a steam system
  - types of steam and steam quality, including:
    - dry steam
    - wet steam
    - superheated steam
    - flash steam
  - properties of steam at varying pressures
  - heat transfer
  - barriers to heat transfer
  - steam applications, including commercial, manufacturing, institution and machinery/equipment operation
  - terms, including:
    - Australian and New Zealand standard definitions, manufacturers terms and naming conventions
    - industry terminology, including:
      - latent heat
      - enthalpy
      - specific enthalpy
      - specific heat capacity
      - absolute pressure
      - gauge pressure
      - heat and heat transfer
      - enthalpy of saturated water
      - enthalpy of evaporation and of saturated steam
      - SI system of units related to steam.

Design requirements include:

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

Cost-benefit analysis includes:

- comparison of range of suitable materials and system choices available to enable cost-effective choices to be made without compromising the integrity of the project.

Statutory and regulatory requirements and Australian and New Zealand standards include:

- acts, regulations and local and state government policies, including group and strata titling
- Australian and New Zealand standards
- Building Code of Australia.

Manufacturer requirements include:

- material specifications
- sizing tables
- technical and trade manuals.

Desktop study includes collection and interpretation of existing data for design purposes from:

- council plans
- developer plans
- architectural and building plans
- other documents, including:
  - forms
  - applications
  - other reports as available.

Performance requirements include:

- steam generation and consumption, and steam and pressure quality, established using Australian and New Zealand standards and manufacturers ' information.

Layout of pipework systems should:

- not unduly affect building integrity and aesthetic appeal
- have principles of economy, serviceability, durability and fit for use applied.

Fittings and valves include:

- steam traps
- steam headers
- pressure relief valves
- isolating valves
- tees
- bends
- unions
- couplings.

Pipe size calculations include:

- sizing
- energy
- pressure
- volume
- storage.

Steam appliances include:

- calorifiers
- sterilisers
- water heaters
- kitchen and laundry appliances
- industrial applications
- details should include:
  - construction
  - components
  - electronic controls
  - methods of temperature and pressure control.

Boilers include:

- water tube
- fire tube
- packaged
- coal
- gas
- solid fuel
- oil
- electric
- factors to be considered when selecting a boiler:
  - capacity and size
  - valves
  - pressure controls and components
  - energy sources
  - advantages and disadvantages of boiler types
  - methods of reducing heat losses
  - storage requirement calculations
  - designs based on anticipated use
  - suitable time period between refilling.

Steam circuits include:

- steam distribution
- condensate return
- headers
- water treatment
- feed tanks
- feed pumps.

Steam trap types and their operation :

- types include:
  - thermostatic
  - mechanical
  - thermodynamic
  - other applicable types
- operation includes:
  - location
  - installation.

Steam injection includes:

- proprietary
- sparge pipe
- open ended pipe
- noise control.

Insulation includes:

- rock wool
- fibreglass
- felt
- insulation protection, including:
  - sheet metal
  - plastic.

Pipe fixings include:

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

Materials include:

- copper
- steel
- other approved materials.

Jointing methods include:

- mechanical joints
- brazing
- threading.

Installation requirements include:

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

Designed includes:

- prescriptive designs, including detail relating to:
  - materials and quality of work
  - quality assurance
  - nominated subcontractors
  - provision of on-site facilities and site access
  - cost
- relating to performance, including:
  - standards of work
  - work schedules
  - standard procedures
  - milestones.

Plans :

- may include:
  - elevations
  - sections
  - details
  - cross-sections
  - isometrics
  - axonometrics
  - schematics
- may be produced using:
  - pencil
  - Indian ink
  - pigment liner
  - computer generation.

Specification includes:

- materials
- workmanship
- jointing
- manufacturer requirements
- clipping
- appliances
- valves
- details of specialised components.

Testing includes:

- leak testing
- flow testing
- pressure testing
- inspection checklist
- quality assurance (QA) audit.

Commissioning schedule includes:

- checking for burrs and obstructions
- confirming fit for purpose
- purging system
- removing contaminants
- commissioning appliances.

Operation and maintenance manual includes:

- regular inspection
- leak detection
- check for blockages
- regular maintenance requirements.

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 on its own or as part of an integrated assessment activity involving preparation of designs for two steam distribution systems for different applications, including plans, specifications and all associated documentation.

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 steam distribution systems
  - producing an appropriate layout for steam distribution systems, planned in accordance with manufacturer and regulatory requirements
  - designing a steam circuit
  - calculating pipe sizes in accordance with regulations and manufacturer requirements
  - designing and sizing steam distribution systems using appropriate software
  - preparing plans for a range of steam distribution systems
  - preparing specifications for steam distribution systems
  - preparing testing and commissioning schedules
  - producing operation and maintenance manuals.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - a comprehensive selection of reference texts
  - documentation relating to Australian standards and product information,including:
    - design brief drawings
    - specifications
    - codes
    - design concepts
    - construction schedule
    - other necessary supporting manufacturers literature
  - research resources, including manufacturers data
  - access to relevant legislation, regulations and codes of practice
  - workplace or simulated environments appropriate to a range of situations and activities
  - computers and software
  - materials appropriate to application activities
  - appropriate documentation and data related to tasks, including plans and specifications of an appropriate building
  - tools and equipment relevant to planning processes, including calculators.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate ' s competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken

in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPMS5001A Design air conditioning and ventilation systems

Unit Descriptor

This unit of competency specifies the outcomes required to evaluate and design air conditioning and ventilation systems for residential, commercial and industrial applications.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the needs of experienced plumbers with a responsibility for providing consultancy or supervision in the evaluation and design of air conditioning and ventilation systems.

Unit Sector Mechanical services

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate design parameters.	1.1 Client requirements are determined from plans, specifications and client briefs. 1.2 User comfort conditions and ***specific use conditions*** are evaluated and ***psychometric evaluation*** and ***heat loads are calculated*** . 1.3 ***Building heat losses*** are evaluated. 1.4 Distribution requirements for air conditioning and ventilation system applications are specified. 1.5 A range of air conditioning and ventilation systems are evaluated in accordance with given applications. 1.6 Mechanical services drawings are evaluated and interpreted. 1.7 Health risks that may arise due to poor maintenance of air conditioning and ventilation systems are evaluated. 1.8 Minimum performance requirements are specified for several different air conditioning and ventilation systems. 1.9 Manufacturer specifications and technical manuals are evaluated for suitability for a range of design applications.

2. Plan system components.	2.1 Appropriate zoning of air conditioning and ventilation systems is planned to comply with given specific performance objectives. 2.2 Air conditioning units are specified for optimum performance with reference to ***legislation, standards and other relevant documentation.*** 2.3 Fan types are specified for a range of applications with reference to legislation, standards and other relevant documentation. 2.4 Air diversion systems, including registers, are planned to ensure a balanced system with reference to legislation, standards and other relevant documentation. 2.5 Required ventilation and ductwork components are planned and locations are specified with reference to legislation, standards and other relevant documentation. 2.6 Approved materials for air conditioning and ventilation systems are ***specified.*** 2.7 All plans and drawings are completed using Australian standard drawing symbols related to air conditioning and ventilation in accordance with legislation, standards and other relevant documentation.
3. Design and size systems.	3.1 Volume air changes per hour are calculated from given floor plans and details. 3.2 Methods for eliminating health risks from existing or proposed systems are specified with reference to legislation, standards and other relevant documentation. 3.3 Range of air conditioning and ventilation systems for given ***applications*** is ***designed and sized.***
4. Test systems.	4.1 Test procedures for air conditioning and ventilation systems are evaluated. 4.2 ***Tests*** are conducted using appropriate ***testing equipment,*** results are recorded and a report is prepared. 4.3 Adjustments required as a result of testing are planned, designed and specified.
5. Prepare documentation.	5.1 Appropriate checklist, including formulae required to carry out an air balance to a given specification, is developed. 5.2 Plans are prepared for a range of air conditioning and ventilation systems. 5.3 A specification for an air conditioning and ventilation system is prepared. 5.4 A testing and commissioning schedule is prepared. 5.5 An operation and maintenance manual is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- numeracy skills to:
  - apply formulae and calculate air displacements and returns
  - calculate heat loads
- oral and written communication skills to:
  - communicate effectively
  - prepare substantial reports and other documentation
- reading and interpretation skills to:
  - interpret and apply documentation from a wide range of sources
  - read and interpret drawings and specifications
- teamwork skills to coordinate own work activities with others.

Required knowledge:

- air psychometrics and the use of psychometric charts
- Australian and New Zealand standards, manufacturer specifications, BCA and other applicable codes or standard operating procedures relevant to the sector
- hazards associated with devices and systems used in the hydraulic sector
- installation methods used in hydraulic systems
- terminology and definitions used in hydraulic design
- compliance with occupational health and safety (OHS) and organisational quality procedures and processes
- heat load calculations
- nature of materials and effect of performance
- work drawings and specifications.

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.

Unit scope :

- interpretation of plans and specifications for an appropriate building and size
- documentation of the layout of pipework and fixtures
- types of products and services, quantities, characteristics, sizes, patterns dimensions, location, surfaces and compatibility.

Specific use conditions include:

- computer requirements
- wet-bulb and dry-bulb temperature and humidity
- age and activity of occupants.

Psychometric evaluation includes:

- absolute, specific and relative humidity
- altitude, density and volume
- air composition
- air properties, including:
  - temperature
  - density
  - specific heat
  - thermal conductivity
  - expansion coefficient
  - kinematic viscosity
  - Prandtl number
- determination of the air condition using a psychometric or Mollier chart, showing:
  - dry-bulb temperature
  - wet-bulb temperature
  - relative humidity
  - humidity ratio
  - specific volume
  - dewpoint temperature
  - enthalpy.

Calculation of heat loads includes:

- assessment of factors affecting heat load, including:
  - room dimensions
  - insulation
  - number of windows
  - weather effects
  - usage
  - number of personnel
- heat load calculation methods and formulae
- manual calculation
- calculation using software systems.

Building heat losses may include:

- construction materials
- insulation materials
- room sizes
- occupancy
- maintaining plenum.

Legislation, standards and other relevant documentation include:

- OHS requirements, including:
  - organic and inorganic contaminants
  - growth and distribution of *Legionella pneumophila* bacteria and other water and airborne infectious bacterial agents
- OHS requirements are to be in accordance with federal, state and territory legislation and regulations and may include:
  - personal protective clothing and equipment
  - use of tools and equipment
  - workplace environment and safety
  - handling of materials, including hazardous
  - materials and substances
  - use of first aid equipment
  - hazard control
- environmental requirements, including water quality management which may include the breeding of mosquitoes
- quality assurance requirements, including:
  - International Standards Organisation
  - internal company quality assurance policy and risk management strategy
  - Environment Protection Authority
  - site safety plan
  - workplace operations and procedures
- AS1668 Ventilation systems Parts 1 and 2
- AS1677 Refrigerating systems
- AS3666 Handling microbial systems
- AS1100 Technical drawing materials
- specifications and operational manuals for:
  - materials
  - valves
  - fittings
  - pumps
  - systems
  - components installation
  - commissioning and testing
- manufacturer specifications, literature and data.

Specifications may include:

- type of application
- fire rating requirements
- durability
- longevity.

Applications include:

- amenities
- residential, industrial and commercial applications.

Designed and sized includes:

- designs should be prescriptive and include detail relating to:
  - materials and quality of work
  - quality assurance
  - nominated subcontractors
  - provision of on-site facilities and site access
  - cost
  - work schedules
  - standard procedures
  - milestones
- design parameters may include:
  - client requirements
  - OHS requirements
  - legislative requirements
  - user requirements in relation to zoning
- design and sizing to be completed:
  - with reference to calculations, tables, regulations and manufacturer specifications
  - using appropriate software.

Tests and testing equipment include:

- air volume
- air velocity
- air pressure
- temperature
- humidity
- Pitot tubes
- sound power levels.

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 on its own or as part of an integrated assessment activity involving effective performance and application of principles used to design air conditioning and ventilation systems listed within the range of variables.
- This unit of competency could be assessed by:
  - developing an air conditioning and ventilation system for a given project, including the schedule of works and job specification
  - preparing a graphical presentation of an air conditioning and/or ventilation system solution with specifications.

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:
  - establishing and evaluating design parameters for a range of air conditioning and ventilation systems
  - planning the system components for a range of air conditioning and ventilation systems, including:
    - air conditioning units
    - fans
    - ducting systems
    - zones
  - designing and sizing a range of air conditioning and ventilation systems for given applications
  - developing an appropriate checklist for tests to be carried out on the system, including formulae required to carry out an air balance
  - conducting tests, recording and evaluating test results and preparing a report
  - preparing plans for a range of air conditioning and ventilation systems
  - preparing specifications for air conditioning and ventilation systems
  - preparing testing and commissioning schedules for air conditioning and ventilation systems
  - preparing operation and maintenance manuals for air conditioning and ventilation systems.

Context of and specific resources for assessment

- The following resources should be made available as appropriate:
  - a comprehensive selection of reference texts
  - Australian and New Zealand standards and product information relating to documentation, including:
    - design brief drawings
    - specifications
    - codes
    - design concepts
    - construction schedule
    - other necessary supporting manufacturers ' literature
  - research resources, including systems literature and data
  - access to relevant legislation, regulations and codes of practice.
- Validity and sufficiency of evidence requires that:
  - competency will need to be demonstrated over a period of time reflecting the scope of the role
  - 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 of competence only taken at the point when the assessor has complete confidence in the candidate ' s competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be current and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPMS5002A Design sound attenuated hydraulic services

Unit Descriptor

This unit of competency specifies the outcomes required to design sound attenuated hydraulic services, determine relevant installation details and prepare specifications for a range of residential, commercial and industrial buildings.

Employability Skills

This unit has employability skills.

Application of the Unit

This unit of competency supports the attainment of skills and knowledge required for competent workplace performance in a consultancy or supervisory capacity in relation to plumbing services and construction hydraulics.

Unit Sector

Mechanical services

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate design parameters.	1.1 ***Scope of work*** is established for sound attenuated hydraulic services for wide span and high-rise building projects. 1.2 ***Design requirements*** are determined from plans, specifications and client briefs. 1.3 Sound transmission categories and levels are identified from relevant acts, codes and standards, and are evaluated for residential, commercial and industrial premises. 1.4 Sound transmission values of building and structural elements and materials are evaluated. 1.5 ***Cost-benefit analysis*** is conducted comparing a range of pipe materials and system designs. 1.6 ***Statutory and regulatory requirements,*** the Building Code of Australia and ***Australian and New Zealand standards*** for the design of sound attenuated hydraulic services are analysed and applied. 1.7 ***Manufacturer requirements*** and trade and technical manuals are interpreted. 1.8 Additional research including a ***desktop study*** is conducted to outline design parameters. 1.9 ***Performance requirements*** are established.
2. Plan and detail system components.	2.1 Causes of ***noise generation*** in hydraulic services are identified and analysed. 2.2 ***Layout*** of sound attenuated ***pipework systems*** is planned. 2.3 ***System calculations*** are performed for a range of sound attenuated hydraulic services. 2.4 ***Pumped hydraulic systems*** are sound attenuated. 2.5 ***Pipe fixings*** are designed for a range of applications. 2.6 Approved ***materials*** and all ***installation requirements*** for sound attenuated hydraulic services are specified.

3. Design and size systems.	3.1 Sound attenuated hydraulic services are designed and sized for a range of applications. 3.2 ***Material combinations*** are identified and documented to achieve sound attenuation requirements. 3.3 Pump installations are sound attenuated. 3.4 Sound attenuated hydraulic services are designed and evaluated using computer software packages.
4. Prepare documentation.	4.1 ***Plans*** are prepared for a range of sound attenuated hydraulic services. 4.2 Report on sound attenuated hydraulic services for a range of applications is prepared. 4.3 A ***specification*** for a sound attenuated hydraulic services plan is prepared. 4.4 A ***testing*** and ***commissioning schedule*** is prepared. 4.5 An ***operation and maintenance manual*** is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources
- teamwork skills to be able to coordinate and action tasks relevant to the design of sound attenuated hydraulic services.

Required knowledge:

- requirements of state regulatory authorities, Australian standards and manufacturer specifications, including hazards identified in relation to devices and systems used
- common terminology and definitions used in the design of sound attenuated hydraulic services for all classes of building
- drafting principles
- nature of materials used and effects of performance under various conditions
- principles of technology in the design of sound attenuated hydraulic services
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Scope of work :

- includes interpretation of plans and specifications
- includes documentation of the layout of sound attenuated hydraulic services, including the reduction of noise transfer for residential, commercial and industrial applications
- may be for new projects or an existing structure being renovated, extended, restored or maintained.

Design requirements include:

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

Cost-benefit analysis includes:

- comparison of range of suitable materials and system choices available to enable cost-effective choices to be made without compromising the integrity of the project.

Statutory and regulatory requirements and Australian and New Zealand standards include:

- acts, regulations and local and state government policies, including group and strata titling
- AS/NZS3500 National plumbing and drainage set Parts 2.1 and 2.2
- AS2200 Design charts for water supply and sewerage.

Manufacturer requirements include:

- specifications
- sizing tables
- pump tables
- technical and trade manuals
- analysis of sound transmission values.

Desktop study includes collection and interpretation of existing data for design purposes from:

- council plans
- developer plans
- architectural and building plans
- other documents, including:
  - forms
  - applications
  - other reports as available.

Performance requirements include:

- pipe grades, cover, flow conditions and discharge requirements, established using Australian and New Zealand standards and local authority plans.

Noise generation includes:

- water hammer
- high velocity
- quick action valves
- loose pipework
- noisy fixtures and appliances
- pumped hydraulic systems
- linking of building compartments by pipework.

Layout of pipework systems includes:

- proximity of residential compartments
- sound transmission category of building compartments.

System calculations include:

- decibel calculations
- noise insulation characteristics of materials
- sound transmission values of plumbing pipework and building materials.

Pumped hydraulic systems include:

- pump and pump installation
- pumproom
- sanitary rising mains
- pressurised water mains
- compressed air systems
- steam systems
- circulating systems.

Pipe fixings include:

- fixings that do not impinge on sound attenuation of the hydraulic service, including:
  - wall and ceiling brackets
  - saddles
  - hanging brackets
  - anchors
  - material requirements
  - corrosion protection
  - bracket spacing.

Materials include:

- copper
- unplasticised polyvinyl chloride (uPVC)
- cast iron
- polyethylene
- specialist sound attenuation piping materials and sound attenuating insulation materials.

Installation requirements include:

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

Material combinations include:	• ducts • plasterboard • wall • floor and ceiling systems • insulation • separation distances.

Plans :	• may include:
	  • elevations
	  • sections
	  • details
	  • cross-sections
	  • isometrics
	  • axonometrics
	  • schematics
	• may be produced using:
	  • pencil
	  • Indian ink
	  • pigment liner
	  • computer generation.

Specification includes:	• materials • workmanship • manufacturer requirements • clipping • details of specialised components.
Testing includes:	• a sound measurement (dB) • compliance testing • quality assurance (QA) audit.
Commissioning schedule includes:	• insulation gap filling.
Operation and maintenance manual includes:	• yearly inspection • regular maintenance requirements.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment

- This unit of competency could be assessed on its own or as part of an integrated assessment activity involving preparation of designs for two sound attenuated hydraulic services for different applications, including plans, specifications and all associated documentation.

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 sound attenuated hydraulic services
  - planning and detailing system components, including:
    - insulation
    - clipping
    - sound attenuated pipework
    - ducts
  - designing and sizing a range of sound
  - attenuated hydraulic services
  - preparing plans to industry standards for a range of sound attenuated hydraulic services
  - preparing reports on sound attenuated hydraulic services for a range of applications
  - preparing specifications for a range of sound attenuated hydraulic services
  - preparing testing and commissioning schedules
  - preparing operation and maintenance manuals.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environments appropriate to a range of situations and activities
  - computers and software
  - materials appropriate to application activities
  - appropriate documentation and data related to tasks, including plans and specifications of an appropriate building
  - tools and equipment relevant to planning processes, including calculators.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPMS5003A Design hydronic heating and cooling systems

Unit Descriptor

This unit of competency specifies the outcomes required to design hydronic heating and cooling systems, determine relevant installation details and prepare system specifications for a range of residential, commercial and industrial buildings.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the attainment of skills and knowledge required for competent workplace performance in a consultancy or supervisory capacity in relation to plumbing services and hydraulics.

Unit Sector Mechanical services

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate design parameters.	1.1 ***Scope of work*** is established for hydronic heating and cooling systems. 1.2 ***Design requirements*** are determined from plans, specifications and client briefs. 1.3 ***Cost-benefit analysis*** is conducted comparing a range of pipe materials and system designs. 1.4 ***Statutory and regulatory requirements and Australian and New Zealand standards*** for the design of hydronic heating and cooling systems are 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 ***Performance requirements*** are established.
2. Plan and detail system components.	2.1 ***Layout of pipework systems*** and type and location of fittings and valves are planned. 2.2 ***Pipe size requirement calculations*** are performed for a range of applications in accordance with regulations and manufacturer requirements. 2.3 ***System components and circuits*** are specified. 2.4 Pump and compressor systems are detailed. 2.5 Distribution flows, velocities and pressures are specified for a range of applications. 2.6 ***Insulation*** is specified. 2.7 ***Pipe fixings*** are designed for a range of applications. 2.8 Approved ***materials, jointing methods*** and all ***installation requirements*** for hydronic heating and cooling systems are specified.
3. Design and size systems.	3.1 Hydronic systems and circuits are designed for a range of applications. 3.2 Hydronic systems are designed and sized using computer software packages.

4. Prepare documentation.	4.1 ***Plans*** are prepared for a range of hydronic heating and cooling systems. 4.2 A ***specification*** for a hydronic system is prepared. 4.3 A ***testing*** and ***commissioning schedule*** is prepared. 4.4 An ***operation and maintenance manual*** is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources
- teamwork skills to be able to coordinate and action tasks relevant to the design of hydronic heating and cooling systems.

Required knowledge:

- requirements of state regulatory authorities, Australian standards and manufacturer specifications, including hazards identified in relation to devices and systems used
- common terminology and definitions used in design of hydronic heating and cooling systems for all classes of building
- drafting principles
- nature of materials used in hydronic heating and cooling systems and effects of performance under various conditions
- principles of technology in the design of hydronic heating and cooling systems
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Scope of work includes:

- interpretation of plans and specifications
- sizing and documenting layout of hydronic heating and cooling systems for residential, commercial or industrial applications for either new projects or an existing structure being renovated, extended, restored or maintained
- principles and properties of hydronic systems, including:
  - conduction
  - convection
  - radiation
  - properties of water steam and gases used for hydronic systems
  - principles of hydronic circuits
  - principles of pressure and energy related to hydronic systems
  - heat transfer
  - barriers to heat transfer
- hydronic applications, including:
  - room heating circuits for residential, commercial and industrial heating applications
  - timber floor heating circuits
  - concrete floor heating circuits
  - chiller circuits for air conditioning and refrigeration applications
  - heat removal applications
  - manufacturing and industrial applications.

Design requirements include:

- interpretation and application of mechanical services drawings and symbols
- owner requirements
- architectural specifications
- builder specifications
- specialist hydronic applications.

Cost-benefit analysis includes:

- comparison of range of suitable materials and system choices available to enable cost-effective choices to be made without compromising the integrity of the project.

Statutory and regulatory requirements and Australian and New Zealand standards include:	• acts, regulations and local and state government policies, including group and strata titling • Australian and New Zealand standards • industry standards • Building Code of Australia.
Manufacturer requirements include:	• specifications • sizing tables • technical and trade manuals.

Desktop study includes collection and interpretation of existing data for design purposes from:	• council plans
	• developer plans
	• architectural and building plans
	• other documents, including:
	  • forms
	  • applications
	  • other reports as available.

Performance requirements include:	• hydronic heating and cooling system requirements, including temperature and safety requirements, established using Australian and New Zealand standards and manufacturers' information.
Layout of pipework systems:	• includes compliance with hydronic principles • should not unduly affect building integrity and aesthetic appeal • should have principles of economy, serviceability, durability and fit for use applied.
Fittings and valves include:	• thermostats • pressure • flow and isolating valves • tees • bends • unions • couplings.
Pipe size requirement calculations include:	• sizing • energy • temperature • pressure • flow and velocity • volume and storage.

System components and circuits include:

- boilers, including:
  - water tube
  - fire tube
  - heat exchanger
  - packaged
  - coal
  - gas
  - solid fuel
  - oil
  - electric
  - capacity and size
  - valves
  - pressure controls and components
  - energy sources
  - advantages and disadvantages of boiler types
  - methods of reducing heat losses
  - factors to be considered when selecting a boiler
- hydronic circuits, including:
  - flow and return pipework
  - pipework grades
  - circulating pump appliances
  - valves and fittings
- cooling towers, including:
  - size
  - sprays
  - construction
  - collection
  - disinfection
  - maintenance
  - fans
  - bacteriological safety
- chillers and refrigerant plant, including:
  - proprietary commercial and industrial equipment and assemblies
  - packaged plants
  - engineered systems
- hydronic appliances, including:
  - types
  - radiators
  - heat exchangers
  - calorifiers
  - water heaters
  - timber floor heating systems
  - concrete construction
  - components
  - electronic controls
  - methods of temperature and pressure control.

Pump and compressor systems include:

- refrigeration compressors
- chilled water pumps
- circulating pumps
- other applications as required.

Insulation includes:

- rock wool
- fibreglass
- felt
- insulation protection, including:
  - sheet metal
  - plastic.

Pipe fixings include:

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

Materials include:

- copper
- steel
- other approved materials.

Jointing methods include:

- mechanical joints
- brazing
- threading.

Installation requirements include:

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

Plans:

- include:
  - elevations
  - sections
  - details
  - cross-sections
  - isometrics
  - axonometrics
  - schematics
- may be produced using:
  - pencil
  - Indian ink
  - pigment liner
  - computer generation.

Specification includes:	• materials • workmanship • jointing • manufacturer requirements • clipping • appliances • valves • details of specialised components.
Testing includes:	• leak testing • flow testing • pressure testing • inspection checklist • quality assurance (QA) audit.
Commissioning schedule includes:	• checking for burrs and obstructions • checking fit for purpose • purging system • removing contaminants • commissioning appliances.
Operation and maintenance manual includes:	• regular inspection • leak detection • check for blockages • regular maintenance requirements.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment	• This unit of competency could be assessed on its own or as part of an integrated assessment activity involving preparation of designs for two hydronic heating and cooling systems for different applications, including plans, specifications and all associated documentation.

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 hydronic heating and cooling systems
  - producing an appropriate layout for hydronic heating and cooling systems, planned in accordance with manufacturer and regulatory requirements
  - calculating pipe sizes in accordance with regulations and manufacturer requirements
  - designing hydronic circuits
  - designing and sizing hydronic systems using appropriate software
  - preparing plans for a range of hydronic systems
  - preparing specifications for hydronic heating and cooling systems
  - preparing testing and commissioning schedules
  - producing operation and maintenance manuals.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environments appropriate to a range of situations and activities
  - computers and software
  - materials appropriate to application activities
  - appropriate documentation and data related to tasks, including plans and specifications of an appropriate building
  - tools and equipment relevant to planning processes, including calculators.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPPS5000A Design gas bulk storage systems

Unit Descriptor

This unit of competency specifies the outcomes required to design gas bulk storage systems, determine relevant installation details and prepare system specifications for a range of residential, commercial and industrial buildings.

Employability Skills

This unit has employability skills.

Application of the Unit

This unit of competency supports the attainment of skills and knowledge required for competent workplace performance in a consultancy or supervisory capacity in relation to plumbing services and hydraulics.

Unit Sector

Plumbing and services

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate design parameters.	1.1 ***Scope of work*** is established for gas bulk storage systems for a range of projects. 1.2 ***Design requirements*** are determined from plans, specifications and client briefs. 1.3 ***Cost-benefit analysis*** is conducted comparing a range of pipe materials and system designs. 1.4 ***Statutory and regulatory requirements and Australian and New Zealand standards*** for the design of gas bulk storage systems are 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 ***Performance requirements*** are established.
2. Plan and detail system components.	2.1 Layout of a liquid petroleum gas (LPG) bulk storage installation is determined in accordance with regulatory authorities. 2.2 Site plans for bulk installations are prepared, including the ***layout of pipework systems***. 2.3 Fire protection systems are specified in accordance with Australian and New Zealand standards and deluge systems are detailed. 2.4 ***Control valves and fittings*** are designed and detailed. 2.5 Content gauges are analysed and located in accordance with code requirements, and ***meters*** and regulators are specified. 2.6 Vaporisers are evaluated and specified and vaporisation rates are calculated. 2.7 ***System calculations*** are performed for a range of applications in accordance with regulations and manufacturer requirements. 2.8 ***Pipe fixings*** are designed for a range of applications. 2.9 Approved ***materials, jointing methods*** and all ***installation requirements*** for gas bulk storage systems are specified.

3. Design and size systems.	3.1 Gas bulk storage systems and circuits are designed for a range of applications. 3.2 Deluge systems are designed. 3.3 Gas bulk storage systems are designed and sized using computer software packages.
4. Prepare documentation.	4.1 ***Plans*** are prepared for a range of gas bulk storage systems. 4.2 A ***specification*** for a gas bulk storage system is prepared. 4.3 A ***testing*** and ***commissioning schedule*** is prepared. 4.4 An ***operation and maintenance manual*** is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources.

Required knowledge:

- requirements of state regulatory authorities, Australian standards and manufacturer specifications, including hazards identified in relation to devices and systems used
- common terminology and definitions used in design of gas bulk storage systems for all classes of building
- drafting principles
- nature of materials used and effects of performance under various conditions
- principles of technology in the design of gas bulk storage systems
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Scope of work includes:

- interpretation of plans and specifications
  - sizing and documenting layout of gas bulk storage installations, including fire protection systems such as:
  - chemical injection
  - extinguishers
  - monitors
  - hydrants
  - hose reels
  - spray systems
  - portable and fixed types of firefighting equipment
- principles of operation of the various types of LPG components and fault conditions in LPG components.

Design requirements include:

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

Cost-benefit analysis includes:

- comparison of range of suitable materials and system choices available to enable cost-effective choices to be made without compromising the integrity of the project.

Statutory and regulatory requirements and Australian and New Zealand standards include:

- acts, regulations and local and state government policies, including group and strata titling
- AS5601 (AG601) Gas installation
- AS/NZS1596 The storage and handling of LP gas
- AS2430 Classification of hazardous areas
- Building Code of Australia.

Manufacturer requirements include:

- specifications
- sizing tables
- pump tables
- technical and trade manuals.

Desktop study includes collection and interpretation of existing data for design purposes from:

- council plans
- developer plans
- architectural and building plans
- other documents, including:
  - forms
  - applications
  - other reports as available.

Performance requirements include:

- operational and safety requirements, established using Australian and New Zealand standards, and local and state authority plans.

Layout of pipework systems should:

- not unduly affect building integrity and aesthetic appeal
- have principles of economy, serviceability, durability and fit for use applied.

Control valves and fittings include:

- individual valve types
- applications of valves and code requirements for installation
- emergency shutdown valves
- excess flow valves
- hydrostatic relief valves
- fittings may include:
  - junctions
  - bends
  - inspection openings
  - traps
  - staged regulators
  - meters
  - vaporisers
  - reflux valves.

Meters include:

- mass flow
- positive displacement
- turbine.

System calculations include:

- pipe sizing calculations
- determination of flow and appliance loadings
- interpretation of design charts and tables.

Pipe fixings include:

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

Materials include:

- copper
- high density polyethylene (HDPE)
- concrete
- fittings and valves
- measures to prevent the spread of fire.

Jointing methods include:
- mechanical joints
- solvent cement welding
- brazing
- threading.

Installation requirements include:
- jointing requirements
- level of workmanship
- clipping
- bedding
- concrete support
- installation details.

Plans:
- include
  - elevations
  - sections
  - details
  - cross-sections
  - isometrics
  - axonometrics
  - schematics
- may be produced using:
  - pencil
  - Indian ink
  - pigment liner
  - computer generation.

Specification includes:
- materials
- workmanship
- jointing
- valves
- manufacturer requirements
- clipping
- details of specialised components.

Testing includes:
- air pressure test
- gas leak test
- quality assurance (QA) audit.

Commissioning schedule includes:
- leak check
- flow testing
- vaporisation rate check.

Operation and maintenance manual includes:
- yearly inspection
- leak detection
- regular maintenance requirements
- safety inspection.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment

- This unit of competency could be assessed on its own or as part of an integrated assessment activity involving preparation of designs for two gas bulk storage systems for different applications, including plans, specifications and all associated documentation.

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 gas bulk storage systems
  - planning and detailing system components, including:
    - valves
    - vaporisers
    - regulators
    - meters
    - pipes
  - designing a deluge system
  - designing and sizing gas bulk storage systems using appropriate software
  - preparing plans for a range of gas bulk storage systems to industry standards
  - preparing specifications for gas bulk storage system installations
  - preparing testing and commissioning schedules
  - producing operation and maintenance manuals.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environments appropriate to a range of situations and activities
  - computers and software
  - materials appropriate to application activities
  - appropriate documentation and data related to tasks, including plans and specifications of an appropriate building
  - tools and equipment relevant to planning processes, including calculators.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPPS5001A Design industrial gas systems

Unit Descriptor

This unit of competency specifies the outcomes required to design industrial gas systems in compliance with Industrial Equipment Code (IEC) requirements, including the design of valve trains, interlocks, pipework and equipment.

Employability Skills

This unit has employability skills.

Application of the Unit

This unit of competency supports the attainment of skills and knowledge required for competent workplace performance in a consultancy or supervisory capacity in relation to plumbing services and hydraulics.

Unit Sector

Plumbing and services

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate design parameters.	1.1 ***Scope of work*** is established for industrial gas systems. 1.2 ***Design requirements*** are determined from plans, specifications and client briefs. 1.3 ***Cost-benefit analysis*** is conducted comparing a range of pipe materials and system designs. 1.4 ***Statutory and regulatory requirements, codes and Australian and New Zealand standards*** for the design of industrial gas systems are 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 Factors that contribute to quality, safety and time efficiency are determined. 1.8 ***Performance requirements*** are established.
2. Plan and detail system components.	2.1 ***Layout of pipework systems*** and type and location of ***fittings and valves*** are planned. 2.2 ***Valve trains*** are designed and specified for a range of industrial gas installations. 2.3 Interlocks and accessories are designed and detailed and components are analysed, selected and located. 2.4 Methods for protection from harsh environments, heat and vibration and combustion air systems are selected. 2.5 Air systems, appliances, closed loop systems, and burner systems and controls are detailed and specified. 2.6 Remote filling systems and pipework are detailed for a given installation and designed in accordance with the IEC. 2.7 ***System calculations*** are performed for a range of industrial gas installations. 2.8 Approved ***materials, jointing methods, pipe fixings*** and all ***installation requirements*** for industrial gas systems are specified.

3. Design and size systems.	3.1 Industrial gas systems are designed for a range of applications. 3.2 Industrial gas systems are designed and sized using computer software packages.
4. Prepare documentation.	4.1 ***Plans*** are prepared for a range of industrial gas systems. 4.2 A ***specification*** for an industrial gas system is prepared. 4.3 A ***testing*** and ***commissioning schedule*** is prepared. 4.4 An ***operation and maintenance manual*** is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources.

Required knowledge:

- application of state regulatory authority requirements; Australian standards, including AS5601 (AG601) Gas installation; other codes or standard operating procedures; and manufacturer specifications, including hazards identified in relation to devices and systems used
- common terminology and definitions used in the design of industrial gas systems
- principles of technology in the design of industrial gas systems
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Scope of work includes:

- interpretation of plans and specifications
- sizing and documenting layout of industrial gas systems for applications, including:
  - types of product and service
  - quantities
  - characteristics
  - sizes
  - patterns
  - dimensions
  - location
  - surfaces
  - compatibility.

Design requirements include:	• owner requirements • architectural specifications • builder specifications • specialist use applications.
Cost-benefit analysis includes:	• comparison of range of suitable materials and system choices available to enable cost-effective choices to be made without compromising the integrity of the project.
Statutory, regulatory requirements, codes and Australian and New Zealand standards include:	• acts, regulations and local and state government policies, including group and strata titling • Gas Act 1965 and amendments • gas regulations • AS5601 (AG601) Gas installation • AS/NZS1596 The storage and handling of LP gas • other Australian and New Zealand standards • Building Code of Australia.
Manufacturer requirements include:	• material specifications • sizing tables • pump tables • technical and trade manuals.

Desktop study includes collection and interpretation of existing data for design purposes from:	• council plans
	• developer plans
	• architectural and building plans
	• other documents, including:
	  • forms
	  • applications
	  • other reports as available.

Performance requirements include:	• pipe grades, cover, flow conditions and discharge requirements, established using Australian and New Zealand standards and local authority plans.
Layout of pipework systems should:	• not unduly affect building integrity and aesthetic appeal • have principles of economy, serviceability, durability and fit for use applied.
Fittings and valves include:	• regulators • meters • relief valves.
Valve trains include:	• analysing the operation of valve components • sizing and selecting components using manufacturer data.

System calculations include:	• pipe sizing calculations • determination of flow and consumption • interpretation of design charts and tables • calculation of purge times • calculation of explosion relief.
Materials include:	• copper • high density polyethylene (HDPE) • fittings and appliances, including measures to prevent the spread of fire.
Jointing methods include:	• mechanical joints • gluing • solvent cement welding • brazing • threading.
Pipe fixings include:	• wall and ceiling brackets • saddles • hanging brackets • anchors • material requirements • corrosion protection • bracket spacing.
Installation requirements include:	• jointing requirements • level of workmanship • clipping • installation details.

Plans:	• include:
	  • elevations
	  • sections
	  • details
	  • cross-sections
	  • isometrics
	  • axonometrics
	  • schematics
	• may be produced using:
	  • pencil
	  • Indian ink
	  • pigment liner
	  • computer generation.

Specification includes:	• materials • workmanship • jointing • valves • manufacturer requirements • clipping • details of specialised components.
Testing includes:	• air pressure test • gas leak test • quality assurance (QA) audit.
Commissioning schedule includes:	• leak check • flow testing • vaporisation rate check.
Operation and maintenance manual includes:	• yearly inspection • leak detection • regular maintenance requirements • safety inspection.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment	• This unit of competency could be assessed on its own or as part of an integrated assessment activity involving preparation of designs for two industrial gas systems for different applications, including plans, specifications and all associated documentation.

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, Gas Act 1965 and amendments, manufacturer and Australian and New Zealand standard requirements for a range of industrial gas systems
  - planning and detailing system components, including:
    - regulators
    - burners
    - controls
  - designing and sizing industrial gas systems
  - preparing plans for a range of industrial gas systems to industry standards
  - preparing specifications for industrial gas systems
  - preparing testing and commissioning schedules
  - producing operation and maintenance manuals.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - a comprehensive selection of reference texts
  - documentation relating to Australian standards and product information, including:
    - design brief drawings
    - specifications
    - codes
    - design concepts
    - construction schedule
    - other necessary supporting manufacturers' literature
  - research resources, including manufacturers' data.
  - access to relevant legislation, regulations and codes of practice
  - workplace or simulated environments appropriate to a range of situations and activities
  - computers and software
  - materials appropriate to application activities
  - tools and equipment relevant to planning processes, including calculators.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the

requirements of the unit of competency and the work being performed.

BCPPS5002A Design gas reticulation systems

Unit Descriptor

This unit of competency specifies the outcomes required to design and size gas reticulation systems, including determining material, placement and ventilation requirements. The unit also covers the analysis and interpretation of relevant gas codes and standards, the preparation of documentation for testing and commissioning, and testing for safe operation.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the attainment of skills and knowledge required for competent workplace performance in a consultancy or supervisory capacity in relation to plumbing services and hydraulics.

Unit Sector Plumbing and services

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate design parameters.	1.1 ***Scope of work*** is established for gas reticulation systems. 1.2 ***Design requirements*** are determined from plans, specifications and client briefs. 1.3 ***Cost-benefit analysis*** is conducted comparing a range of pipe materials and system designs. 1.4 ***Statutory and regulatory requirements and Australian and New Zealand standards*** for the design of gas reticulation systems are 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 ***Performance requirements*** are established.
2. Plan and detail system components.	2.1 ***Layout of pipework systems*** and type and location of ***fittings and valves*** are planned. 2.2 Pipe sizes are ***calculated*** for a range of applications. 2.3 ***Ventilation and flue requirements*** are specified for a range of applications. 2.4 Gas metering and measurement of gas consumption are conducted. 2.5 Distribution pressures and ***specifications of regulators and appliances*** are detailed for a range of applications. 2.6 ***Cylinder and tank systems are designed*** and detailed. 2.7 Safety, ignition, thermostat and gas control devices are specified in compliance with relevant standards and codes. 2.8 ***Pipe fixings*** are designed for a range of applications. 2.9 Approved ***materials, jointing methods*** and all ***installation requirements*** for gas reticulation systems are specified.

3. Design and size systems.	3.1 Gas reticulation systems are designed for a range of applications. 3.2 Gas reticulation systems are designed and sized using computer software packages.
4. Prepare documentation.	4.1 ***Plans*** are prepared for a range of gas reticulation systems. 4.2 A ***specification*** for a gas reticulation system is prepared. 4.3 A ***testing*** and ***commissioning schedule*** is prepared. 4.4 An ***operation and maintenance manual*** is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources.

Required knowledge:

- requirements of state regulatory authorities, Australian standards and manufacturer specifications, including hazards identified in relation to devices and systems used
- common terminology and definitions used in design of gas reticulation systems for all classes of building
- principles of technology used in design of gas reticulation systems
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Scope of work:	• includes interpretation of plans and specifications • includes sizing and documenting layout of gas reticulation systems for applications including residential, commercial and industrial • may be for new projects or an existing structure being renovated, extended, restored or maintained.
Design requirements include:	• owner requirements • architectural specifications • builder specifications • specialist use applications.

Cost-benefit analysis includes:	• comparison of range of suitable materials and system choices available to enable cost-effective choices to be made without compromising the integrity of the project.
Statutory and regulatory requirements and Australian and New Zealand standards include:	• acts, regulations and local and state government policies, including group and strata titling • AS/NZS1596 The storage and handling of LP gas • AS5601 (AG601) Gas installation • manufacturer requirements • industry standards • gas utility/supplier information and requirements • Gas Act 1965 and amendments • gas regulations • Building Code of Australia.
Manufacturer requirements includes:	• material specifications • sizing tables • pump tables • technical and trade manuals.

Desktop study includes collection and interpretation of existing data for design purposes from:	• council plans
	• developer plans
	• architectural and building plans
	• other documents, including:
	  • forms
	  • applications
	  • other reports as available.

Layout of pipework systems should:	• not unduly affect building integrity and aesthetic appeal • have principles of economy, serviceability, durability and fit for use applied.
Fittings and valves include:	• regulators • tees • bends • unions • couplings.
Calculations include:	• sizing • energy • pressure • gas volume • storage.
Ventilation and flue requirements include:	• appliance flue design and ventilation requirements in accordance with standards, regulations and gas authority requirements.

Specifications of regulators include:

- types of gas regulators
- gas regulation method
- principles of operation
- adjustment procedures of regulators
- sizing of regulators
- excessive pressure protection types of regulators
- selection and installation requirements
- identification, analysis and documentation of regulator faults.

Specifications of appliances include:

- domestic appliance design
- commercial appliances
- industrial appliances
- construction of the appliance
- components
- electronic controls.

Design of cylinder and tank systems is based on:

- gas storage requirements calculations
- anticipated use
- appropriate time period between refilling.

Pipe fixings include:

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

Materials include:

- copper
- galvanised steel
- unplasticised polyvinyl chloride (uPVC)
- polyethylene
- fittings and fixtures.

Jointing methods include:

- rubber ring
- mechanical joints
- gluing
- solvent cement welding
- brazing and threading.

Installation requirements include:

- jointing requirements
- level of workmanship
- clipping, bedding and installation detail
- installation requirements for mobile, marine installation and portable appliances (high and low-pressure).

Plans:

- include:
  - elevations
  - sections
  - details
  - cross-sections
  - isometrics
  - axonometrics
  - schematics
- may be produced using:
  - pencil
  - Indian ink
  - pigment liner
  - computer generation.

Specification includes:

- materials
- workmanship
- jointing
- manufacturer requirements
- clipping
- bedding
- appliances
- valves
- details of specialised components.

Testing includes:

- bubble leak testing
- electronic gas leak detection
- flow testing
- pressure testing
- inspection checklist
- quality assurance (QA) audit.

Commissioning schedule includes:

- checking for burrs and obstructions
- confirming fit for purpose
- purging system
- removing contaminants
- commissioning appliances.

Operation and maintenance manual includes:

- regular inspection
- leak detection
- check for blockages
- regular maintenance requirements.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment

- This unit of competency could be assessed on its own or as part of an integrated assessment activity involving preparation of designs for two gas reticulation systems for different applications, including plans, specifications and all associated documentation.

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 gas reticulation systems
  - producing an appropriate layout for gas reticulation systems planned in accordance with manufacturer and regulatory requirements
  - calculating pipe sizes in accordance with regulations and manufacturer requirements
  - designing and sizing gas reticulation systems using appropriate software
  - preparing plans for a range of gas reticulation systems
  - preparing specifications for gas reticulation systems
  - preparing testing and commissioning schedules
  - producing operation and maintenance manuals.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environments appropriate to a range of situations and activities
  - computers and software
  - materials appropriate to application activities
  - appropriate documentation and data related to tasks, including plans and specifications of an appropriate building
  - tools and equipment relevant to planning processes, including calculators.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPPS5003A Design solar water heating systems

Unit Descriptor

This unit of competency specifies the outcomes required to design efficient, costeffective solar water heating systems for residential, commercial and industrial applications using proprietary components and manufacturer design information.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the needs of experienced tradespeople with a responsibility for designing solar water heating systems for residential, commercial and industrial buildings.

Unit Sector Plumbing and services

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate design parameters.	1.1 ***Scope of work*** is established for solar water heating system design. 1.2 ***Design requirements*** are determined from plans, specifications and client briefs. 1.3 Locations of solar collectors are assessed and effect of each location on ***efficiency*** is evaluated. 1.4 ***Cost-benefit analysis*** is conducted comparing a range of materials and system designs. 1.5 ***Environmental and community benefits*** of solar water heating systems are evaluated. 1.6 ***Statutory and regulatory requirements and Australian and New Zealand standards*** for the design of solar water heating systems are analysed and applied. 1.7 ***Manufacturer requirements*** and trade and technical manuals are interpreted. 1.8 Additional research including a ***desktop study*** is conducted to outline design parameters. 1.9 ***Performance requirements*** are established.

2. Plan and detail system components.	2.1 ***Layout of pipework systems*** and type and location of ***fittings and valves*** are planned. 2.2 Range configuration and application of ***proprietary solar hot water systems*** , and materials and valves to be selected, are evaluated. 2.3 ***Solar water heating system calculations*** are performed. 2.4 Typical configuration of a hydraulic circuit (flow and return) and its components for a pumped-storage solar water heating system is designed. 2.5 Water quality and water pre-treatment methods are specified. 2.6 Suitable types and levels of insulation for system components are specified and a range of methods for ***freezing protection*** is detailed. 2.7 ***Pipe size, velocity, flow and pressure calculations*** are performed for a range of applications. 2.8 ***Pipe fixings*** are designed for a range of applications. 2.9 Approved ***materials, jointing methods*** and all ***installation requirements*** for solar water heating systems are specified.
3. Design and size systems.	3.1 A ***solar collector*** is designed. 3.2 Residential, commercial and industrial solar water heating systems are designed. 3.3 Solar pre-heat systems are designed. 3.4 Solar pool and spa heating systems are designed. 3.5 Solar water heating systems are designed and sized using computer software packages.
4. Prepare documentation.	4.1 ***Plans*** are prepared for a range of solar water heating systems. 4.2 A ***specification*** for a solar water heating system is prepared. 4.3 A ***testing*** and ***commissioning schedule*** is prepared. 4.4 An ***operation and maintenance manual*** is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources.

Required knowledge:

- requirements of state regulatory authorities, Australian standards and manufacturer specifications, including hazards identified in relation to devices and systems used
- common terminology and definitions used in design of solar water heating systems
- principles of technology used in design of solar water heating systems
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Scope of work includes:

- interpretation of plans and specifications, and sizing and documenting layout of solar water heating systems for applications including residential, commercial and industrial buildings for new projects or an existing structure being renovated, extended, restored or maintained
- solar radiation calculations, including:
  - daily, monthly and yearly calculations
  - calculations of radiation falling on collectors
  - calculations of efficiency
- heat transfer mechanism analysis, including conduction, convection and radiation (long wave and short wave), and the evaluation of transmittance, absorption and emittance properties of materials used in solar collectors.

Design requirements include:

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

Efficiency includes:

- current and potential shading
- direction in relation to north
- magnetic north as opposed to true north
- angle of collector in relation to latitude
- efficiency in relation to:
  - location
  - ambient temperature
  - prevailing wind conditions
  - pollution
  - flow
- comparison of demand and efficiency curves for various types of solar collectors.

Cost-benefit analysis includes:

- comparison of range of suitable materials and system choices available to enable cost-effective choices to be made without compromising the integrity of the project
- comparison of initial set-up costs to the energy savings available and establishment of cost recovery period
- comparison and evaluation of capital cost, simple pay back and life cycle cost of solar and electric or gas hot water heaters.

Statutory and regulatory requirements and Australian and New Zealand standards include:

- acts, regulations, and local and state government policies
- Australian and New Zealand standards:
  - AS/NZS3500 National plumbing and drainage set
  - AS2200 Design charts for water supply and sewerage
  - AS2369.1 Materials for solar collectors for swimming pool heating - rubber materials
  - AS2369.2 Materials for solar collectors for swimming pool heating - flexible or plasticised polyvinyl chloride
  - AS2535.1 Test methods for solar collectors - thermal performance of glazed liquid heating collectors including pressure drop
  - AS2712 Solar and heat pump water heaters - design and construction
  - AS3634 Solar heating systems for swimming pools
  - AS4234 Solar water heaters - domestic and heat pump - calculation of energy consumption
  - AS4445.1 Solar heating - domestic water heating systems - performance rating procedure using indoor test methods
  - DR04527 Amendment 1 to AS2712 Solar water heaters - design and construction
- Building Code of Australia.

Manufacturer requirements include:

- material specifications
- sizing tables
- pump tables
- technical and trade manuals.

Desktop study includes:

- collection and interpretation of existing data for design purposes from:
  - council plans
  - developer plans
  - architectural and building plans
  - other documents, including:
    - forms
    - applications
    - other reports as available
- comparison of performance of various types of solar water heaters in terms of design, location and predicted solar fraction.

Performance requirements are established using Australian and New Zealand standards and local authority plans and may include:

- flow
- velocity
- pressure
- discharge requirements
- water quality and its effect on system life.

Layout of pipework systems :

- includes:
  - ring main
  - single pipe
  - dual feed
- should not unduly affect building integrity and aesthetic appeal
- should have principles of economy, serviceability, durability and fit for use applied.

Fittings and valves may include:

- fittings:
  - tees
  - elbows
  - bends
  - unions
- valves:
  - isolating
  - over temperature
  - pressure reduction
  - pressure limiting
  - backflow prevention
  - excess pressure
  - strainers
- frost protection devices
- location of valves.

Proprietary solar hot water systems include:

- close coupled
- split systems
- direct and indirect heating systems
- circulating systems
- alternative supplementary fuel sources, including:
  - wood
  - coal
  - gas
  - fuel oil
  - electricity
- pool heaters
- hot water heaters
- solar pre-heaters
- spa heaters
- clarifiers
- storage systems
- heat exchange systems
- sun track systems.

Solar water heating system calculations include:

- heat loss calculations, including:
  - standing losses
  - overnight losses
  - collector losses
- energy balance equation
- volume calculations
- flow calculations
- circulation calculations
- temperature and energy equations
- varying inlet temperature and flow rate effect on the performance of a solar collector.

Components include:

- suitable type and size of circulating pumps
- flow and return pipework
- valves
- fittings
- collectors
- storage vessels
- supplementary heat sources
- electronics
- timers and mechanical components
- heat exchangers
- expansion tanks
- filters
- differential controllers
- insulation
- support frames
- overflows
- safe trays.

Freezing protection methods include:	• dump valves • circulating systems • heat trace systems.
Pipe size, velocity, flow and pressure calculations include:	• rate of discharge • volume • temperature.
Pipe fixings include:	• wall and ceiling brackets • saddles • hanging brackets • anchors • material requirements • corrosion protection • bracket spacing.
Materials include:	• copper • polybutylene • glass • galvanised steel • other approved pipe materials • protective coatings • fittings and fixtures.
Jointing methods include:	• compression • brazing • threading • flaring • soldering • mechanical joints.
Installation requirements include:	• jointing requirements • level of workmanship • clipping • roof support • installation details.
Solar collector design includes:	• fin and tube collectors • pipe collectors • insulation • glass • box • sun tracking systems • pre-heat systems.

Plans :

- include:
  - elevations
  - sections
  - details
  - cross-sections
  - isometrics
  - axonometrics
  - schematics
- may be produced using:
  - pencil
  - Indian ink
  - pigment liner
  - computer generation.

Specification includes:

- materials
- workmanship
- jointing
- manufacturer requirements
- clipping
- valve selection
- details of specialised components.

Testing includes:

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

Commissioning schedule includes:

- pump commissioning
- flow test
- pressure test
- valve operation
- leak check
- system purge.

Operation and maintenance manual includes:

- valve maintenance
- yearly inspection
- leak detection
- water and energy auditing
- yearly maintenance requirements
- pump maintenance.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment

- This unit of competency could be assessed on its own or as part of an integrated assessment activity involving preparation of designs for solar water heating systems for different applications, including plans, specifications and all associated documentation.

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 solar water heating systems
  - conducting a cost-benefit analysis
  - planning and detailing system components, including:
    - circulating systems
    - solar collectors
    - valve and piping systems
  - designing a range of residential, commercial and industrial solar water heating systems
  - designing solar pre-heat systems
  - designing solar pool and spa heating systems
  - preparing plans for a range of solar water heating systems
  - preparing specifications for solar water heating systems
  - preparing testing and commissioning schedules
  - producing operation and maintenance manuals.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - a comprehensive selection of reference texts
  - Australian standards and product information relating to documentation, including:
    - design brief drawings
    - specifications
    - codes
    - design concepts
    - construction schedule
    - other necessary supporting manufacturers' literature
  - research resources, including manufacturers' data
  - access to relevant legislation, regulations and codes of practice
  - workplace or simulated environments appropriate to a range of situations and activities
    - computers and software
    - materials appropriate to application activities
    - tools and equipment relevant to planning processes, including calculators.
  - Where applicable, physical resources should include equipment modified for people with disabilities.
  - Access must be provided to appropriate learning and/or assessment support when required.
  - Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that

may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPPS5004A Conduct a water audit and identify water-saving initiatives

Unit Descriptor

This unit of competency specifies the outcomes required to identify wasted water and any leaks in pipework and fixtures and, where water reduction is possible, types of water-saving devices that are appropriate. The unit also requires the preparation of a report that reflects this assessment.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the needs of experienced tradespeople with a responsibility for conducting water and energy audits and for recommending water-saving initiatives.

Unit Sector Plumbing and services

ELEMENT	PERFORMANCE CRITERIA
1. Calculate water usage.	1.1 ***Scope of work*** is established for water auditing. 1.2 ***Client requirements*** are identified from plans, specifications and client briefs. 1.3 ***Types of meter and flow measuring devices*** and their use and location are specified. 1.4 ***Flow and pressure tests*** are conducted and the flows at outlets are calculated. 1.5 Expected and anticipated water use are compared to actual use and difference is calculated. 1.6 ***Statutory and local government regulatory requirements*** for the use of water are interpreted and applied. 1.7 ***Manufacturer requirements*** and trade and technical manuals are interpreted. 1.8 A ***desktop study*** is conducted and performance requirements are established.
2. Identify excessive water and energy usage.	2.1 ***Leak identification processes*** are implemented. 2.2 Flows are measured and evaluated against national and industry standards. 2.3 Suitability of existing fixtures and fittings is evaluated against new technology. 2.4 Water use times are identified and compared to optimal timing. 2.5 Existing inefficient system conditions such as dead legs are identified and analysed. 2.6 Pressure test is conducted and consequences of high and low pressures are identified and compared to industry standards.

3. Evaluate measures to conserve water and energy.	3.1 Flow restrictors, ***sensors*** and pressure limiting devices are specified for a range of applications. 3.2 ***Automatic systems*** are specified for a range of applications. 3.3 ***Alternative processes and practices*** are evaluated for optimum water and energy usage. 3.4 ***Alternative fixtures and fittings*** are evaluated for optimum water and energy usage. 3.5 ***Rainwater harvesting*** techniques and processes are applied. 3.6 ***Recycling and re-use processes*** are designed.
4. Report findings.	4.1 ***Cost-benefit analysis*** is conducted, including the investment return period. 4.2 ***Water and energy audit*** report is prepared. 4.3 Resultant environmental benefits and water and energy savings are identified and reported.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- accurate application of design principles relating to hydraulic systems, design concepts, and measurements and calculations
- application and interpretation of documentation from a wide range of sources, including legislation, standards, drawings and specifications
- compliance with occupational health and safety and organisational quality procedures and processes.

Required knowledge:

- terminology and definitions used in hydraulic design
- installation methods used in hydraulic systems
- hazards associated with devices and systems used in the hydraulic sector
- requirements of state regulatory authorities, Australian and New Zealand standards, manufacturer specifications, Building Code of Australia (BCA) and other applicable codes or standard operating procedures relevant to the sector
- nature of materials and effect of their performance in a variety of conditions
- preparation and interpretation of work drawings and specifications
- variety of applications of technology principles in design of water and energy-efficient usage systems for all classes of building.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Scope of work includes:

- identifying:
  - wasted water
  - water-saving initiatives
  - alternative procedures, practices and products that reduce water and energy consumption
- compiling reports
- producing a cost-benefit analysis.

Client requirements include:

- reduction in water and energy costs
- more efficient use of water resources
- reserve capacity
- compliance with regulatory requirements.

Types of meter and flow measuring devices include:

- direct
- indirect
- mechanical
- electronic
- in-line
- hand-held
- applications may include:
  - trade waste
  - sanitation
  - irrigation
  - mechanical
  - domestic supply.

Flow and pressure tests include:

- on-site measurement of flow (l/s), velocity (m/s) and pressure (Kpa)
- interpretation of flow and pressure tests conducted by a contractor.

Statutory and local government regulatory requirements include:

- acts and regulations
- state and local government policies
- BCA.

Manufacturer requirements include:

- material specifications
- sizing tables
- pump tables
- technical and trade manuals.

Desktop study includes:

- research and evaluation of water-saving products, processes and procedures currently available.

Performance requirements include:

- flow, velocity, pressure and discharge requirements, established using Australian and New Zealand standards, local authority plans and BCA.

Leak identification processes include:

- metering
- electronic leak detection
- pipe inspection cameras
- listening devices.

Sensors include:

- moisture
- high and low level
- entry and exit
- motion
- heat
- energy.

Automatic systems include:

- sprinkler
- electronic and mechanical timer
- sun-tracking
- wind-activated
- pressure-activated
- use-activated.

Alternative processes and practices include:

- processes:
  - such as wash-down processes and order of operation
  - alternatives may include:
    - discontinuation of a process
    - modification of a process
    - change in materials used in a process
    - change in timing of a process
- practices:
  - watering before sunrise and after sunset
  - washing teeth with the tap off
  - running dishwashers and washing machines with full loads
  - testing pipe systems with air instead of water.

Alternative fixtures and fittings include:	• irrigation systems
	• solar hot water systems
	• continuous-flow gas water heaters
	• heat-pump hot water systems
	• low-flow shower roses
	• outlet-flow control devices
	• low-energy and water-use appliances, including:
	  • dishwashers
	  • washing machines
	  • air conditioners
	  • cooling towers
	  • refrigerators
	  • freezers
	  • low volume toilet flushing systems
	  • cisterns
	  • urinals
	  • tapware.

Rainwater harvesting includes:	• collection, storage and distribution of rainwater, including the use of tanks and dams.
Recycling and re-use processes include:	• recycling of water from washing down floors • re-use of rinse water from washing processes • grey water re-use options.
Cost-benefit analysis includes:	• comparison of installation and set-up costs and cost recovery period with environmental water and energy savings.
Water and energy audit report is a comprehensive report written to industry standards that includes:	• methodology • results • analysis • conclusions • recommendations.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment	• This unit of competency could be assessed on its own or as part of an integrated assessment activity involving audit of water and energy use in at least two different types of building and the preparation of comprehensive reports.

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:
  - conducting a water audit
  - conducting pressure and flow measurements
  - interpreting and applying statutory and local government requirements for the use of water and energy
  - reporting water wasting practices and processes, including leaks
  - specifying sensors and automatic systems for a range of applications
  - recommending recycling and re-use processes
  - preparing a water and energy audit report
  - conducting a cost-benefit analysis, including investment return period
  - identifying and reporting on environmental benefits and water and energy savings.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environment
  - tools and equipment appropriate to the planning process, including calculators
  - computers and software
  - support materials appropriate to activity
  - plans and specifications of an appropriate building
  - research resources, including systems literature and data.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPPS5005A Design grey water re-use systems in sewered areas

Unit Descriptor

This unit of competency specifies the outcomes required to design grey water re-use systems in sewered areas. The unit requires the ability to consider legislation; risk implications; and collection, treatment, diversion and storage options when designing these systems.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the needs of experienced tradespeople with a responsibility for designing grey water re-use systems in sewered areas.

Unit Sector Plumbing and services

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate design parameters.	1.1 ***Scope of work*** is established for design of grey water re-use systems for wide span and high-rise building projects. 1.2 ***Design requirements*** are determined from plans, specifications and client briefs. 1.3 Potential household or community ***health and environmental risks*** are identified and ***measures to protect public health*** are identified and implemented. 1.4 ***Cost-benefit analysis*** is conducted. 1.5 ***National water programs, statutory and regulatory requirements, and Australian and New Zealand standards*** for the design of grey water re-use systems are interpreted, analysed and applied. 1.6 ***Manufacturer requirements*** and trade and technical manuals are interpreted. 1.7 Additional research including a ***desktop study*** is conducted to outline design parameters. 1.8 ***Performance requirements*** are established.

2.	Plan and detail system components.	2.1 Primary, secondary and advanced secondary treatment and tertiary systems are detailed. 2.2 ***Layout of pipework systems*** and type and location of ***fittings, valves, indexing valves and other system components*** are planned. 2.3 Changes to building drainage system are designed and detailed, and inspection requirements are identified. 2.4 Diversion and storage options are evaluated, problems identified and solutions applied. 2.5 Diversion to sewer options, wet weather storage options and ***land application options*** are detailed. 2.6 Stored and pressurised wastewater systems for irrigation and toilet or urinal flushing are detailed. 2.7 ***Holding tanks*** and ***gullies*** are designed and detailed. 2.8 ***Pipe size and pump duty calculations*** are made and pumpwell, ***pump and pump control requirements*** are sized and detailed. 2.9 Approved ***materials*** and ***jointing methods*** for grey water re-use systems are evaluated, ***pipe fixings*** are designed and ***installation requirements*** are specified.
3.	Design and size systems.	3.1 Grey water re-use systems are designed for a range of residential, commercial and industrial applications. 3.2 Grey water re-use systems are designed and sized using computer software packages.
4.	Prepare documentation.	4.1 ***Plans*** are prepared for a range of grey water re-use systems. 4.2 A ***specification*** for a grey water re-use system is prepared. 4.3 A ***testing*** and ***commissioning schedule*** is prepared. 4.4 An ***operation and maintenance manual*** is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- application of design concepts and principles relating to hydraulic systems
- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- reading skills, including the ability to read and interpret documentation from a variety of sources, including:
  - drawings and specifications
  - regulatory authority requirements
  - standards
  - codes
  - legislation.

Required knowledge:

- nature of materials and effect of their performance in a variety of conditions
- occupational health and safety and organisational quality procedures and processes
- principles of technology in the design of grey water re-use systems for all classes of building
- terminology and definitions used in hydraulic design
- installation methods used in hydraulic systems
- hazards associated with devices and systems used in the hydraulic sector
- Australian and New Zealand standards, manufacturer specifications, Building Code of Australia (BCA) and other applicable codes or standard operating procedures relevant to the sector
- work drawings and specifications
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Scope of work:

- includes interpretation of plans and specifications
- includes sizing and documenting layout of grey water re-use systems for applications including residential, commercial and industrial
- may be for new projects or an existing structure being renovated, extended, restored or maintained.

Design requirements include:

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

Health and environmental risks include:

- health risks:
  - salmonellosis (food poisoning)
  - typhoid fever
  - bacillary dysentery
  - gastroenteritis
  - cholera
  - poliomyelitis
  - meningitis
  - hepatitis
  - fever
  - common colds
  - diarrhoea
  - infectious hepatitis
  - respiratory infections, such as pneumonia
  - acute enteritis
  - giardiasis
  - dysentery
  - toxoplasmosis
  - digestive and nutritional disturbances
  - abdominal pain
  - vomiting
  - restlessness
  - coughing
  - chest pain
  - anaemia
  - weight loss
  - muscle aches
  - neurological symptoms, including nervousness and insomnia
  - anorexia
  - hookworm disease
  - taeniasis
  - helminthes, including flukes and worms
- environmental risks:
  - algal blooms
  - oxygen depletion
  - excess nutrient loads
  - fish kills.

Measures to protect public health include:

- disinfection and sterilisation
- separation barriers
- set back distances
- contact avoidance
- contact minimisation
- timing discharges
- wet weather storage
- education
- legislation
- licensing
- auditing
- maintenance.

Cost-benefit analysis includes:

- comparison of range of suitable treatment, disposal options, materials, system choices and disinfection options
- water savings and environmental benefits compared to initial and ongoing maintenance costs.

National water programs, statutory and regulatory requirements, and Australian and New Zealand standards include:

- acts and regulations
- local and state government policies, including group and strata titling
- Australian and New Zealand standard requirements, including:
  - AS/NZS3500 National plumbing and drainage set
  - AS/NZS1546 On-site domestic wastewater treatment units
  - AS/NZS1547 On-site domestic wastewater management
  - AS2200 Design charts for water supply and sewerage
- BCA.

Manufacturer requirements include:

- material specifications
- sizing tables
- pump tables
- technical and trade manuals.

Desktop study includes collection and interpretation of existing data for design purposes from:

- manufacturers' data
- council plans
- developer plans
- architectural and building plans
- other documents, including:
  - policies
  - brochures
  - forms
  - applications
  - other reports as available.

Performance requirements include:

- compliance limits for:
  - pH
  - nutrients
  - phosphates
  - bacteria levels
  - chlorine levels
- requirements established using Australian and New Zealand standards and local authority plans, including:
  - pipe grades
  - cover
  - flow conditions
  - discharge.

Layout of pipework systems:	• includes:
	  • gravity systems
	  • pumped and rising mains
	  • drainage systems
	  • elevated pipework systems
	  • stack systems including fully vented, fully vented modified, single stack and single stack modified systems
	• should not unduly affect building integrity and aesthetic appeal
	• should have principles of economy, serviceability, durability and fit for use applied.

Fittings, valves, indexing valves and other system components include:	• first junctions • bends • inspection openings • traps • reflux valves.
Land application options include:	• shallow subsurface irrigation • covered surface irrigation • surface irrigation systems open to atmospheric pressure.
Holding tanks include:	• sizing • connections • pumps • valves • switches.
Gullies include:	• diversion of gullies to holding tanks or treatment systems • design and installation of gullies for the collection of grey water.
Pipe size and pump duty calculations include:	• reduced level calculations • gradient calculations • pipe sizing calculations • determination of flow and fixture loadings • interpretation of design charts and tables.

Pumpwell, pump and pump control requirements include:	• pumpwell sizing • detailing • capacity • warning system • automatic controls • high and low-level water controls and alarms • corrosion-resistant materials • macerator requirements • selection of pump type • pump sizing • installation and mounting requirements • valve requirements • inlet and outlet design requirements.
Materials include:	• unplasticised polyvinyl chloride (uPVC) • earthenware • high density polyethylene (HDPE) • low density polyethylene (LDPE) • concrete • fittings.
Jointing methods include:	• compression joints • mechanical joints • gluing • solvent cement • welding • brazing • threading.
Pipe fixings include:	• wall brackets • saddles • anchors • material requirements • corrosion protection • bracket spacing • bedding • concrete support • cover.
Installation requirements include:	• jointing requirements • level of workmanship • clipping • bedding • concrete support • installation details.

Plans:

- include:
  - elevations
  - sections
  - details
  - cross-sections
  - isometrics
  - axonometrics
  - schematics
- may be produced using:
  - pencil
  - Indian ink
  - pigment liner
  - computer generation.

Specification includes:

- materials
- workmanship
- jointing
- holding tanks
- manufacturer requirements
- clipping
- bedding
- concrete support
- detailing of specialised components.

Testing includes:

- hydrostatic test
- air pressure test
- drainage inspection
- quality assurance (QA) audit.

Commissioning schedule includes:

- balancing sprinklers
- pump settings
- flow and pressure adjustments
- system flushing
- leak check.

Operation and maintenance manual includes:

- regular inspections
- leak detection
- check for blockages
- surface ponding checks
- land application compliance checks
- pump maintenance
- ongoing maintenance requirements
- system operational parameter adjustments and checks, including:
  - pH
  - dissolved oxygen
  - suspended solids
  - nitrates
  - phosphates
  - chlorine levels.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment

- This unit of competency could be assessed on its own or as part of an integrated assessment activity involving preparation of two designs for a grey water re-use system for two different types of building, including plans, specifications and all associated documentation.

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 grey water re-use systems
  - planning and detailing system components, including:
    - indexing valves
    - pumpwells
    - holding tanks
    - piping systems
  - designing and sizing a grey water re-use system
  - preparing plans for a range of grey water re-use systems to industry standards
  - preparing specifications for a grey water re-use system
  - preparing testing and commissioning schedules
  - preparing operation and maintenance manuals.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environment
  - tools and equipment appropriate to the planning process, including calculators
  - computers and software
  - support materials appropriate to activity
  - plans and specifications of an appropriate building
  - research resources, including systems literature and data.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPPS5006A Design rainwater collection, storage, distribution and

Unit Descriptor

This unit of competency specifies the outcomes required to design systems for the collection, storage, distribution and re-use of rainwater for potable and non-potable uses, including irrigation, toilet flushing and other uses as defined by local authorities.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the attainment of skills and knowledge required for competent workplace performance in a consultancy or supervisory capacity in relation to the design of systems for the collection, storage, distribution and re-use of rainwater.

Unit Sector Plumbing and services

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate design parameters.	1.1 ***Scope of work*** is established for rainwater harvesting systems for wide span and high-rise building projects. 1.2 ***Design requirements*** are determined from plans, specifications and client briefs. 1.3 Potential ***contamination*** sources are analysed and solutions are applied. 1.4 Monthly and annual rainfall patterns and required rainwater storage volumes are established. 1.5 ***Cost-benefit analysis*** is conducted comparing a range of pipe materials and system designs. 1.6 ***Statutory, regulatory requirements and Australian and New Zealand standards*** for the design of rainwater harvesting systems are interpreted, analysed and applied. 1.7 ***Manufacturer requirements*** and trade and technical manuals are interpreted. 1.8 Additional research including a ***desktop study*** is conducted to outline design parameters. 1.9 ***Performance requirements*** are established.
2. Plan and detail system components.	2.1 ***Tank type*** and ***location*** are specified. 2.2 ***Layout of pipework systems*** and type and location of ***fittings and valves*** are planned. 2.3 ***First-flush systems*** are designed and detailed. 2.4 ***Strainers*** and ***water contamination solutions*** are specified. 2.5 ***Pipe size and pipe grade calculations*** are completed and ***pipe fixings*** are designed for a range of applications. 2.6 Separation of services and backflow prevention devices are designed and detailed. 2.7 Approved non-contaminating ***materials*** and ***jointing methods*** for rainwater harvesting are specified. 2.8 ***Pump and pump control requirements*** are sized and detailed. 2.9 ***Installation requirements*** are specified.

3. Design and size systems.	3.1 Rainwater harvesting systems are designed and detailed for a range of residential, commercial and industrial applications. 3.2 ***Rainwater re-use systems*** are designed and detailed. 3.3 Rainwater harvesting systems are designed and sized using computer software packages.
4. Prepare documentation.	4.1 ***Plans*** are prepared for a range of rainwater harvesting systems. 4.2 A ***specification*** for a rainwater harvesting system is prepared. 4.3 A ***testing*** and ***commissioning schedule*** is prepared. 4.4 An ***operation and maintenance manual*** is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources.

Required knowledge:

- 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
  - AS/NZS1546 On-site domestic wastewater treatment units
  - AS/NZS1547 On-site domestic wastewater management
  - AS2200 Design charts for water supply and sewerage
  - other standards, codes or standard operating procedures
- common terminology and definitions used in the design of rainwater collection, storage, distribution and re-use
- nature of materials used and effects of performance under various conditions
- principles of technology in the design of rainwater collection, storage, distribution and re-use for all classes of building
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Scope of work:

- includes:
  - rainfall analysis
  - volume calculations
  - interpretation of plans and specifications
  - sizing and documenting layout of rainwater harvesting systems for applications including residential, commercial and industrial
- may be for new projects or an existing structure being renovated, extended, restored or maintained.

Design requirements include:

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

Contamination includes:

- bacterial
- viral
- heavy metal
- organic
- inorganic
- taste
- odour.

Cost-benefit analysis includes:

- comparison of range of suitable materials and system choices available to enable cost-effective choices to be made without compromising the integrity of the project.

Statutory, regulatory requirements and Australian and New Zealand standards include:

- acts and regulations
- local and state government policies, including group and strata titling
- AS/NZS3500 National plumbing and drainage set
- AS2200 Design charts for water supply and sewerage
- Building Code of Australia.

Manufacturer requirements include:

- material specifications
- sizing tables
- pump tables
- technical and trade manuals.

Desktop study includes collection and interpretation of existing data for design purposes from:	• manufacturers' data
	• council plans
	• developer plans
	• architectural and building plans
	• other documents, including:
	  • forms
	  • applications
	  • sewer detail maps
	  • other reports as available.

Performance requirements include:	• pipe grades, cover, flow conditions and discharge requirements, established using Australian and New Zealand standards and local authority plans.

Tank type and location includes:	• tank type:
	  • concrete
	  • galvanised steel
	  • coloured steel
	  • plastic
	  • fibreglass
	  • polyethylene
	  • other approved materials
	• tank location:
	  • site plan
	  • reduced levels
	  • in-ground
	  • above-ground.

Layout of pipework systems:	• includes:
	  • gravity systems
	  • pumped systems
	• should not unduly affect building integrity and aesthetic appeal
	• should have principles of economy, serviceability, durability and fit for use applied.

Fittings and valves include:	• junctions • bends • inspection openings • backflow prevention devices • isolating valves.
First-flush systems include:	• manual • mechanical • electronic • volume-activated • time-activated • float-activated.

Strainers include:

- gutter
- downpipe
- tank inlet
- tank outlet
- pump inlet
- pump outlet
- tap
- point of use.

Water contamination solutions include:

- filters
- screens
- strainers
- disinfection
- chlorination
- reverse osmosis
- ozone
- ultraviolet.

Pipe size and pipe grade calculations include:

- reduced level calculations
- gradient calculations
- pipe sizing calculations
- determination of flow
- interpretation of design charts and tables.

Pipe fixings include:

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

Materials include:

- copper
- unplasticised polyvinyl chloride (uPVC)
- low density polyethylene (LDPE)
- high density polyethylene (HDPE)
- concrete
- fittings and fixtures.

Jointing methods include:

- mechanical joints
- gluing
- solvent cement
- welding
- brazing
- compression
- threading.

Pump and pump control requirements include:

- detailing
- capacity
- warning system
- automatic controls
- high and low-level water controls and alarms
- corrosion-resistant materials
- impeller sizing
- installation
- mounting
- valve
- inlet and outlet design
- pump selection and pump sizing based on:
  - flow
  - velocity
  - lift
  - pressure requirements.

Installation requirements include:

- independent anchoring of above-ground and in-ground tanks
- jointing
- level of workmanship
- clipping
- bedding
- concrete support
- installation details.

Rainwater re-use systems include:

- potable re-use
- irrigation applications
- toilet flushing
- laundry applications
- wash-down applications.

Plans:

- include:
  - elevations
  - sections
  - details
  - cross-sections
  - isometrics
  - axonometrics
  - schematics
- may be produced using:
  - pencil
  - Indian ink
  - pigment liner
  - computer generation.

Specification includes:	• materials • workmanship • jointing • manufacturer requirements • clipping • bedding • concrete support • detailing specialised components.
Testing includes:	• hydrostatic test • air pressure test • quality assurance (QA) audit.
Commissioning schedule includes:	• pressure testing • flow adjustments • pump adjustments • water filling in-ground tanks • flushing system • leak check.
Operation and maintenance manual includes:	• disinfection of storage tanks • yearly inspections • leak detection • cleaning filters and strainers • water auditing • regular maintenance requirements • pump maintenance.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment	• This unit of competency could be assessed on its own or as part of an integrated assessment activity involving preparation of two designs for rainwater collection, storage, distribution and re-use systems for two different types of buildings, including plans, specifications and all associated documentation.

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 rainfall, client, regulatory, manufacturer and Australian and New Zealand standard requirements and storage capacity for a range of rainwater harvesting systems
  - planning and detailing system components, including:
    - piping systems
    - strainers
    - filters
    - pumps
  - designing and sizing rainwater harvesting systems
  - designing and sizing rainwater re-use systems
  - preparing plans for a range of rainwater harvesting and re-use systems to industry standards
  - preparing specifications for rainwater harvesting and re-use systems
  - preparing testing and commissioning schedules
  - preparing operation and maintenance manuals.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environment
  - tools and equipment appropriate to the planning process, including calculators
  - computers and software
  - support materials appropriate to activity
  - plans and specifications of an appropriate building
  - research resources, including systems literature and data.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPPS5007A Design irrigation systems

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.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the attainment 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.

Unit Sector Plumbing and services

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate design parameters.	1.1 ***Design requirements*** are determined from plans, specifications and client briefs. 1.2 ***Cost-benefit analysis*** is conducted comparing a range of pipe materials and system designs. 1.3 ***Statutory and regulatory requirements and Australian and New Zealand standards*** for the design of irrigation systems are interpreted, analysed and applied. 1.4 ***Manufacturer requirements*** and trade and technical manuals are interpreted. 1.5 Additional research including a ***desktop study*** is conducted to outline design parameters. 1.6 ***Flow and pressure tests*** are conducted. 1.7 ***Water sources, volumes and areas to be irrigated*** are established. 1.8 ***Soil types*** are analysed and categorised and impacts on irrigation systems are documented. 1.9 ***Performance requirements*** are established.
2. Plan and detail system components.	2.1 ***Layout of pipework systems*** and type and location of ***fittings and valves*** 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 fixings*** are designed for a range of applications. 2.7 ***Pump, pump controls and pumproom requirements*** are sized and detailed. 2.8 ***Installation requirements*** are specified.

3. Design and size systems.	3.1 Irrigation systems are designed for a range of residential, commercial, industrial and agricultural ***applications***. 3.2 A range of ***delivery systems and patterns*** is designed. 3.3 Irrigation systems are designed and sized using computer software packages.
4. Prepare documentation.	4.1 ***Plans*** are prepared for a range of irrigation systems. 4.2 A ***specification*** for an irrigation system is prepared. 4.3 A ***testing*** and ***commissioning schedule*** is prepared. 4.4 An ***operation and maintenance manual*** is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources.

Required knowledge:

- 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
- 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
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Unit scope:	• includes application of the irrigation project • includes interpretation of plans and specifications • includes sizing and documenting layout of irrigation systems, for applications including residential, commercial, industrial and agricultural • may be for new projects or an existing structure being renovated, extended, restored or maintained.

Design requirements include:	• owner requirements • architectural specifications • builder specifications • specialist water use applications.
Cost-benefit analysis includes:	• comparison of range of suitable materials and system choices available to enable cost-effective choices to be made without compromising the integrity of the project.

Statutory and regulatory requirements and Australian and New Zealand standards include:	• acts and regulations
	• local and state government policies
	• Australian and New Zealand standards, including:
	  • AS/NZS3500 National plumbing and drainage set
	  • AS2200 Design charts for water supply and sewerage
	• BCA.

Manufacturer requirements include:	• material specifications • sizing tables • pump tables • technical and trade manuals.
Desktop study includes collection and interpretation of existing data for design purposes from:	• council plans • developer plans • landscape and architectural plans • building plans • other documents and reports as available.
Flow and pressure tests include:	• on-site measurement of flows (l/s), velocity (m/s) and pressure (Kpa) • interpretation of flow and pressure tests conducted by a contractor.

Water sources, volumes and areas to be irrigated include:	• sources include:
	  • dams
	  • creeks
	  • rivers
	  • lakes
	  • streams
	  • tanks
	  • mains supply
	• volumes and areas include:
	  • 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:

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

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

Fittings and valves may include:

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

Backflow prevention devices include:

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

Materials include:

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

Jointing methods include:

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

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 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:

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

Pump, pump controls and pumproom requirements include:	• pump selection • pump sizing • impeller sizing • installation and mounting requirements • valve requirements • inlet and outlet design requirements • automatic controls • space requirements.
Installation requirements include:	• jointing requirements • level of workmanship • clipping • bedding • installation details.

Applications:	• include:
	  • lawn watering
	  • garden irrigation
	  • golf courses
	  • agricultural crops
	  • greenhouses
	  • nurseries
	• should also cover:
	  • types of plants and their respective crop factors
	  • individual crop water requirements.

Delivery systems and patterns include:	• main delivery
	• number and design of stations
	• range pipes
	• ring mains
	• sprinkler head placement
	• size and delivery of sprinklers
	• sprinkler patterns
	• design:
	  • to avoid obstacles
	  • for irregular shapes
	  • to minimise water wastage
	  • for a range of irrigation applications.

Plans:

- include:
  - elevations
  - sections
  - details
  - cross-sections
  - isometrics
  - axonometrics
  - schematics
- may be produced using:
  - pencil
  - Indian ink
  - pigment liner
  - computer generation.

Specification includes:

- materials
- workmanship
- jointing
- valve selection
- manufacturer
- clipping
- bedding
- specialised components.

Testing includes:

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

Commissioning schedule includes:

- flow test
- pressure test
- valve operation
- leak check
- system flush.

Operation and maintenance manual includes:

- valve maintenance
- yearly inspection
- leak detection
- water auditing
- yearly maintenance requirements
- pump maintenance.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment

- This unit of competency could be assessed on its own or as part of an integrated assessment activity involving preparation of designs for two irrigation systems for different applications, including plans, specifications and all associated documentation.

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, manufacturers and Australian and New Zealand standard requirements for a range of irrigation systems
  - planning and detailing system components, including:
    - backflow prevention devices
    - stations
    - manifold and piping systems
  - 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

- Resource implications for assessment include:
  - workplace or simulated environment
  - tools and equipment appropriate to the planning process, including calculators
  - computers and software
  - support materials appropriate to activity
  - plans and specifications of an appropriate building
  - research resources, including systems literature and data.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPPS5008A Design trade waste pre-treatment systems

Unit Descriptor

This unit of competency specifies the outcomes required to design trade waste pre-treatment systems for commercial and industrial premises. The unit requires identification of appropriate installation details and preparation of specifications.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the attainment of skills and knowledge required for competent workplace performance in a consultancy or supervisory capacity in relation to plumbing services and hydraulics.

Unit Sector Plumbing and services

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate design parameters.	1.1 ***Scope of work*** is established for trade waste pre-treatment systems. 1.2 ***Design requirements*** are determined from plans, specifications and client briefs. 1.3 ***Statutory and regulatory requirements*** and ***Australian*** and ***New Zealand standards*** for the design of trade waste pre-treatment systems are analysed and applied. 1.4 ***Trade waste applications*** are analysed and a ***cost-benefit analysis*** is conducted, comparing a range of pipe materials and system designs. 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 ***Performance requirements*** are established.
2. Plan and detail system components.	2.1 ***Layout of pipework systems*** and type and location of ***fittings and valves*** are planned. 2.2 ***Solid removal systems*** are planned and ***detailed***. 2.3 ***Grease and oil interceptors, neutralising chambers*** and ***wash-down areas*** are planned and detailed. 2.4 ***Diffused air flotation systems*** are planned and detailed. 2.5 ***Bacterial treatment processes*** and ***combination and specialised treatment processes*** are detailed for a range of commercial and industrial applications. 2.6 ***Stormwater diversion and first-flush systems*** are detailed. 2.7 ***System calculations*** are performed for a range of applications. 2.8 ***Pumpwell, pump and pump control requirements*** are sized and detailed. 2.9 ***Pipe fixings*** are designed for a range of applications. 2.10 Approved ***materials, jointing methods*** and all ***installation requirements*** for trade waste pre-treatment systems are specified.

3. Design and size systems.	3.1 Trade waste pre-treatment systems are designed for a range of applications. 3.2 Trade waste pre-treatment systems are designed and sized using ***computer software packages***.
4. Prepare documentation.	4.1 ***Plans*** are prepared for a range of trade waste pre-treatment systems. 4.2 A ***specification*** for a trade waste pre-treatment system is prepared. 4.3 A ***testing*** and ***commissioning schedule*** is prepared. 4.4 An ***operation and maintenance manual*** is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources.

Required knowledge:

- requirements of state regulatory authorities, Australian standards and manufacturer specifications, including hazards identified in relation to devices and systems used
- common terminology and definitions used in the design of trade waste pre-treatment systems for all classes of building
- drafting principles
- nature of materials used and effects of performance under various conditions
- principles of technology used in the design of trade waste pre-treatment systems
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Scope of work includes:	• interpretation of plans and specifications, and sizing and documenting layout of trade waste systems, for residential, commercial and industrial applications for either new projects or existing structures being renovated, extended, restored or maintained.

Design requirements include:	• owner requirements • architectural specifications • builder specifications • specialist water use applications.
Statutory and regulatory requirements and Australian and New Zealand standards include:	• local government trade waste policies • acts, regulations and local and state government policies, including group and strata titling • AS/NZS3500 National plumbing and drainage set • AS2200 Design charts for water supply and sewerage • Building Code of Australia.
Trade waste applications include:	• food preparation facilities • photography development facilities • wash-down facilities • chemical facilities • commercial and industrial facilities that produce a liquid waste stream.
Cost-benefit analysis includes:	• comparison of the range of suitable materials and system choices available to enable cost-effective choices to be made without compromising the integrity of the project.
Manufacturer requirements include:	• material specifications • sizing tables • pump tables • technical and trade manuals.

Desktop study includes collection and interpretation of existing data for design purposes from:	• manufacturers' data
	• council plans
	• developer plans
	• architectural and building plans
	• other documents, including:
	  • forms
	  • applications
	  • sewer detail maps
	  • other reports as available.

Performance requirements include:	• pipe grades, cover, flow conditions and discharge requirements, established using Australian and New Zealand standards and local authority plans.

Layout of pipework systems:	• includes:
	  • gravity systems
	  • pumped systems
	• should not unduly affect building integrity and aesthetic appeal
	• should have principles of economy, serviceability, durability and fit for use applied.

Fittings and valves include:	• junctions • bends • inspection openings • traps • reflux valves.
Solid removal systems include removal of:	• silt • sand • dirt • grit • rubbish • wood • paper • plastic • metal • bone • other solid contaminants.
Grease and oil interceptors include:	• vertical separators • coalescing plate separators • grease traps • skimmers.
Neutralising chambers include:	• chemical neutralisation • acid neutralisation.
Wash-down areas include:	• machinery wash down • bin wash down • floor wash down • commercial and industrial wash-down processes that may or may not require stormwater diversion.
Diffused air flotation systems include:	• removal of contaminants from commercial and industrial processes.
Bacterial treatment processes include:	• anaerobic • aerobic • facultative and specialised bacteria for the removal of grease and other contaminants.
Combination and specialised treatment processes include any combination of processes, including:	• solid removal systems • neutralising chambers • diffused air flotation systems • bacterial treatment processes • stormwater diversion • first-flush systems • specialised treatment process.

Stormwater diversion and first-flush systems include:

- exclusion of stormwater from sewerage systems or admittance of first portion of stormwater generated by a rain event to the sewerage system.

System calculations include:

- treatment system sizing
- reduced level calculations
- gradient calculations
- pipe sizing calculations
- determination of flow and fixture loadings
- interpretation of design charts and tables.

Pumpwell, pump and pump control requirements include:

- pumpwell sizing
- detailing
- ladder access
- step irons
- chains
- capacity
- warning system
- automatic controls
- high and low-level water controls and alarms
- corrosion-resistant materials
- macerator requirements
- pump selection
- pump sizing
- impeller sizing
- installation and mounting requirements
- valve requirements
- inlet and outlet design requirements
- space requirements.

Pipe fixings include:

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

Materials include:

- copper
- unplasticised polyvinyl chloride (uPVC)
- earthenware
- cast iron
- high density polyethylene (HDPE)
- concrete
- fittings and fixtures, including sound attenuation requirements.

Jointing methods include:
- rubber ring
- mechanical joints
- gluing
- solvent cement welding
- brazing
- threading.

Installation requirements include:
- jointing requirements
- level of workmanship
- clipping
- bedding
- concrete support
- installation details.

Computer software packages include:
- proprietary design software
- manufacturers' software.

Plans:
- include:
  - elevations
  - sections
  - details
  - cross-sections
  - isometrics
  - axonometrics
  - schematics
- may be produced using:
  - pencil
  - Indian ink
  - pigment liner
  - computer generation.

Specification includes:
- sewer admission limits
- materials
- workmanship
- jointing
- manholes
- manufacturer requirements
- clipping
- bedding
- concrete support
- detailing of specialised components.

Testing includes:
- hydrostatic test
- air pressure test
- drainage inspection
- quality assurance (QA) audit.

Commissioning schedule includes:	• pump commissioning • treatment system commissioning • operational commissioning • charging traps • leak check.
Operation and maintenance manual includes:	• regular water quality testing • regular treatment system maintenance • leak detection • check for blockages • water auditing • yearly maintenance requirements • pump maintenance.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment	• This unit of competency could be assessed on its own or as part of an integrated assessment activity involving preparation of designs for two trade waste pre-treatment systems for different applications, including plans, specifications and all associated documentation.

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, trade-waste policy, regulatory, manufacturer and Australian and New Zealand standard requirements for a range of trade waste pre-treatment systems
	  • planning and detailing system components, including pre-treatment systems and piping systems
	  • designing and sizing trade waste systems
	  • designing and sizing wash-down and first-flush systems
	  • preparing plans for a range of trade waste pre-treatment systems to industry standards
	  • preparing specifications for trade waste pre-treatment systems
	  • preparing schedules for testing and commissioning
	  • producing operation and maintenance manuals.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environments appropriate to a range of situations and activities
  - computers and software
  - materials appropriate to application activities
  - appropriate documentation and data related to tasks, including plans and specifications of an appropriate building
  - tools and equipment relevant to planning processes, including calculators.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPPS5009A Analyse and report on technical plumbing systems

Unit Descriptor

This unit of competency specifies the outcomes required to analyse and report on technical aspects of plumbing systems. It entails analysis of plumbing systems, processes, legislation, practices, materials, installation methods, and safety procedures and impacts. It covers the preparation and publishing of reports to add to the growth of the plumbing industry in general.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports attainment of skills and knowledge required for competent workplace performance in a consultancy or supervisory capacity in relation to plumbing services and hydraulics.

Unit Sector Plumbing and services

ELEMENT	PERFORMANCE CRITERIA
1. Select and analyse a plumbing system or aspect of a plumbing system.	1.1 A ***plumbing system*** or ***aspect of a plumbing system*** is selected with a view to improve or better understand the system or aspect of the system. 1.2 A detailed and comprehensive ***analysis*** is made of the plumbing/hydraulic system or aspect of the system and impacts are identified and documented.
2. Research and trial the system.	2.1 Appropriate comprehensive ***research and literature review*** are undertaken. 2.2 Alternative solutions are trialled and evaluated for suitability. 2.3 Results from ***evaluations*** are documented.
3. Evaluate and report on the system or aspect of the system.	3.1 The system or aspect of the system is evaluated, identifying ***alternatives and redundancies***. 3.2 ***Conclusions*** are drawn and any changes are ***recommended***. 3.3 A comprehensive and professional ***report*** is produced. 3.4 The report is ***published*** to increase the body of knowledge within the plumbing/hydraulic field.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- hazard identification skills, including the ability to identify hazard categories according to Australian and New Zealand standards, legislation and manufacturer specifications
- oral and written communication skills, including the ability to write reports to professional standards
- organisational skills, including the ability to plan and set out work
- problem-solving skills, including the ability to identify typical faults and problems and action required to rectify problems
- reading skills, including the ability to interpret drawings, specifications and documentation from a variety of sources.

Required knowledge:

- design principles relating to performance of plumbing systems and their components
- plumbing systems, including plumbing system components and impact of various components
- workplace and equipment safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Plumbing system may include:

- water supply
- sanitary plumbing and drainage
- stormwater
- wastewater
- trade waste
- air conditioning
- ventilation
- steam
- compressed air
- sprinklers
- hydrants
- hose reels
- roofing.

Aspect of a plumbing system may include:

- backflow prevention
- water heating
- solar heating
- ventilation
- trapping
- materials
- valves
- flows.

Analysis may include:

- practices and work or installation methods
- materials
- durability, longevity and practicality
- legislation
- safety systems and practices
- sustainability
- health issues and concerns
- needs or desired outcomes
- impacts, including:
  - environmental
  - health
  - financial
  - personal
- system processes or aspect of the system.

Research and literature review may include:

- trade publications
- legislation and standards
- manufacturers' literature
- textbooks
- internet
- journals
- industry personnel.

Evaluations:

- should draw together key aspects of the project and identify interrelationships of elements identified through the analysis.

Alternatives and redundancies may include:

- outdated practices and systems, for example systems and processes replaced by new technologies
- new work practices
- changes in community expectations
- changes in legislation
- duplication of tasks and processes.

Conclusions:

- may be drawn on any or all aspects of the project but must be supported by analysis and research.

Recommendations should point to future directions and may include:

- legislation changes
- changes in work practices
- new systems and procedures
- deletion of old systems and procedures
- changes in materials to reduce impacts on cost, health, safety and the environment.

Report:	• should cover:
	  • outline of the project
	  • research and literature review
	  • analysis
	  • evaluation
	  • alternative solutions
	  • conclusions
	  • recommendations
	• may be in any recognised and professional format
	• must be appropriately referenced.

Report may be published:	• in trade publications • in journals • in textbooks • on the internet.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment	• This unit of competency could be assessed on its own or as part of an integrated assessment activity involving effective performance and application of principles used to analyse and report on technical plumbing systems.

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:
	  • analysing and evaluating plumbing systems
	  • trialling and evaluating alternative solutions
	  • complying with occupational health and safety regulations applicable to workplace operations
	  • applying organisational quality procedures and processes within context of analysing and reporting on technical plumbing systems
	  • writing a report to professional standards
	  • making appropriate supported recommendations
	  • using appropriate techniques to publish reports
	  • interactive communication with others to ensure safe and effective work site operations.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environments appropriate to a range of situations and activities
  - computers and software
  - materials appropriate to application activities
  - appropriate documentation and data related to tasks, including plans and specifications of an appropriate building
  - tools and equipment relevant to planning processes, including calculators.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPPS5010A Design pump systems

Unit Descriptor

This unit of competency specifies the outcomes required to undertake the specification, selection and sizing of pumps and the design of associated piping and components for hydraulic systems.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the attainment of skills and knowledge required for competent workplace performance in a consultancy or supervisory capacity in relation to plumbing services and hydraulics.

Unit Sector Plumbing and services

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate design parameters.	1.1 ***Scope of work*** is established for ***pump*** system requirements for wide span and high-rise building projects. 1.2 ***Pump duties*** are established. 1.3 ***Design requirements*** are determined from plans, specifications and client briefs. 1.4 A ***cost-benefit and life cycle analysis*** is conducted comparing a range of pump alternatives, materials and system designs. 1.5 ***Statutory and regulatory requirements*** and ***Australian and New Zealand standards*** for the design of pump systems are analysed, interpreted and applied. 1.6 ***Manufacturer requirements***, and trade, technical and sizing manuals are interpreted. 1.7 Additional research including a ***desktop study*** is conducted to outline design parameters. 1.8 ***Flow and pressure tests*** of the hydraulic system are conducted. 1.9 ***Performance requirements*** are established.
2. Plan and detail system components.	2.1 ***Pump, pump controls and pumproom requirements*** are sized and detailed. 2.2 ***Layout of pipework systems*** and type and location of ***fittings and valves*** are planned. 2.3 Pipe sizes, velocities, flows and pressures are calculated for a range of applications. 2.4 ***Energy sources*** are specified for a range of hydraulic pumping applications. 2.5 ***Pump plinths*** and ***pump mountings*** are designed for a range of applications. 2.6 Pump impellers are sized and detailed. 2.7 Approved ***materials, jointing methods*** and ***installation requirements*** are specified.

3. Design and size systems.	3.1 Pump systems are designed for a range of wide span and high-rise building applications. 3.2 Net positive suction head calculations are performed. 3.3 Design principles are applied for the optimal performance of pump systems. 3.4 A range of ***delivery systems*** is designed. 3.5 Pump systems are designed and sized using computer software packages.
4. Prepare documentation.	4.1 ***Plans*** and details are prepared for a range of pump systems. 4.2 A ***specification*** for a pump system is prepared. 4.3 A ***testing*** and ***commissioning schedule*** is prepared. 4.4 An ***operation and maintenance manual*** is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- problem-solving skills, including the ability to identify typical faults and action required to rectify problems
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources
- technical skills, including the ability to apply design concepts and principles relating to hydraulic systems.

Required knowledge:

- requirements of state regulatory authorities, Australian standards and manufacturer specifications
- terminology, definitions, installation methods and hazards identified in relation to devices and systems used according to:
  - AS/NZS3500 National plumbing and drainage set
  - AS2419 Fire hydrant installations - system design, installation and commission
  - AS/NZS1547 On-site domestic wastewater management
  - AS2200 Design charts for water supply and sewerage
  - Building Code of Australia (BCA)
  - other standards, codes or standard operating procedures
- nature of materials used and effects of performance under various conditions
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Scope of work includes:

- interpretation of plans and specifications, and sizing and documenting layout of pump systems, for applications including residential, commercial and industrial and new projects or an existing structure being renovated, extended, restored or maintained.

Pump types may include:

- circulating
- solid and semi-solid pumping systems
- warm and hot water
- vacuum and multi-stage pumps
- multiple impeller pumps
- variable speed pumps
- constant flow variable speed pumps
- motor pumps
- submersible pumps
- macerator pumps
- centrifugal pumps
- piston pumps.

Pump duties may include:

- flow
- head
- velocity
- delivery.

Design requirements may include:

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

Cost-benefit and life cycle analysis may include:

- comparison of the range of suitable materials, pumps and system designs available to enable cost-effective choices to be made without compromising the integrity of the project
- balancing initial cost with durability, longevity maintenance and ongoing fuel/energy cost requirements.

Statutory and regulatory requirements may include:

- acts and regulations
- local and state government policies.

Australian and New Zealand standards may include:	• AS/NZS3500 National plumbing and drainage set • AS2419 Fire hydrant installations - system design, installation and commission • AS/NZS1547 On-site domestic wastewater management • AS2200 Design charts for water supply and sewerage • BCA.
Manufacturer requirements may include:	• material specifications • sizing tables • pump tables • technical and trade manuals.
Desktop study may include collection and interpretation of existing data for design purposes from:	• council plans • developer plans • architectural and building plans • other documents and reports as available.
Flow and pressure tests may include:	• on-site measurement of flow (l/s), velocity (m/s) and pressure (Kpa) • interpretation of flow and pressure tests conducted by a contractor.
Performance requirements may include:	• flow, velocity, pressure and discharge requirements, established using Australian and New Zealand standards and local authority plans.
Pump, pump controls and pumproom requirements may include:	• pump sizing and selection • impeller sizing • installation and mounting requirements • valve requirements • inlet and outlet design requirements • automatic controls • space requirements.
Layout of pipework systems may include:	• ring main • single pipe • dual feed.

Fittings and valves may include:

- fittings:
  - tees
  - bends
  - unions
- valves:
  - isolating
  - pressure reduction
  - pressure limiting
  - excess pressure valves
  - backflow prevention
  - vibration couplings
  - strainers.

Energy sources may include:

- single phase
- three phase
- petrol
- diesel and diesel-electric generator sets.

Pump plinths may include:

- concrete
- masonry
- timber
- bases designed to resist the forces exerted by the pump.

Pump mountings may include:

- anchoring bolts
- vibration couplings
- rubber and synthetic pump mounts
- motor pump
- pump mountings and adjustments.

Materials should include:

- copper
- polybutylene
- cross-linked polyethylene
- acrilonitrile butadiene styrene (ABS)
- composite pipework
- steel
- protective coatings
- fittings and fixtures
- pump construction
- impeller materials.

Jointing methods may include:

- compression
- brazing
- threaded
- flaring
- soldering
- mechanical joints.

Installation requirements include:
- jointing requirements
- level of workmanship
- clipping
- mounting
- installation details.

Delivery systems may include:
- upfeed
- downfeed
- pressure ratio
- hydropneumatic
- constant flow variable speed pump.

Plans:
- include:
  - elevations
  - sections
  - details
  - cross-sections
  - isometrics
  - axonometrics
  - schematics
- may be produced using:
  - pencil
  - Indian ink
  - pigment liner
  - computer generation.

Specification may include:
- materials
- workmanship
- jointing
- valve selection
- manufacturer
- clipping
- bedding
- specialised components.

Testing may include:
- hydrostatic test
- air pressure test
- mains pressure test
- defect insp-ection
- quality assurance (QA) audit.

Commissioning schedule may include:
- flow test
- pressure test
- valve operation
- leak check
- system purge.

Operation and maintenance manual may include:	• valve maintenance • yearly inspection • leak detection • water auditing • yearly maintenance requirements • pump maintenance.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment	• This unit of competency could be assessed on its own or as part of an integrated assessment activity involving effective performance and application of drainage principles and detailing of systems components used in the drainage industry.

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 pump systems
	  • planning and detailing system components, including:
	  • mounting
	  • impeller sizing
	  • fittings
	  • valves
	  • plinths
	  • piping systems
	  • complying with occupational health and safety regulations applicable to workplace operations
	  • applying organisational quality procedures and processes
	  • designing and sizing a range of pump systems
	  • developing a cost-benefit, life cycle analysis for a range of pump systems
	  • preparing plans for a range of pump systems
	  • preparing a specification for a pump system
	  • preparing a testing and commissioning schedule
	  • preparing an operation and maintenance manual
	  • interactive communication with others to ensure safe and effective work site operations.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environments appropriate to a range of situations and activities
  - computers and software
  - materials appropriate to application activities
  - research resources, including systems literature and data
  - plans and specifications of an appropriate building.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPPS5011A Coordinate services and penetrations

Unit Descriptor

This unit of competency specifies the outcomes required to coordinate services and penetrations within a building to minimise clashes with work on other builiding services and ensure structured integrity.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the attainment of fundamental skills and knowledge required for competent workplace performance in a consultancy, business or supervisory capacity in relation to plumbing services and construction hydraulics.

Unit Sector Plumbing and services

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate structural, architectural and mechanical services drawings.	1.1 ***Plans***, elevations and sections are evaluated. 1.2 Multidisciplinary terminology is applied. 1.3 ***Service components*** are located. 1.4 Cast-in services are identified and located.
2. Overlay plans to ensure feasibility of building the service.	2.1 Reduced levels are checked to ensure compliance. 2.2 Drawings are overlayed to check for ***building services*** and building element clashes. 2.3 Service clashes are identified and rectified by design modification and/or liaising with consultants.
3. Coordinate penetrations.	3.1 Product specifications, architectural finishes and structural elements are used to position penetrations. 3.2 Design modifications are made to ensure compliance. 3.3 Plans and documentation are updated to reflect design modifications.
4. Prepare a duct and penetration plan.	4.1 All ***duct*** and penetration information is collated. 4.2 A ***duct and penetration plan*** is prepared for a complex building project. 4.3 Maintenance access and testing provisions are located.
5. Position penetrations in ducts.	5.1 ***Penetrations are positioned*** within ducts.
6. Coordinate fire services and emergency exit requirements.	6.1 Landing valve penetrations are positioned to ensure regulatory requirements are met. 6.2 Required clearances in fire-isolated stairways are not obstructed by fire services. 6.3 Hose reels are located to comply with regulatory requirements.

7. Compile checklists for checking quality and legislative conformity of design and drafting.	7.1 Checklists for drafting quality and conformity with sketch designs and legislative requirements are developed. 7.2 Interoffice checklists for checking design and conformity with legislation are developed. 7.3 Checklists are developed to ensure correlation between drawings and specifications. 7.4 Checklists are developed to ensure on-site supervision with regards to checking that installation is in accordance with design and specifications.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications
- organisational skills, including the ability to coordinate, plan and set out work
- reading skills, including the ability to read and interpret drawings, specification and documentation from a variety of sources
- technical skills, including the ability to draw.

Required knowledge:

- application of technical knowledge, including drafting principles and understanding of services
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Plans may include:	• interpretation of building services • architectural and base building plans • specifications for an appropriate building.
Service components may include:	• mechanical • ventilating • registers • lights • beams.

Building services may include:	• air conditioning • hot and cold water supply • sanitary plumbing and drainage • gas • fire • mechanical • electrical • data and communications • ventilation • stormwater • trade waste.
Ducts and positioning may be affected by:	• required services location • positioning of reinforcing steel • slab thickenings • pre and post-tensioning bars • other services • building stress zones • clearances • regulatory requirements.
A duct and penetration plan may include:	• floor plan showing all ducts and penetrations • scale dimensions and sizes for all ducts and penetrations to gridlines • highlighted potential problem areas or building set-out elements • cast-in pipework • detail drawings of duct layout beam penetrations.
Penetrations are positioned to take into account:	• fire collars and their operation • branches • junction • other services to fit within the duct.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment	• This unit of competency could be assessed on its own or as part of an integrated assessment activity involving effective application of principles relating to the coordination of services and penetrations.

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:
  - coordinating hydraulic service plans to ensure compliance and resolution of clashes
  - selecting and applying appropriate techniques to prepare a penetration plan for a complex building project
  - complying with occupational health and safety regulations applicable to workplace operations
  - applying organisational quality procedures and processes
  - preparing detailed drawings for service risers
  - preparing elevation and plan details for sanitary stack connections within the duct
  - preparing a detailed drawing of a service penetrating a beam
  - preparing checklists for use in coordinating services
  - interactive communication with others to ensure safe and effective work site operations.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - a comprehensive selection of reference texts
  - Australian standards and product information relating to documentation, including:
    - design brief drawings
    - specifications
    - codes
    - design concepts
    - construction schedule
    - other necessary supporting manufacturers' literature
  - research resources, including systems literature and data
  - access to relevant legislation, regulations and codes of practice.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPPS5012A Design siphonic stormwater drainage systems

Unit Descriptor

This unit of competency specifies the outcomes required to design siphonic stormwater drainage systems, determine installation details and prepare specifications for a range of residential, commercial and industrial buildings.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the attainment of skills and knowledge required for competent workplace performance in a consultancy or supervisory capacity in relation to plumbing services and hydraulics.

Unit Sector Plumbing and services

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate design parameters.	1.1 ***Scope of work*** is established for siphonic stormwater drainage systems. 1.2 ***Design requirements*** are determined from plans, specifications and client briefs. 1.3 ***Siphonic system attributes*** are evaluated and a ***cost-benefit analysis*** is conducted, comparing a range of pipe materials and system designs. 1.4 ***Statutory and regulatory requirements and Australian and New Zealand standards*** for the design of siphonic stormwater drainage systems are analysed and applied. 1.5 Stormwater design manuals, ***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 ***Performance requirements*** are established.
2. Plan and detail system components.	2.1 Siphonic stormwater drainage systems are integrated with the building structure. 2.2 Volume of roof water/stormwater is calculated using a range of approved methods. 2.3 ***Layout of pipework systems*** and type and location of ***fittings and valves*** are planned. 2.4 ***Pipe size and pipe grade requirement calculations*** are performed for a range of applications in accordance with regulations and manufacturer requirements. 2.5 ***Pipe fixings*** are designed for a range of applications. 2.6 Approved ***materials and components, jointing methods*** and all ***installation requirements*** for siphonic stormwater drainage systems are specified.

3. Design and size systems.	3.1 Siphonic stormwater drainage systems are designed for a range of applications. 3.2 Catchment areas are calculated, guttering requirements determined and siphonic systems sized. 3.3 Siphonic stormwater drainage systems are designed and sized using ***computer software packages***.
4. Prepare documentation.	4.1 ***Plans*** are prepared for a range of siphonic stormwater drainage systems. 4.2 A ***specification*** for a siphonic stormwater drainage system is prepared. 4.3 A ***testing*** and ***commissioning schedule*** is prepared. 4.4 An ***operation and maintenance manual*** is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources.

Required knowledge:

- requirements of state regulatory authorities, Australian standards and manufacturer specifications, including hazards identified in relation to devices and systems used
- common terminology and definitions used in design of siphonic stormwater drainage systems for all classes of building
- drafting principles
- nature of materials used and effects of performance under various conditions
- principles of technology in the design of siphonic stormwater drainage systems
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Scope of work includes:

- interpretation of plans and specifications
- calculation of rainfall intensities in given catchment areas, including:
  - meteorological information
  - roof calculations
  - surface and subsurface calculations
  - time and concentration
  - rainfall intensities
  - average rainfall intervals
- sizing and documenting layout of siphonic stormwater drainage systems for residential, commercial or industrial applications and for either new projects or an existing structure being renovated, extended, restored or maintained.

Design requirements include:

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

Siphonic system attributes include:

- cost
- risks
- availability
- installation requirements
- site conditions.

Cost-benefit analysis includes:

- comparison of range of suitable materials and system choices available to enable cost-effective choices to be made without compromising the integrity of the project.

Statutory and regulatory requirements and Australian and New Zealand standards include:

- acts, regulations and local and state government policies, including group and strata titling
- AS/NZS3500 National plumbing and drainage set
- AS2200 Design charts for water supply and sewerage
- Building Code of Australia.

Manufacturer requirements include:

- material specifications
- sizing tables
- pump tables
- technical and trade manuals.

Desktop study includes collection and interpretation of existing data for design purposes from:	• council plans
	• developer plans
	• architectural and building plans
	• other documents, including:
	  • forms
	  • applications
	  • sewer detail maps
	  • other reports as available.

Performance requirements include:	• pipe grades, cover, flow conditions and discharge requirements, established using Australian and New Zealand standards and local authority plans.

Layout of pipework systems:	• includes consideration of:
	  • type of building structure
	  • size of penetrations
	  • fireproofing
	  • materials to be used
	  • clipping and pipe support
	  • amenity of the building
	  • function of the building
	  • impingement on floor heights
	• should not unduly affect building integrity and aesthetic appeal
	• should have principles of economy, serviceability, durability and fit for use applied.

Fittings and valves include:	• junctions • bends • inspection openings.
Pipe size and pipe grade requirement calculations include:	• volumes • flow • discharge • velocity • freeboard • sizing according to Australian and New Zealand standards • urban drainage requirements • manufacturers' tables.
Pipe fixings include:	• wall and ceiling brackets • saddles • hanging brackets • anchors • material requirements • corrosion protection • bracket spacing • cover.

Materials and components include:	• appropriate materials specified, based on fit for purpose, durability, compatibility and cost-effectiveness, including:
	  • polyvinyl chloride (PVC)
	  • high density polyethylene (HDPE)
	  • stainless steel
	• components, including:
	  • pipework
	  • fittings
	  • valves
	  • clips
	  • fasteners
	  • siphonic outlets.

Jointing methods include:	• rubber ring • mechanical joints • gluing • solvent cement welding • brazing • threading.
Installation requirements include:	• jointing requirements • level of workmanship • clipping • bedding • concrete support • installation details.
Computer software packages include:	• proprietary design software • manufacturers' software.

Plans:	• include:
	  • elevations
	  • sections
	  • details
	  • cross-sections
	  • isometrics
	  • axonometrics
	  • schematics
	• may be produced using:
	  • pencil
	  • Indian ink
	  • pigment liner
	  • computer generation.

Specification includes:	• materials • workmanship • jointing • manholes • manufacturer requirements • clipping • bedding • concrete support • details of specialised components.
Testing includes:	• hydrostatic test • air pressure test • inspection • quality assurance (QA) audit.
Commissioning schedule includes:	• cleaning grates • charging traps • purging system • checking leaks.
Operation and maintenance manual includes:	• regular inspection • leak detection • check for blockages • regular maintenance requirements.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment	• This unit of competency could be assessed on its own or as part of an integrated assessment activity involving preparation of designs for two siphonic stormwater drainage systems for different applications, including plans, specifications and all associated documentation.

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 siphonic stormwater drainage systems
  - producing an appropriate layout for siphonic stormwater drainage systems, planned in accordance with manufacturer and regulatory requirements
  - calculating pipe sizes in accordance with regulations and manufacturer requirements
  - designing and sizing siphonic stormwater drainage systems using appropriate software
  - preparing plans for a range of siphonic stormwater drainage systems
  - selecting materials and components for compliance, fit for purpose, durability, compatibility and cost-effectiveness
  - preparing specifications for siphonic stormwater drainage systems
  - preparing testing and commissioning schedules
  - producing operation and maintenance manuals.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environments appropriate to a range of situations and activities
  - computers and software
  - materials appropriate to application activities
  - appropriate documentation and data related to tasks, including plans and specifications of an appropriate building
  - tools and equipment relevant to planning processes, including calculators.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPPS5013A Design vacuum sewerage systems

Unit Descriptor

This unit of competency specifies the outcomes required to design vacuum sewerage systems, determine installation details and prepare specifications for a range of residential, commercial and industrial buildings, using proprietary components.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the attainment of skills and knowledge required for competent workplace performance in a consultancy or supervisory capacity in relation to plumbing services and hydraulics.

Unit Sector Plumbing and services

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate design parameters.	1.1 ***Scope of work*** is established for vacuum sewerage systems for wide span and high-rise building projects. 1.2 ***Design requirements*** are determined from plans, specifications and client briefs. 1.3 ***Vacuum sewerage system attributes*** are evaluated and a ***cost-benefit analysis*** is conducted, comparing a range of pipe materials and system designs. 1.4 ***Statutory and regulatory requirements and Australian and New Zealand standards*** for the design of vacuum sewerage systems are 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 ***Performance requirements*** are established.
2. Plan and detail system components.	2.1 ***Layout of pipework systems*** and type and location of ***fittings and valves*** are planned. 2.2 Sewerage loading is calculated using a range of approved methods. 2.3 ***Pipe size calculations*** are performed for a range of applications in accordance with regulations and manufacturer requirements. 2.4 ***Pipe fixings*** are designed for a range of applications. 2.5 ***Pumpwell, pump and pump control requirements*** are sized and detailed. 2.6 Approved ***materials, jointing methods*** and all ***installation requirements*** for vacuum sewerage systems are specified.
3. Design and size systems.	3.1 Vacuum sewerage systems are designed for a range of applications. 3.2 Vacuum sewerage systems are designed and sized using ***computer software packages***.

4. Prepare documentation.	4.1 ***Plans*** are prepared for a range of vacuum sewerage systems. 4.2 A ***specification*** for a vacuum sewerage system is prepared. 4.3 A ***testing*** and ***commissioning schedule*** is prepared. 4.4 An ***operation and maintenance manual*** is produced.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources.

Required knowledge:

- requirements of state regulatory authorities, Australian standards and manufacturer specifications, including hazards identified in relation to devices and systems used
- common terminology and definitions used in design of vacuum sewerage systems for all classes of building
- drafting principles
- nature of materials used and effects of performance under various conditions
- principles of technology in the design of vacuum sewerage systems
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Scope of work includes:	• interpretation of plans and specifications, and sizing and documenting layout of vacuum sewerage systems, for residential, commercial and industrial applications, for either new projects or an existing structure being renovated, extended, restored or maintained.
Design requirements include:	• owner requirements • architectural specifications • builder specifications • specialist water use applications.

Vacuum sewerage system attributes include:	• cost • sewerage loading • risks • availability • installation requirements • site conditions.
Cost-benefit analysis includes:	• comparison of range of suitable materials and system choices available to enable cost-effective choices to be made without compromising the integrity of the project.
Statutory and regulatory requirements and Australian and New Zealand standards include:	• acts, regulations and local and state government policies, including group and strata titling • AS/NZS3500 National plumbing and drainage set • AS2200 Design charts for water supply and sewerage • Building Code of Australia.
Manufacturer requirements include:	• material specifications • sizing tables • pump tables • technical and trade manuals.

Desktop study includes collection and interpretation of existing data for design purposes from:	• council plans
	• developer plans
	• architectural and building plans
	• other documents, including:
	  • forms
	  • applications
	  • sewer detail maps
	  • other reports as available.

Performance requirements include:	• pipe grades, cover, flow conditions and discharge requirements, established using Australian and New Zealand standards and local authority plans.

Layout of pipework systems:	• includes consideration of:
	  • type of building structure
	  • size of penetrations
	  • fireproofing
	  • materials to be used
	  • clipping and pipe support
	  • amenity of the building
	  • function of the building
	  • impingement on floor heights
	• should not unduly affect building integrity and aesthetic appeal
	• principles of economy, serviceability, durability and fit for use should be applied.

Fittings and valves include:

- junctions
- bends
- inspection and maintenance access
- traps
- air admittance
- pressure relief
- reflux valves.

Pipe size calculations include:

- reduced level calculations
- pipe sizing calculations
- determination of flow and fixture loadings
- interpretation of design charts and tables.

Pipe fixings include:

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

Pumpwell, pump and pump control requirements include:

- vacuum pump systems
- pumpwell sizing
- detailing
- capacity
- warning system
- automatic controls
- high and low-level water controls and alarms
- corrosion-resistant materials
- macerator requirements
- pump selection
- pump sizing
- impeller sizing
- installation and mounting requirements
- valve requirements
- inlet and outlet design requirements
- space requirements.

Materials include:

- appropriate materials specified based on:
  - fit for purpose
  - durability
  - compatibility
  - cost effectiveness
- polyvinyl chloride (PVC)
- high density polyethylene (HDPE)
- stainless steel.

Jointing methods include:
- rubber ring
- mechanical joints
- gluing
- solvent cement welding
- brazing
- threading.

Installation requirements include:
- jointing requirements
- level of workmanship
- clipping
- bedding
- concrete support
- installation details.

Computer software packages include:
- proprietary design software
- manufacturers' software.

Plans include:
- appropriate design, sizing, notes and legend
- compliance with industry conventions
- production to industry standards and in accordance with regulatory and manufacturer requirements
- being produced by using:
  - pencil
  - Indian ink
  - pigment liner
  - computer generation
- may also include:
  - elevations
  - sections
  - details
  - cross-sections
  - isometrics
  - axonometrics
  - schematics.

Specification includes:
- materials
- clipping
- jointing
- vacuum sewerage fixtures
- vacuum sewerage components
- fittings
- valves
- pipework
- installation methods
- installation standards
- workmanship
- manufacturer requirements
- bedding
- concrete support
- details of specialised components.

Testing includes:	• hydrostatic test • compressed air test • flow testing • inspection checklist • quality assurance (QA) audit.

Commissioning schedule includes:	• checking for:
	  • burrs and obstructions
	  • fit for purpose
	• flushing system
	• removing contaminants
	• checking vacuum leaks.

Operation and maintenance manual includes:	• required maintenance • maintenance intervals • system inspection checklist • operation guidelines • leak detection • checking for blockages • vacuum pump maintenance.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment	• This unit of competency could be assessed on its own or as part of an integrated assessment activity involving preparation of designs for two vacuum sewerage systems for different applications, including plans, specifications and all associated documentation.

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:
  - planning and producing an appropriate layout for the vacuum sewerage system in accordance with manufacturer and regulatory requirements
  - calculating pipe sizes in accordance with regulations and manufacturer requirements
  - designing and sizing vacuum sewerage systems using appropriate software
  - selecting materials and components for compliance, fit for purpose, durability, compatibility and cost-effectiveness
  - preparing plans for a range of vacuum sewerage systems
  - preparing design specification for vacuum sewerage systems
  - preparing a testing and commissioning schedule
  - producing an operation and maintenance manual.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environments appropriate to a range of situations and activities
  - computers and software
  - materials appropriate to application activities
  - appropriate documentation and data related to tasks, including plans and specifications of an appropriate building
  - tools and equipment relevant to planning processes, including calculators.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPPS5014A Locate and maintain piping systems

Unit Descriptor

This unit of competency specifies the outcomes required to specify procedures to locate and maintain piping systems. The unit requires a range of applications, including pipefreezing equipment and procedures, sewer and drain camera equipment and procedures, under-road boring equipment and procedures, robotic sewer repair, chemical grout systems and procedures, and high-pressure drain cleaning equipment and procedures.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the attainment of skills and knowledge required for competent workplace performance in a consultancy or supervisory capacity in relation to plumbing services and hydraulics.

Unit Sector Plumbing and services

ELEMENT	PERFORMANCE CRITERIA
1. Specify pipe and service locating equipment and procedures.	1.1 ***Applications for pipe and service locating equipment*** are specified. 1.2 Pipe and service ***locating equipment*** is specified for specific applications. 1.3 ***Operating procedures*** are specified for the selected equipment. 1.4 ***Safety procedures*** are specified for the selected equipment.
2. Specify pipe-freezing equipment and procedures.	2.1 ***Applications for pipe-freezing equipment*** are specified. 2.2 Pipe-freezing equipment is specified for specific applications. 2.3 Operating procedures are specified for the selected equipment. 2.4 Safety procedures are specified for the selected equipment.
3. Specify sewer and drain camera equipment and procedures.	3.1 ***Applications for sewer and drain camera equipment*** are specified. 3.2 Sewer and drain camera equipment is specified for specific applications. 3.3 Operating procedures are specified for the selected equipment. 3.4 Safety procedures are specified for the selected equipment.
4. Specify under-road boring equipment and procedures.	4.1 ***Applications for under-road boring equipment*** are specified. 4.2 Under-road boring equipment is specified for specific applications. 4.3 Operating procedures are specified for the selected equipment. 4.4 Safety procedures are specified for the selected equipment.

5. Specify robotic sewer repair and chemical grout systems and procedures.	5.1 ***Applications for robotic sewer repair, trenchless pipe repair systems and chemical grout systems*** are specified. 5.2 Robotic sewer repair and chemical grout systems are specified for specific applications. 5.3 ***Trenchless pipe repair systems*** are specified for specific applications. 5.4 Operating procedures are specified for the selected equipment. 5.5 Safety procedures are specified for the selected equipment.
6. Specify high-pressure drain cleaning equipment and procedures.	6.1 ***Applications for high-pressure drain cleaning equipment*** are specified. 6.2 High-pressure drain cleaning equipment is specified for specific applications. 6.3 Operating procedures are specified for the selected equipment. 6.4 Safety procedures are specified for the selected equipment.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources.

Required knowledge:

- requirements of state regulatory authorities, Australian standards and manufacturer specifications, including hazards identified in relation to devices and systems used
- common terminology and definitions used in the specification of piping system maintenance procedures
- nature of materials used and effects of performance under various conditions
- principles of technology in the specification of piping system maintenance procedures
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Applications for pipe and service locating equipment include:	• burst water pipes • excavations where existing services may be located • locating existing services for new connections.
Locating equipment includes:	• sound detection equipment • metal detectors • electronic detection equipment.
Operating procedures include:	• defining the application, equipment operation and equipment limitations.
Safety procedures include:	• electrical safety • excavation safety • equipment safety requirements • personal protective equipment • access restrictions.
Applications for pipe-freezing equipment include:	• burst water mains • maintenance • repairs • applications where interruption to water supply is not an option.
Applications for sewer and drain camera equipment include:	• location of damaged pipework • inspection of pipework • root intrusion identification.
Applications for under-road boring equipment include:	• replacement of services • installation of new services where damage to roads and structures is undesirable or cost prohibitive.

Applications for robotic sewer repair, trenchless pipe repair systems and chemical grout systems include:	• re-lining of:
	  • damaged sewers
	  • stormwater drains
	  • water mains.

Trenchless pipe repair systems include:	• stainless steel sleeves • polyethylene sleeves • other pipelining materials.

Applications for high-pressure drain cleaning equipment include:	• blocked:
	  • sewers
	  • stormwater drains
	  • manholes.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment	• This unit of competency could be assessed on its own or as part of an integrated assessment activity involving preparation of specifications for procedures to locate and maintain piping systems.

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:
	  • specifying equipment and procedures to be used for the location of pipes and services
	  • specifying pipe-freezing equipment and procedures
	  • specifying sewer and drain camera equipment and procedures
	  • specifying under-road boring equipment and procedures
	  • specifying robotic sewer repair and chemical grout systems and procedures
	  • specifying high-pressure drain cleaning equipment and procedures.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environments appropriate to a range of situations and activities
  - computers and software
  - materials appropriate to application activities
  - appropriate documentation and data related to tasks, including plans and specifications of an appropriate building
  - tools and equipment relevant to planning processes, including calculators.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

BCPPS5015A Inspect plumbing and drainage systems

Unit Descriptor

This unit of competency specifies the outcomes required to conduct inspections of hydraulic systems for a range of residential, commercial and industrial buildings to ensure compliance with Australian and New Zealand standards and local authority and operational performance requirements.

Employability Skills This unit has employability skills.

Application of the Unit This unit of competency supports the attainment of skills and knowledge required for competent workplace performance in a consultancy or supervisory capacity in relation to plumbing services and hydraulics.

Unit Sector Plumbing and services

ELEMENT	PERFORMANCE CRITERIA
1. Specify local authority inspection requirements.	1.1 Local authority inspection requirements for ***hydraulic systems*** are specified in accordance with legislation and standards. 1.2 ***Approved materials*** are specified for different applications. 1.3 Installation requirements are specified in compliance with manufacturers' manuals and regulatory requirements.
2. Develop inspection procedures.	2.1 ***Administrative procedures*** for ***inspection projects*** are developed. 2.2 ***Inspection checklists*** are developed.
3. Conduct inspections.	3.1 Communication channels are established with relevant site personnel and stakeholders. 3.2 Inspection routes and schedules are planned and detailed. 3.3 Occupational health and safety guidelines are applied to inspections, and personal protective equipment is worn. 3.4 Inspections are conducted to assess compliance with regulatory requirements and professional workmanship standards. 3.5 On-site ***as-constructed plans*** are hand sketched and measurements are taken. 3.6 ***Dispute-resolution techniques*** are implemented as necessary when non-compliance is identified. 3.7 ***Testing procedures*** are implemented. 3.8 Inspection and testing results are accurately recorded.
4. Prepare reports.	4.1 ***Inspection reports*** are prepared using on-site records, including as-constructed plans. 4.2 Recommendations are detailed. 4.3 Rectification schedules are produced.

5. Enforce compliance.	5.1 Breaches of any relevant regulation or standard are detailed. 5.2 Infringement notices are issued and the relevant follow-up procedures are implemented. 5.3 In cases of non-compliance, ***enforcement action*** is implemented with infringement notices.
6. Maintain records.	6.1 An inspection diary is maintained. 6.2 Inspection records are processed according to established administrative procedures.

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- mathematical and numeracy skills to be able to apply measurements and calculations
- oral and written communication skills, including the ability to confirm job specifications and client requirements
- organisational skills, including the ability to plan and set out work
- reading skills, including the ability to read and interpret drawings, specifications and documentation from a variety of sources.

Required knowledge:

- requirements of state regulatory authorities, Australian standards and manufacturer specifications, including hazards identified in relation to devices and systems used
- common terminology and definitions used in the design of plumbing and drainage systems
- nature of materials used and effects of performance under various conditions
- principles of technology used in the design of plumbing and drainage systems
- workplace safety requirements, including relevant statutory regulations, codes and standards.

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. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

Hydraulic systems include:	• sanitary plumbing and drainage • water supply • trade waste • fire services • mechanical services • gas services • stormwater drainage.

Approved materials are identified from Australain and New Zealand standards and include:	• fittings • fixtures • pipes.
Administrative procedures include:	• logging inspections • inspection allocation • file management • inspection records.
Inspection projects include:	• local authority • hydraulic consultant • plumbing supervisor.

Inspection checklists include:	• project section
	• authorised materials
	• approved installation methods
	• compliance with:
	  • distances
	  • limitations
	  • Australian and New Zealand standards
	  • Building Code of Australia
	  • Other regulatory requirements.

As-constructed plans include layout of:	• sanitary plumbing and drainage pipework • water supply pipework • mechanical services pipework • stormwater pipework • trade waste drainage systems • gas pipework • fire services pipework.
Dispute-resolution techniques include:	• active listening techniques • non-threatening body language • power neutral relationships • other recognised dispute avoidance and resolution techniques.
Testing procedures include:	• hydrostatic tests • air pressure tests • gas leak detection • mirror tests • sound testing • quality assurance (QA) audit • compliance checklist.

Inspection reports include:	• defect • inspection • performance • quality assurance.
Enforcement action includes:	• legal action • notification to plumbing licensing body • fines • penalties.

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment	• This unit of competency could be assessed on its own or as part of an integrated assessment activity involving planning and conducting two compliance inspections of hydraulic installations and completing all relevant documentation.

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:
	  • specifying local authority inspection requirements for hydraulic systems in accordance with legislation and standards
	  • developing administrative procedures for inspection projects
	  • implementing dispute-resolution techniques
	  • conducting compliance inspections
	  • taking relevant measurements and sketching on-site as-constructed plans
	  • implementing testing procedures
	  • preparing inspection reports
	  • detailing breaches to regulations or standards
	  • maintaining an inspection diary.

Context of and specific resources for assessment

- Resource implications for assessment include:
  - workplace or simulated environments appropriate to a range of situations and activities
  - computers and software
  - appropriate documentation and data related to tasks, including plans and specifications of an appropriate building
  - tools and equipment relevant to planning processes, including calculators.
- Where applicable, physical resources should include equipment modified for people with disabilities.
- Access must be provided to appropriate learning and/or assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy requirements of the work being performed.
- 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 of competence only taken at the point when the assessor has complete confidence in the candidate's competence
  - all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
  - where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency demonstrated over a period of time
  - assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the unit of competency and the work being performed.

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