

22672VIC Course in Balancing and Commissioning HVAC Systems

Version 1 3/7/2024

**This course has been accredited under Part 4.4 of the
*Education and Training Reform Act 2006.***

Accredited for the period:

1 February 2025 to 31 January 2030

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Section A – Copyright and course classification information

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<p>2. Address</p>	<p>Executive Director Deputy CEO Victorian Skills Authority Department of Jobs Skills, Industry and Regions(DJSIR) GPO Box 4509 Melbourne Vic 3001</p> <p>Organisational Contact: Manager, Training and Learning Products Unit Engagement Branch Victorian Skills Authority Telephone: 131 823 Email: course.enquiry@djsir.vic.gov.au</p> <p>Day-to-day contact: Curriculum Maintenance Manager (CMM) Building Industries Holmesglen Institute PO Box 42 Holmesglen VIC 3148 Telephone: (03) 9564 1987 Email: teresa.signorello@holmesglen.edu.au</p>
<p>3. Type of submission</p>	<p>This submission is for the re-accreditation of the 22544VIC Course in Balancing and Commissioning HVAC Systems</p>
<p>4. Copyright acknowledgement</p>	<p>Not applicable</p>
<p>5. Licensing and franchise</p>	<p>Copyright of this material is reserved to the Crown in the right of the State of Victoria. © State of Victoria (Department of Jobs, Skills, Industry and Regions) 2024.</p> <p>This work is licensed under a Creative Commons Attribution-No Derivatives 4.0 International licence (see Creative Commons for more information).</p> <p>You are free to re-use the work under that on the condition that you credit the State of Victoria (Department of Jobs Skills Industry and Regions) provide a link to the licence indicated if changes were made</p>

	<p>and comply with all other licence terms. You must not distribute modified material. Request for other use should be addressed to:</p> <p>Request for other use should be addressed to:</p> <p>Deputy CEO Victorian Skills Authority Department of Jobs, Skills, Industry and Regions (DJSIR) GPO Box 4509 Melbourne Vic 3001</p> <p>Email: course.enquiry@djsir.vic.gov.au</p> <p>Copies of this publication can be downloaded free of charge from the Victorian Government website</p>
6. Course accrediting body	Victorian Registration and Qualifications Authority
7. AVETMISS information	<p>ANZSCO code – 6 digit</p> <ul style="list-style-type: none"> <u>Australian and New Zealand Standard Classification of Occupations</u> 342111 Airconditioning and Refrigeration Mechanic <p>ASCED Code – 4 digit</p> <ul style="list-style-type: none"> <u>Field of Education</u> 0313 Electrical and Electronic Engineering and Technology <p>National course code 22672VIC</p>
8. Period of accreditation	1 February 2025 to 31 January 2030

Section B – Course information

1. Nomenclature	Standard 4.1 and 5.8 AQTF 2021 Standards for Accredited Courses
1.1 Name of the qualification	Course in Balancing and Commissioning HVAC Systems
1.2 Nominal duration of the course	150 nominal hours.
2. Vocational or educational outcomes	Standard 5.1 AQTF 2021 Standards for Accredited Courses
2.1 Outcome(s) of the course	<p>The Course in Balancing and Commissioning HVAC Systems is designed to provide learners with the skills and knowledge required to:</p> <ul style="list-style-type: none"> • apply knowledge of legislative and safe work practices, industry standards and codes of practice to HVAC testing, adjusting and balancing work processes • determine final adjustment requirements for essential services, building management system and energy management • apply final adjustment, setting and balancing procedures for HVAC systems and air conditioning plant and equipment, post installation • complete, finalise and submit workplace reports • advise clients of ongoing energy efficiency maintenance strategies. <p>This course will enhance the capability of experienced HVAC practitioners. At the completion of the Course in Balancing and Commissioning HVAC Systems graduates will have the skills and knowledge required to undertake the job role of HVAC balancing and commissioning technician.</p>
2.2 Course description	The 22672VIC Course in Balancing and Commissioning HVAC systems will provide learners with the skills and knowledge required to work effectively to apply final adjustment, setting and balancing procedures for HVAC systems and air conditioning plant and equipment (excluding refrigeration), post installation. The work context relates to mechanical services systems that are installed to create an artificial / closed environment in residential, commercial, industrial and civic buildings.
3. Development of the course	Standards 4.1, 5.1, 5.2, 5.3 and 5.4 AQTF 2021 Standards for Accredited Courses
3.1 Industry, education, legislative, enterprise or community needs	<p>Background</p> <p>The heating, ventilation and air conditioning (HVAC) balancing and commissioning function is critical to the energy performance of a building. It ensures that the mechanical services system not only provides heating, ventilation and cooling as per client requirements, but also meets energy and safety performance standards as specified in the National Construction Code (NCC) and Australian Standards. HVAC systems are required to be tested and commissioned according to</p>

these energy efficiency provisions. New energy efficiency provisions for the residential sector were recently adopted in the NCC in May 2023¹.

Understanding a building's energy consumption breakdown means strategies can be developed to improve both energy efficiency and building performance. The primary consumption of energy for a residential building are heating, cooling, ventilation, lighting, refrigeration, hot water heating, plug loads². Commercial and industrial consumption varies according to the nature of the business activity, the size of the building and its use.

In the commercial sector, HVAC systems account for approximately 40% of a typical office building's total energy consumption³. In buildings with older or less efficient systems, HVAC can account for upwards of 75% of total energy usage. This represents a significant portion of a building's energy consumption.

International studies have shown that energy efficient HVAC systems can lead to a 20-30% reduction in energy consumption compared to traditional systems⁴. HVAC optimisation is therefore a worthwhile consideration for energy and cost reduction.

As HVAC systems vary from one building to another, optimisation opportunities are unique to each context. This requires the systematic collection of information from building management systems and facilities staff, historical utility data and energy data collected from key items of equipment. Subsequent testing and the analysis of energy data is then required to identify inconsistencies between current system operation and required standards of efficiency.

This course develops the capacity of learners to maximise HVAC system efficiency to required NCC standards for a variety of building contexts. This includes providing advice to clients on HVAC design, installation, operation, and energy efficient maintenance strategies.

Course demand

HVAC systems play a crucial role in regulating temperature, ensuring indoor air quality, and providing thermal comfort⁵. An increasing consumer demand for comfort and the growing focus on building energy-efficient systems are expected to drive expansion of the Australian HVAC market between 2023 and 2029⁶. During this period, the size of Australia HVAC market is projected to grow at a compound annual growth rate (CAGR) of 6.16%. The rising demand for smart

¹ <https://www.energy.vic.gov.au/for-households/7-star-energy-efficiency-building-standards>

² <https://www.buildingsiot.com/blog/building-energy-consumption-breakdown-for-owners-and-management-bd#:~:text=According%20to%20Department%20of%20Energy,kilowatt%2Dhours%20per%20square%20foot.>

³ <https://www.environment.gov.au/system/files/energy/files/hvac-factsheet-energy-breakdown.pdf>

⁴ <https://energy5.com/comparing-the-costs-of-energy-efficient-and-standard-hvac-systems>

⁵ <https://www.blueweaveconsulting.com/report/australia-hvac-market#:~:text=Australia%20HVAC%20Market%20size%20was,USD%201.56%20billion%20by%202029.>

⁶ <https://www.blueweaveconsulting.com/report/australia-hvac-market#:~:text=Australia%20HVAC%20Market%20size%20was,USD%201.56%20billion%20by%202029.>

homes, coupled with rapid urbanization and industrialization, further fuels the demand for HVAC systems. Technological advancements such as automated control systems and remote access are expected to contribute to the expansion of the Australia HVAC market to 2029.

Government support

Development of this course is supported and funded by the Department of Education, Victoria. Major stakeholders within the industry are also supportive of the reaccreditation of the Course in Balancing and Commissioning HVAC systems as evidenced by their acceptance to participate on the Project Steering Committee (PSC).

Target group

The identified cohort represents those with trade experience in either mechanical services plumbing, electronics, refrigeration mechanics or relevant engineering experience, who are seeking a career shift into a HVAC balancing and commissioning technician role, which includes providing advice to clients on energy efficient maintenance strategies. The course will therefore provide a pathway for further skill building. At completion of the course participants will have the skills and knowledge to be a HVAC balancing and commissioning technician, to effectively test, balance and commission mechanical services systems, post installation, across a range of residential, commercial, industrial and civic structures.

Course enrolment

While there were no course enrolments in the expired course, the PSC confirmed that this did not accurately reflect course need. A skill gap continues to exist within nationally endorsed training package training products related to the HVAC balancing and commissioning technician vocation. Industry considers the course important to provide technical upskilling for professional development purposes and will explore implementation options with Holmesglen Institute for delivery as accredited and micro credential training. Anticipated demand for the course is expected to trend positively in the short to medium term.

Project steering committee

Course developers undertook desktop research and consulted with industry stakeholders to inform training product development. The members of the steering committee met formally on two occasions to consider and confirm the required skill and knowledge outcomes of the course, course structure and final accreditation submission. Stakeholder feedback was incorporated to refine the technical content and assessment requirements of the course and enterprise units, as appropriate. The project for the development of the 22672VIC Course in Balancing and Commissioning HVAC Systems was overseen by a project steering committee (PSC) comprised of the following industry and RTO representatives:

Brad McAndrew (Chair)	AC Hall Airconditioning Group
Paul Chasteauneuf	AG Coombs Pty Ltd

Laura Steedman	Air Conditioning and Mechanical Contractors Association (AMCA)
Keith Pearson	OP Industries Melbourne
Elizabeth Jansz	Holmesglen Institute
In attendance:	
Teresa Signorello	CMM Building Industries, Holmesglen Institute
Susan Fechner	Project Officer, Building Industries, Holmesglen Institute

This course:

- does not duplicate, by title or coverage, the outcomes of an endorsed training package qualification
- is not a subset of a single training package qualification that could be recognised through one or more statements of attainment or a skill set
- does not include units of competency additional to those in a training package qualification that could be recognised through statements of attainment in addition to the qualification
- does not comprise units that duplicate units of competency of a training package qualification.

**3.2 Review for re-
accreditation**

This is the second iteration of the Course in Balancing and Commissioning HVAC Systems, having first been accredited in 2020 via the Office of the Victorian Skills Commission (OVSC).

The course has had no enrolments since its accreditation. Research and consultation undertaken by the CMM Building Industries in late 2022 attributed the following reasons for poor course uptake:

- the course was not published on the Department of Education (DET) website therefore course awareness was limited
- the course was not placed on the funded courses list (FCL), discouraging provider implementation
- a lack of training and assessing resource material to support course delivery
- a considerable lack of suitably qualified trainers and assessors to deliver the course according to Standards for Registered Training Organisation (SRTTO) compliance requirements.

Course need continues as a skills gap exists within the building and construction industry regarding recognised training that focuses on balancing and commissioning HVAC systems.

The reaccredited course will be a Crown Copyright owned course, published on the DET website and freely available for provider use. RTO's will be able to seek permission to use the course for training



purposes through that avenue. Key industry stakeholders of the PSC are committed to course uptake, with potential partnerships for delivery by the AMCA and Holmesglen Institute. This is expected to have a positive impact on course uptake and student enrolments.

The course 22672VIC Course in Balancing and Commissioning HVAC Systems supersedes and is equivalent to 22544VIC Course in Balancing and Commissioning HVAC Systems.

The following table identifies the relationship between the current and previous units.

22672VIC Course in Balancing and Commissioning HVAC Systems	22544VIC Course in Balancing and Commissioning HVAC Systems	Relationship
VU23708 Work effectively as a balancing and commissioning technician in the HVAC industry	VU22890 Work effectively as a balancing and commissioning technician in the HVAC industry	Equivalent
VU23709 Balance and commission heating ventilation and air conditioning systems	VU22891 Balance and commission heating ventilation and air conditioning systems	Equivalent

4. Course outcomes	Standards 5.5, 5.6 and 5.7 AQTF 2021 Standards for Accredited Courses
4.1 Qualification level	The 22672VIC Course in Balancing and Commissioning HVAC Systems meets an identified industry/enterprise need, but does not have the breadth, depth or volume of learning of a qualification specified in the Australian Qualification Framework.
4.2 Foundation skills	Foundation skills applicable to the outcomes of this course are identified in the units of competency.
4.3 Recognition given to the course (if applicable)	Not applicable
4.4 Licensing/regulatory requirements (if applicable)	There are no licensing requirements related to the outcome of this course. Participants who visit a construction site will require a Construction Induction Card (CIC), which can be achieved through the completion of the unit CPCWHS1001 Prepare to work safely in the construction industry. Further information is available on the WorkSafe website or other relevant jurisdictional sites.

5. Course rules	Standards 5.8 and 5.9 AQTF 2021 Standards for Accredited Courses
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5.1 Course structure	<p>To achieve the award of 22672VIC Course in Balancing and Commissioning HVAC Systems the learner must successfully complete two (2) units listed below.</p> <p>Where the full course is not completed, a VET Statement of Attainment will be issued for each unit successfully completed.</p>
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Unit of competency code	Unit of competency title	Field of Education code (six-digit)	Pre-requisite	Nominal hours
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Core units

VU23708	Work effectively as a balancing and commissioning technician in the HVAC industry	031315	Nil	50
VU23709	Balance and commission heating ventilation and air conditioning systems	031315	VU23708	100
Total nominal hours				150

Standard 5.11 AQTF 2021 Standards for Accredited Courses

5.2 Entry requirements	<p>To undertake the 22672VIC Course in Balancing and Commissioning HVAC Systems, the participant must have a relevant trade qualification in one of the following;</p> <ul style="list-style-type: none"> • Certificate III in Plumbing • Certificate III Electrical • Certificate III in Refrigeration and Air Conditioning • and/or have relevant undergraduate or higher level AQF engineering qualification. <p>Learners enrolling in the Course are best equipped to successfully undertake the course if they have as a minimum, language, literacy and numeracy skills that align to Level 3 of the Australian Core Skills Framework (ACSF). The ACSF can be accessed from the education department's website available here.</p> <p>Learners with language, literacy and numeracy skills at a lower level than recommended will require additional support to successfully undertake the 'course'.</p>
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6. Assessment	Standard 5.12 and 5.14 AQTF 2021 Standards for Accredited Courses
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6.1 Assessment strategy	All assessment, including Recognition of Prior Learning (RPL), must be compliant with the requirements of:
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- Standard 1 of the AQTF: Essential Conditions and Standards for Initial/Continuing Registration and Guidelines 4.1 and 4.2 of the VRQA Guidelines for VET Providers,

or

- the Standards for Registered Training Organisations 2015 (SRTOs),

or

- the relevant standards and Guidelines for RTOs at the time of assessment.

The nature of work undertaken in the construction industry is hands-on and practical and therefore, the assessment strategies should reflect this. It is recommended that assessment be a holistic process that integrates the units in practical tasks or projects. Assessment strategies should reflect a range of variables, the underpinning skills and knowledge and the assessment requirements specified in each unit. Assessment strategies should be designed to:

- cover a range of skills and knowledge required to demonstrate the intended course outcomes
- be appropriate to the skills, knowledge, methods of delivery and needs/characteristics of learners
- assist assessors to interpret evidence consistently
- recognise prior learning
- be equitable to all groups of learners
- be valid, reliable, flexible and fair
- inform learners of the context and purpose of the assessment and the assessment process
- provide feedback to learners about the outcomes of the assessment process and guidance given for future options
- allow reasonable time to complete a task which specifically reflects the industry context in which the task takes place.

Where not mandated in the units of competency, a range of appropriate assessment methods may be used to determine competency.

The following methods are appropriate for the units of competency in this course:

- direct observation
- written and/or oral questioning to assess required knowledge
- scenario based activities
- problem solving activities.

<p>6.2 Assessor competencies</p>	<p>Assessment must be undertaken by a person or persons in accordance with:</p> <ul style="list-style-type: none"> • Standard 1.4 of the AQTF: Essential Conditions and Standards for Initial/Continuing Registration and Guidelines 3 of the VRQA Guidelines for VET Providers, <p>or</p> <ul style="list-style-type: none"> • the Standards for Registered Training Organisations 2015 (SRTOs), <p>or</p> <ul style="list-style-type: none"> • the relevant standards and Guidelines for RTOs at the time of assessment.
<p>7. Delivery Standards 5.12, 5.13 and 5.14 AQTF 2021 Standards for Accredited Courses</p>	
<p>7.1 Delivery modes</p>	<p>As the role involves practical skill development, the practical skill component of the course must be delivered in a:</p> <ul style="list-style-type: none"> • workplace <p>or</p> <ul style="list-style-type: none"> • simulated workplace that accurately reflects workplace conditions. <p>The course may be delivered either on a full-time or part-time basis using a combination of delivery modes, including:</p> <ul style="list-style-type: none"> • face-to-face, classroom-based delivery • blended (e-learning) delivery. <p>Delivery strategies should recognise the nature of the units and the learning styles of the participants. Where the enterprise units address common content, integration may be appropriate. Occupational Health and Safety (OHS) / Work Health and Safety (WHS) must be incorporated at every opportunity.</p> <p>Delivery options, including grouping of learners and learning activities, should recognise the varying learning needs, educational backgrounds, preferred learning styles and constraints of the individual learner and the specific requirements of each unit.</p> <p>The objective of the course is to develop practical competencies within an industry context. Practical demonstrations in the form of realistic, holistic projects that provide participants with a sense of 'real-work' experience are considered most suitable to achieving this aim. Delivery methods of units of competency may involve:</p> <ul style="list-style-type: none"> • practical exercises • group discussion • individual scenario-based assignments.

<p>7.2 Resources</p>	<p>Training must be undertaken by a person or persons in accordance with:</p> <ul style="list-style-type: none"> Standard 1.4 of the AQTF: Essential Conditions and Standards for Initial/Continuing Registration and Guideline 3 of the VRQA Guidelines for VET Providers, <p>OR</p> <ul style="list-style-type: none"> the Standards for Registered Training Organisations 2015 (SRTOs), <p>OR</p> <ul style="list-style-type: none"> the relevant standards and Guidelines for RTOs at the time of assessment. <p>Delivery and assessment materials should reflect the local work environment as far as possible.</p> <p>Resources for assessment must include:</p> <ul style="list-style-type: none"> access to HVAC systems comprised of components and systems related to the requirements of the units of competency relevant Occupational Health & Safety (OH&S) / Work Health & Safety (WH&S) and Personal Protective Equipment (PPE) policies and procedures plant specifications for sites which contain the requirements for the unit of work documentation covering commissioning methods at own workplace e.g. samples of test report forms tools and equipment relevant to balancing and commissioning task documentation including job plans and product specifications, job safety analyses (JSA's), safe work method statement (SWMS), Safety data sheets (SDS), and industry standards. documentation of any OH&S / WH&S hazards present and the reports issued to relevant personnel.
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<p>8. Pathways and articulation</p>	<p>Standard 5.10 AQTF 2021 Standards for Accredited Courses</p> <p>Graduates may choose to undertake further study to extend their post trade skill base for the testing and commissioning of HVAC systems. This may include relevant certificate IV qualifications or above, within the CPC Construction Plumbing and Services Training Package or UEE Electrotechnology Training Package, depending on the entry requirement satisfied by the learner.</p> <p>Refer to the AQF 2nd Edition, 2013 Pathways Policy available here.</p> <p>There are no formal articulation arrangements in place at the time of accreditation.</p>
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9. Ongoing monitoring and evaluation	Standard 5.15 AQTF 2021 Standards for Accredited Courses
	<p>The Curriculum Maintenance Manager for Building Industries is responsible for the ongoing monitoring and evaluation of the 22672VIC Course in Balancing and Commissioning HVAC Systems.</p> <p>Formal course evaluations will be undertaken halfway through the accreditation period and will be based on student and teacher evaluation surveys and industry stakeholder surveys/consultations.</p> <p>The Victorian Registration and Qualifications Authority (VRQA) will be notified of any changes to the course.</p>

Section C – Units of competency

Units of competency developed for the course, which comply with the *AQTF 2021 Standards for Accredited Courses - Unit of Competency Template* and detailed in this section include:

- VU23708 Work effectively as a balancing and commissioning technician in the HVAC industry
 - VU23709 Balance and commission heating ventilation and air conditioning systems
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Unit code	VU23708		
Unit title	Work effectively as a balancing and commissioning technician in the HVAC industry		
Application	<p>This unit describes the performance outcomes, skills and knowledge required to work effectively as a balancing and commissioning technician within the heating ventilation and air conditioning (HVAC) industry.</p> <p>It requires the ability to prepare to work, interpret building mechanical services, codes and specifications, confirm operating requirements against specification, determine HVAC systems operation, and the operation of HVAC control systems, apply appropriate testing techniques for various air and water systems and finalise documentation.</p> <p>The unit applies to heating ventilation and air conditioning (HVAC) technicians who apply knowledge of legislative and safe work practices, industry standards and codes of practice to HVAC testing, adjusting and balancing work processes.</p> <p>The work context relates to a range of air conditioning and mechanical services systems post installation. Work practices related to refrigeration do not apply to this unit.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p>		
Pre-requisite Unit(s)			
Element	Performance Criteria		
Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the assessment requirements.		
1	Prepare for work	1.1.	Determine and confirm compliance with Occupational Health & Safety (OH&S) / Work Health & Safety (WH&S) requirements associated with the workplace and work involving balancing and commissioning HVAC systems
		1.2.	Establish risk control in the work area and report hazards to relevant authority
		1.3.	Communicate with designated personnel and co-workers relevant to OH&S / WH&S issues, in accordance with site requirements
		1.4.	Identify relevant National Construction Code (NCC), Australian or other Standards and defined procedures required to undertake activities as a balancing and commissioning technician

		1.5.	Access enterprise / site procedures for dealing with accidents, fires and other emergencies as required within the scope of role
		1.6.	Identify and prepare reports of maintenance items and safety hazards, which may compromise OH&S / WH&S site requirement or hinder testing and commissioning procedures
2	Interpret building mechanical services, codes and specifications	2.1.	Determine system requirements from design documentation for air and water distribution, constant volume / variable air volume systems, air and water systems, control systems and applications
		2.2.	Compare design diagrams and site drawings to site specification to determine accuracy
		2.3.	Apply relevant building code, essential services, federal, state and local government regulations and Australian Standards to site specifications
		2.4.	Calculate basic air conditioning processes with the use of psychometric charts
3	Confirm operating requirements against specification	3.1.	Determine an appropriate method for comparing ventilation requirements with the design specification and Australian Standards, to ensure compliance
		3.2.	Calculate duct sizing, using charts and / or tables, and compare results to design specification
		3.3.	Calculate pipe sizing, using charts and / or tables, and compare results to design specification
		3.4.	Select appropriate tools and equipment to measure air and water flow, air and water pressures, air and water temperature, electrical voltage and current within scope of work role
4	Determine HVAC systems operation	4.1.	Establish the operational requirements of a range of mechanical ventilation, heating, cooling, and dehumidification systems using site drawings, design specifications and site installation
		4.2.	Confirm operational requirements of the heating and /or cooling systems according to design specifications
5	Determine the operation of HVAC control systems	5.1.	Interpret control system terminology and design diagrams and apply to circuit, site diagrams and design specifications
		5.2.	Determine the operating characteristics for components in a range of control system circuits with reference to site drawings and design specifications

		5.3.	Identify and report any unusual control operation or function during commissioning of building management system (BMS)
		5.4.	Determine the requirements to test and adjust control systems for building systems control, airflow control, chiller, boiler and distribution systems control
		5.5.	Apply building management systems (BMS) and building energy management principles to HVAC systems
6	Apply appropriate testing techniques for various air and water systems	6.1.	Determine appropriate fan testing techniques for air handling systems
		6.2.	Determine appropriate testing techniques for water sourced systems
		6.3.	Perform accurate capacity calculations for air flows and energy exchange
		6.4.	Perform accurate water flow testing calculations
		6.5.	Perform accurate pump pressure and valve performance calculations
7	Finalise documentation	7.1.	Complete workplace reports according to organizational procedures
		7.2.	Submit reports in line with organizational procedures

Range of Conditions

N/A

Foundation Skills

Foundation skills essential to performance and not explicit in the performance criteria must be assessed.

Skill	Description
Reading skills to:	<ul style="list-style-type: none"> • interpret specifications, standard operating procedures and OH&S / WH&S requirements relevant to work task • interpret design documentation to determine system operating requirements <ul style="list-style-type: none"> ○ apply OH&S/WH&S, Safe Work Method Statements and other relevant workplace procedures
Writing skills to:	<ul style="list-style-type: none"> • prepare reports related to workplace safety and balancing and commissioning testing • prepare routine reports to workplace standard
Oral communication skills to:	<ul style="list-style-type: none"> • inform building / site manager of arising issues
Numeracy skills to:	<ul style="list-style-type: none"> • perform calculations using formulae
Learning skills to:	<ul style="list-style-type: none"> • follow work safety procedures
Problem-solving skills to:	<ul style="list-style-type: none"> • compare accuracy of system design diagrams to site drawings • apply codes, regulations and standards to site specifications • determine methods for comparing project requirements with specifications • interpret component and system operation output to specifications
Initiative and enterprise skills to:	<ul style="list-style-type: none"> • act on OH&S/WH&S issues • notify appropriate personnel of unexpected Building Management System issues during testing • identify methods for systems improvement
Teamwork skills to:	<ul style="list-style-type: none"> • promote a safe work environment
Planning and organising skills to:	<ul style="list-style-type: none"> • identify codes, standards and regulations required to undertake activities • identify tools and equipment required for balancing and commissioning tasks • determine appropriate testing techniques for air and water sourced systems • determine control system test and adjust requirements • sequencing operations in a logical and efficient manner
Self-management skills to:	<ul style="list-style-type: none"> • apply site procedures as appropriate to work role

Technology skills to:	<ul style="list-style-type: none"> • use air, water and electrical measuring equipment • use HVAC specialised tools and equipment.
Digital literacy skills to:	<ul style="list-style-type: none"> • save, attach and send electronic documents

Unit Mapping Information

Code and Title Current Version	Code and Title Previous Version	Comments
VU23708 Work effectively as a balancing and commissioning technician in the HVAC industry	VU22890 Work effectively as a balancing and commissioning technician in the HVAC industry	Unit equivalent

Assessment Requirements	
Title	Assessment Requirements for VU23708 Work effectively as a balancing and commissioning technician in the HVAC industry
Performance Evidence	<p>The learner must demonstrate the ability to complete tasks outlined in the elements, performance criteria and foundation skills of this unit including evidence of the ability to performance test two (2) different HVAC systems. In so doing the candidate must:</p> <ul style="list-style-type: none"> • read, interpret and apply relevant information for HVAC balancing and commissioning task/work • comply with appropriate workplace procedures, NCC, standards and regulations related to HVAC balancing and commissioning practices • select and apply appropriate testing methods for project requirements • prepare workplace reports of project test outcomes.
Knowledge Evidence	<p>The learner must be able to apply essential knowledge required to effectively do the task outlined in elements, performance criteria and foundation skills of this unit, manage the task and manage contingencies in the context of the work role. This includes knowledge of:</p> <ul style="list-style-type: none"> • OH&S/WH&S legislation as it applies to the balancing & commissioning work context • common terminology used within the HVAC industry • scope of work role related to: <ul style="list-style-type: none"> ○ types of readings to be taken and how to perform the measurements ○ timing of recording for voltage and current of a start up motor ○ process for setting systems to maximum output for final measurement ○ type of information to record on a test report ○ testing conditions that require the services of an electrician • relevant National Construction Code (NCC) building codes related to: <ul style="list-style-type: none"> ○ smoke control ○ light and ventilation ○ heating appliances, fireplaces, chimneys and flues ○ essential safety measures • relevant Australian and industry standards • types and features of design diagrams relevant to HVAC contexts • safety hazards related to the interruption of: <ul style="list-style-type: none"> ○ ventilation ○ exhaust

- essential services
- basic principles of:
 - fluid mechanics
 - thermodynamics
- range and operation of mechanical ventilation service systems and their components including:
 - air distribution principles
 - air system design
 - fans
 - ventilation and dust extraction
 - air systems
 - underfloor cooling
 - chilled beams
- air conditioning processes related to:
 - fundamental functions
 - coil characteristics
 - spray processes
 - system analysis
 - dehumidification
- types and features of control systems
- types and uses of tools and equipment for HVAC balancing and commissioning functions
- fan testing considerations and techniques
- air distribution principles
- dual and single duct constant volume
- range and type of duct sizing tools including:
 - fan curves
 - duct charts
 - ductulator
- range and type of pipe sizing tools including:
 - pump curves
 - pipe sizing charts and tables
- air systems:
 - variable air volume
 - induction units
 - multi-zone units
- indoor air quality factors

	<ul style="list-style-type: none"> • HVAC system components • types of calculations associated with: <ul style="list-style-type: none"> ○ duct sizing ○ pipe sizing ○ air flow and heat exchange capacity • principles of operation for: <ul style="list-style-type: none"> ○ mechanical ventilation systems ○ heating and cooling systems ○ de-humidification systems ○ HVAC control systems • procedures relevant to testing and commissioning building management systems, including enterprise and site requirements • types of documents and reports related to testing, balancing and commissioning HVAC systems • types and functions of HVAC building management systems and their components • building energy management considerations related to efficient HVAC operation
<p>Assessment Conditions</p>	<p>Skills in this unit must be demonstrated in a workplace or simulated environment where testing and commissioning practices for heating, ventilation and cooling (HVAC) equipment is applied.</p> <p>Learners must have access to the following resources:</p> <ul style="list-style-type: none"> • two (2) HVAC systems • a representative range of equipment normally required for the balancing and commissioning of HVAC systems • documentation including job plans and product specifications, , safe work method statement (SWMS), safety data sheets (SDS), and industry standards. <p>Assessor requirements</p> <p>No specialist vocational competency requirements for assessors apply to this unit.</p>

Unit code	VU23709
Unit title	Balance and commission heating ventilation and air conditioning (HVAC) systems
Application	<p>This unit describes the performance outcomes, skills and knowledge required to balance and commission heating ventilation and air conditioning (HVAC) systems.</p> <p>It requires the ability to prepare for balancing and commissioning, perform and record pre commissioning checks to HVAC plant and equipment, test and commission HVAC air handling systems to specifications, compare HVAC hydronic system to specifications, commission HVAC hydronic systems and finalise commissioning and complete relevant documentation.</p> <p>The unit applies to heating, ventilation and air conditioning HVAC technicians who apply final adjustment, setting and balancing procedures for HVAC systems and air conditioning plant and equipment, post installation. It includes testing pump and fan operations and balancing ducted air flows and water flows to standards/regulations and reporting outcomes. Work practices related to refrigeration do not apply to this unit.</p> <p>The work context relates to residential, commercial, industrial and civic structures predominantly, where HVAC systems are installed to create an artificial / closed environment. These may include single or multi residential developments, office buildings, factories, hospitals, schools, and may extend to transport forms (trains, airplanes, ships), gas and oil plants.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p>
Pre-requisite Unit(s)	VU23708 Work effectively as a balancing and commissioning technician in the HVAC industry

Element		Performance Criteria
Elements describe the essential outcomes of a unit of competency.		Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the assessment requirements.
1	Prepare for balancing and commissioning	<p>1.1. Identify balancing and commissioning procedures to ensure that occupational health and safety (OH&S) / work health and safety (WH&S) policies for commissioning HVAC systems are followed and the work is sequenced as required for the project</p> <p>1.2. Obtain building / site / plant specification and determine system operational requirements to ensure testing and balancing procedures selected will deliver the required system operation</p>



		1.3.	Identify any special project requirements to deliver the required system operation
		1.4.	Communicate with appropriate personnel to ensure the work is coordinated effectively in conjunction with others involved on the work site
		1.5.	Prepare the tools, equipment / testing devices needed to carry out the testing and balancing work and check that all calibration certificates are current
		1.6.	Plan and sequence the reporting procedures to authorities and project managers, including documentation to record system performance and quality assurance
2	Perform and record pre commissioning checks to HVAC plant and equipment	2.1.	Follow organisational procedures, including OH&S/WH&S policies, to ensure the testing and balancing work is conducted safely in accordance with Codes, Standards and regulations
		2.2.	Inspect HVAC plant and equipment for damage or missing equipment guards which may compromise safety or operational requirements
		2.3.	Check the correct operation of isolation controls for plant and equipment according to all OH&S / WH&S and electrical wiring requirements and procedures
		2.4.	Verify that air filters are fitted, ducts clear of obstructions, duct dampers / damper motors and auto / manual controls are set in operational position
		2.5.	Verify correct directional flow, undertake visual leak test and confirm piping are correctly secured and labelled in hydronic piping systems
		2.6.	Inspect that all manual valves are in correct operating position and automatic controls are set and /or energised in operational positions
		2.7.	Document results of pre commissioning checks
3	Test and commission HVAC air handling systems to specifications	3.1.	Verify currency of calibration and safety certificates for all equipment
		3.2.	Select the required tools, equipment and testing devices needed to test and balance the air systems
		3.3.	Measure and record the operating current and operating voltage of the systems electric motors, compare all results to specification, within scope of job role

		3.4.	Confirm the correct direction of rotation of the system motors, following approved safety measures and OH&S / WH&S requirements
		3.5.	Use air measuring instruments to test, adjust, and balance the air systems and control systems to specifications without damage or distortion to the surrounding environment or services
		3.6.	Record all air flows, pressures and temperatures obtained during commissioning and compare to specifications, implementing contingency measures where abnormal operation is detected
4	Compare HVAC hydronic system to specifications	4.1.	Determine the appropriate method of balancing requirements for the different hydronic systems
		4.2.	Compile a list of the different type of pumps installed, the component parts of each pump and obtain the relevant pump curve from the job/site specifications and manufacturers' data
		4.3.	Calculate the impeller size and pumping capacity of the pumps utilised in the installation, using pump curves and formulae to compare pumping capacities to specification
		4.4.	Locate and identify the types of fluid balancing valves and devices installed in the hydronic system
		4.5.	Calculate and record the flow and pressure drop in the hydronic system balancing valves using the relevant performance curve
5	Test and commission HVAC hydronic systems	5.1.	Select the required tools, equipment and testing devices needed to test and balance the hydronic systems, ensure calibration and safety certificates for all equipment are current
		5.2.	Use the selected equipment to accurately test, adjust balance and record flows in the hydronic systems valves, throttling devices, pumps and heat exchangers
		5.3.	Test and adjust the hydronic systems control system for conformance to specification
		5.4.	Record flows, pressures and temperatures obtained during commissioning and compare to specifications, implementing contingency measures where required
6	Finalise commissioning and complete relevant documentation	6.1.	Carry out final inspections and performance checks to ensure the commissioning work conforms to specifications

		6.2.	Complete the testing and balancing reports and documentation
		6.3.	Follow established procedure to notify the relevant authorities of the commissioning results and completion of the work

Range of Conditions

N/A

Foundation Skills

Foundation skills essential to performance and not explicit in the performance criteria must be assessed.

Skill	Description
Reading skills to:	<ul style="list-style-type: none"> interpret specifications to determine system operating requirements interpret system site drawings, symbols and diagrams
Writing skills to:	<ul style="list-style-type: none"> complete workplace safety documentation, including Safe Work Methods Statement and risk assessments
Oral communication skills to:	<ul style="list-style-type: none"> use questioning to identify and confirm job requirements clarify site information with building / site manager inform building / site manager of arising issues
Numeracy skills to:	<ul style="list-style-type: none"> check currency of calibration and safety certificates
Learning skills to:	<ul style="list-style-type: none"> modify work processes to suit changing circumstances
Problem-solving skills to:	<ul style="list-style-type: none"> identify workplace hazards and assess associated risk determine effect of component adjustment on system operations interpret testing, adjusting and balancing (TAB) outcomes to identify system faults / probable causes diagnose plant and equipment damage / faults check correct operation of plant /equipment /control systems to requirements / procedures / specifications
Initiative and enterprise skills to:	<ul style="list-style-type: none"> act on faults with tools and equipment
Teamwork skills to:	<ul style="list-style-type: none"> recognise individual inputs to coordinate work effectively contribute to completion of work tasks to quality standards and timeframes promote a safe working environment
Planning and organising skills to:	<ul style="list-style-type: none"> complete work tasks in a logical and efficient sequence

Self-management skills to:	<ul style="list-style-type: none"> • work safely by applying appropriate Personal Protective Equipment and hazard minimisation procedures • take responsibility for productive and compliant work practices
Technology skills to:	<ul style="list-style-type: none"> • set /adjust operational positions of plant / equipment / HVAC control systems • identify and operate: <ul style="list-style-type: none"> ○ plant components e.g. air dampers, throttling devices, heat exchangers ○ measuring equipment • use HVAC specialised tools
Digital literacy skills to:	<ul style="list-style-type: none"> • save, attach and send electronic documents

Unit Mapping Information

Code and Title Current Version	Code and Title Previous Version	Comments
VU23709 Balance and commission heating ventilation and air conditioning systems	VU22891 Balance and commission heating ventilation and air conditioning systems	Unit equivalent

Assessment Requirements

Title

Assessment Requirements for VU23709 Balance and commission heating ventilation and air conditioning (HVAC) systems

Performance Evidence

The learner must demonstrate the ability to complete tasks outlined in the elements, performance criteria and foundation skills of this unit including evidence of the ability to test, adjust and balance two (2) HVAC systems. One (1) must be an air handling system and one (1) must be a hydronic system. In so doing, for each system the learner must:

- prepare and provide a commissioning report
- provide set points and parameters for a functional control system
- prepare a deficiency list.

Knowledge Evidence

The learner must be able to apply essential knowledge required to effectively do the task outlined in elements, performance criteria and foundation skills of this unit, manage the task and manage contingencies in the context of the work role. This includes knowledge of:

- Occupational Health & Safety (OH&S)/ Work Health & Safety (WH&S) legislation applied to testing / commissioning and workplace
- common terminology used within the HVAC industry
- scope of work role related to:
 - types of readings to be taken and how to perform the measurements
 - timing of recording for voltage and current of a start up motor
 - process for setting systems to maximum output for final measurement
 - type of information to record on a test report
 - testing conditions that require the services of an electrician
- types and operating features of mechanical services systems:
 - basic fluid mechanics and thermodynamics
 - air conditioning processes
 - fan laws and curves
 - pump laws and curves
 - air distribution principles
 - dual and single duct constant volume
 - variable volume
 - induction and multi-zone units
- types and uses of HVAC tools, plant, equipment and testing devices
- factors that impact indoor air quality
- components of HVAC systems components
- range and type of calculations for duct and pipe sizing

- types of pumps and their operating features
- types and operation of hydronic balancing valves
- uses and methods of interpretation of valve performance curves
- principles of operation for :
 - mechanical ventilation systems
 - heating and cooling systems
 - de-humidification systems
 - HVAC control systems
- commissioning procedures of building management systems
- types of HVAC building management systems
- general HVAC energy management principles
- calculations related to air flow and heat exchange capacity
- features and functions of:
 - cooling and heating coils
 - bypass valves
 - expansion tanks
- range and general purpose of HVAC balancing and commissioning related codes, Standards, regulations and legislation
- types and operation of isolation controls:
 - electrical panel isolation controls
 - electric motor isolation control
 - control system isolation
 - energy management control
 - fluid isolation valves
 - air isolation control
- types and functions of automatic controls
- range of testing methods and associated processes for HVAC systems
- features of air systems and associated air distribution principles, air system design (including fans and dust extraction)
- types, characteristics and components of HVAC control systems
- configuration and functions of building management systems (BMS)
- indicators and reasons for abnormal operation of air flow, air pressure and air temperatures
- types and functions of hydronic system valves, throttling devices, pumps and heat exchangers.

**Assessment
Conditions**

Skills in this unit must be demonstrated in a workplace or simulated environment where testing and commissioning practices for heating, ventilation and cooling (HVAC) equipment is applied.

Learners must have access to the following resources:

- one (1) air handling HVAC system
- one (1) hydronic HVAC system
- a representative range of tools and equipment normally required for the balancing and commissioning of HVAC systems
- documentation including job plans and product specifications, job safety analyses (JSA's), safe work method statements (SWMS), Safety data sheets (SDS), and industry standards
- documentation of any OH&S / WH&S hazards present and the reports issued to relevant personnel
- relevant OH&S / WH&S PPE
- plant specifications for sites which contain the requirements of this unit of work
- document selection of commissioning methods at own workplace e.g. samples of test report forms.

Assessor requirements

No specialist vocational competency requirements for assessors apply to this unit.