

22470VIC

Certificate II in Engineering Studies

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

Accredited for the period: 1 July 2018 to 30 June 2023



Education
and Training



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Section A: Copyright and Course Classification Information

- 1. Copyright owner of the course**

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- 2. Address**

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- 3. Type of submission**

Reaccreditation
- 4. Copyright acknowledgment**

The units of competencies:

 - MEM13014A Apply principles of Occupational Health & Safety in work environment
 - MEM18001C Use hand tools
 - MEM18002B Use power tools/hand held operations
 - MEM30011A Set up basic pneumatic circuits
 - MEMPE006A Undertake a basic engineering project

are from the MEM05 Metals and Engineering Training Package

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- 5. Licensing and franchise**

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|-----------------------------------|--|--|
| 6. Course accrediting body | Victorian Registration and Qualifications Authority (VRQA) | |
| 7. AVETMISS information | ANZSCO code: 399999 | Other miscellaneous technicians and trades workers |
| | ASCED Code: 0307 | Mechanical and Industrial Engineering and Technology |
| | National course code: | 22470VIC |
| 8. Accreditation period | 1 July 2018 to 30 June 2023 | |

Section B: Course Information

1. Nomenclature <i>Standard 1 AQTF Standards for Accredited Courses</i>	
1.1 Name of the qualification	Certificate II in Engineering Studies
1.2 Nominal duration of the course	380 - 480 hours
2. Vocational or educational outcomes <i>Standard 1 AQTF Standards for Accredited Courses</i>	
2. Purpose of the course	<p>The aim of this course is to provide pre-employment training and a pathway into the engineering, manufacturing or related industries. Specifically a graduate of this course will be eligible to:</p> <ul style="list-style-type: none"> – undertake a work-based traineeship or apprenticeship in a range of engineering, manufacturing or related areas – enrol in Certificate III qualifications in the engineering, manufacturing or related areas – seek entry level employment in the engineering, manufacturing or related industries
3. Development of the course <i>Standards 1 and 2 AQTF Standards for Accredited Courses</i>	
3.1 Industry /enterprise/ community needs	<p>The Certificate II in Engineering Studies was first accredited in 2004 and this is the fourth review for reaccreditation since the initial accreditation period. The ongoing availability of the course continues to have support of key industry bodies, RTOs and the secondary school sector via the Victorian Curriculum and Assessment Authority (VCAA).</p> <p>The course continues to provide pre-employment training and a pathway into apprenticeships, traineeships or entry level employment into the manufacturing, engineering and related industries. The course also provides a pathway to further study. A breakdown of the enrolment figures from the past five years indicates there are more than one thousand students across the State, who completed the course annually as part of their VCE program.</p> <p>The manufacturing, engineering and related industries are extremely diverse and significant to the Victorian economy. The manufacturing sector alone according to ABS figures, encompasses a broad range of industries including automotive components, advanced electronics and machinery, aerospace and aviation, defence, chemicals and plastics, pharmaceuticals, fabricated metals, textiles, clothing and footwear (TCF) and food processing.</p> <p>The Victorian sector directly employs approximately</p>

	<p>295,000 people (State's largest employer of full time jobs), which represents 30% of the country's manufacturing workers and accounts for \$30.8 billion or 10% of the Gross State Product (GSP). Manufacturing and Engineering industries are the key areas of support for the development of emerging industry areas which are important to the State's economy such as nanotechnology, biotechnology and clean energy technology.</p> <p>Current spending on research and development and productivity innovation in these industries at the national level is estimated to be approximately \$4.0 billion.</p> <p>On the other hand the industry is facing some challenges. It has an ageing workforce and it is having difficulty attracting the number of new entrants required including suitable trained people willing to take up apprenticeships. The reason for this is two-fold. Firstly, there continues to be a poor perception of manufacturing which is often portrayed as dirty, dangerous and dying and secondly, apprenticeships and trades generally, are no longer valued as in the past by parents and secondary school career advisers as a career choice. These preceptions together with a stronger promotion of a university pathway as the best way for a young person to achieve social and economic standing contribute to the difficulty of recruitment for the engineering and manufacturing industries.</p> <p>This course aims to reverse these negative perceptions by introducing young people to the wide range of employment opportunities, career choices and study pathways to further training in the engineering, manufacturing and related industries.</p> <p>In summary the Certificate II in Engineering Studies aims to provide graduates with:</p> <ul style="list-style-type: none"> • a broad-based underpinning competencies in a range of engineering skills such as machining, fabrication and use of tools which will prepare them for entry-level employment in the industry through an traineeship or apprenticeship • knowledge of a range of occupations at engineering trade level enabling graduates to make informed choices in the selection of vocational career paths • knowledge of advanced manufacturing and engineering technologies • social and interpersonal skills relevant to participation in the engineering industry by integrating general competencies as part of the course curriculum • a recognised credential with credits for further training including an apprenticeship <p>A survey was conducted and the feedback guided the CMM in the preparation of a knowledge and skills summary which was reviewed, adjusted and validated by the project steering committee. For more details see Item 3.2 and Appendix 1.</p>
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	<p>Enrolments in the current 22209VIC Certificate II in Engineering Studies for 2017 totalled one thousand four hundred and seventy eight (1478). This figure includes both VET in School/VCE programs and individual Government funded places. It is expected the annual enrolments for this course for 2018 and beyond will be similar to the 2017 figure.</p> <p>The review of the existing course and redevelopment of this course has been guided by a project steering committee (PSC) consisting of the following people:</p> <p>Greg Warren (Chair) Manufacturing and Engineering Skills Advisory Board (MESAB)</p> <p>Daryl Sutton Victorian Curriculum and Assessment Authority (VCAA)</p> <p>Craig Hilton Australian Industry Group</p> <p>David Wilson Ringwood Training</p> <p>Greg Rees Swinburne University of Technology</p> <p>Andrew Santucciono Chisholm Institute</p> <p>In attendance:</p> <p>George Adda CMM Engineering Industries</p> <p>Dennis Crowley CMM Engineering Industries</p> <p>This course:</p> <ul style="list-style-type: none"> – 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.
<p>3.2 Review for re-accreditation</p>	<p>The current course 22209VIC Certificate II in Engineering Studies was initially accredited for a period of five years (1 January 2013 to 31 December 2017). The accreditation period has been extended a further six months to the 30 June 2018.</p> <p>Enrolment figures for the 22209VIC Certificate II in Engineering Studies for the past five years including both VET in School/VCE programs and individual Government funded places are:</p> <ul style="list-style-type: none"> • 2013 - 1057 • 2014 - 1868 • 2015 - 1857 • 2016 - 1688 • 2017 – 1478. <p>During the accreditation period the course was monitored by the CMM - Engineering Industries and a survey was conducted with</p>

	<p>key stakeholder and providers. In summary, the feedback indicated the current course structure remains appropriate. Some units need to be updated or new units added to address advances in engineering and manufacturing practices and there needs to be an increase in the practical hand-on skills in the second year of the course to maintain student interest and to reduce the number of student who chose to drop out. In addition, it was also felt a higher level of practical experience is required to further enhance graduates employment opportunities.</p> <p>The survey feedback guided the CMM in the preparation of a knowledge and skills summary which was reviewed, adjusted and validated by the project steering committee (refer Appendix 1).</p> <p>The redevelopment of the course curriculum that followed was guided by the project steering committee. The following is a summary of the more significant changes:</p> <ul style="list-style-type: none"> • Number of core units has reduced from eleven units to seven units. The reduction has occurred through merging of contents, transfers to the elective bank or deletions. • Two former elective units: Perform basic machining processes and Apply basic fabrication techniques have been included into the core component. Each unit now includes an extra element which addresses basic trade computations relevant to machining or fabrication. • New unit of competency has been added to the elective bank entitled: Perform advanced level engineering trade computations. This unit replaces MEM30012A- Apply mathematical techniques in a manufacturing engineering or related environment, which was designed for use at Technician Level. • Core unit “Produce basic engineering sketches and drawings” is now a prerequisite to the unit “Create engineering drawings using computer aided systems” to ensure they are delivered in the correct order. • Two new units of competency have been added to the elective bank to address use of new technologies: <ul style="list-style-type: none"> ○ use 3D printing to create products ○ apply basic computer networking concepts and practices • Number of vocational pathways within the elective component of the course structure has been reduced from four to three pathways. <p>The 22470VIC Certificate II in Engineering Studies is deemed not equivalent to the 22209VIC Certificate II in Engineering Studies. There can be no new enrolments in the 22209VIC after 30 June 2018.</p> <p>Transition arrangements between the current and new course is provided in Table 1</p>
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Table 1: Transition Arrangements for 22470VIC

22209VIC Certificate II in Engineering Studies		22470VIC Certificate II in Engineering Studies		Comments
Unit code	Unit Title	Unit code	Unit Title	
VU20903	Produce basic engineering components and products using fabrication and machining	VU22334	Produce basic engineering components and products using fabrication and machining operations	Equiv
VU20904	Perform cutting, grinding and turning operations	VU22335	Perform metal machining operations	Equiv
VU20905	Assist with the design of a basic mechanical system			Deleted
VU20906	Configure and program a basic robotic system	VU22338	Configure and program a basic robotic system	Equiv
VU20907	Participate in basic engineering maintenance			Deleted
VU20909	Develop an individual career plan for the engineering industry			Deleted
VU20910	Produce basic engineering sketches and drawings	VU22330	Select and interpret drawings and prepare three dimensional (3D) sketches and drawings	Equiv
VU20911	Handle engineering materials			Deleted
VU20912	Perform basic machining processes	VU22331	Perform basic machining processes	Not Equiv
VU20913	Apply basic fabrication techniques	VU22332	Apply basic fabrication techniques	Not Equiv
VU20914	Form, bend and shape engineering materials	VU22336	Perform metal fabrication operations	Equiv
VU20915	Perform basic welding and thermal cutting processes to fabricate engineering structures	VU22337	Perform basic welding and thermal cutting processes to fabricate engineering structures	Equiv
VU20916	Create engineering drawings using computer aided systems	VU22339	Create engineering drawings using computer aided systems	Equiv
		VU22329	Report on a range of sectors in manufacturing engineering and related industries	New
		VU22333	Perform intermediate engineering computations	New

Table 1: Transition Arrangements for 22470VIC

22209VIC Certificate II in Engineering Studies		22470VIC Certificate II in Engineering Studies		Comments
Unit code	Unit Title	Unit code	Unit Title	
		VU22340	Use 3D printing to create products	New
		VU22341	Apply basic computer networking concepts and practices	New
MEM12024A	Perform computations			Deleted
MEM13014A	Apply principles of Occupational Health & Safety in work environment	MEM13014A	Apply principles of Occupational Health & Safety in work environment	Equiv
MEM16006A	Organise and communicate information			Deleted
MEM16008A	Interact with computing technology			Deleted
MEM18001C	Use hand tools	MEM18001C	Use hand tools	Equiv
MEM18002B	Use power tools/hand held operations	MEM18002B	Use power tools/hand held operations	Equiv
MEM24012C	Apply metallurgy principles			Deleted
MEM30002A	Produce basic engineering graphics			Deleted
MEM30011A	Set up basic pneumatic circuits	MEM30011A	Set up basic pneumatic circuits	Equiv
MEM30012A	Apply mathematical techniques in a manufacturing, engineering or related environment			Deleted
		MEMPE006A	Undertake a basic engineering project	New
MSAENV272B	Participate in environmentally sustainable work practices			Deleted
MSS402040A	Apply 5S procedures			Deleted

4. Course outcomes	<i>Standards 1, 2, 3 and 4 AQTF Standards for Accredited Courses</i>
4.1 Qualification level	<p><i>Standards 1, 2 and 3 AQTF Standards for Accredited Courses</i></p> <p>This course is consistent with the Australian Qualifications Framework (AQF) for a Certificate II level qualification in that graduates will have the following learning attributes.</p> <p>Knowledge</p> <p>Graduates of the Certificate II in Engineering Studies will have basic factual, technical and procedural knowledge in a defined area of work and learning covering a range of engineering streams and related areas.</p> <p>Skills</p> <p>Graduates will have:</p> <ul style="list-style-type: none"> • cognitive skills to access, record and act on a defined range of information from various sources to gain an understanding of the diversity and coverage of the engineering and manufacturing industry, together with career pathways and employment opportunities • cognitive and communication skills to apply and communicate known solutions to a limited range of predictable problems such as setting up a computer and relevant software to undertake a specified engineering task • technical skills to use a limited range of equipment to complete tasks involving known routines and procedures with a limited range of options such as planning and setting up machining operations and perform basic machining processes. <p>Application of knowledge and skills</p> <p>Graduates will demonstrate the application of knowledge and skills:</p> <ul style="list-style-type: none"> • with some accountability for the quality of their own outcomes and some responsibility for their own outputs in work and learning such as reporting completed work to appropriate personnel • with limited autonomy and judgment in the completion of their own defined and routine tasks in known and stable contexts such as selecting and preparing machines and accessories for use • with limited autonomy and judgment to complete routine but variable tasks in collaboration with others in a team environment such as conducting fabrication operations under supervision. <p>Volume of learning</p> <p>The volume of learning for this qualification is typically between 0.5 to 1 year and incorporates structured training and unstructured learning activities such as locating and gathering information for assignments and projects, investigating pathway options for further study and/or future employment in the engineering/manufacturing industry.</p>

4.2 Employability skills	<p><i>Standard 4 AQTF Standards for Accredited Courses</i></p> <p>The Employability Skills for the Certificate II in Engineering Studies are summarised in Table 2.</p>
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Table 2: Summary of the Employability Skills

Employability Skills	Industry/enterprise requirements for this qualification include the following facets. On successful completion of the course a graduate should be able to:
Communication	<ul style="list-style-type: none"> • complete work related documents e.g. logs, reports • access and interpret information on engineering and/or manufacturing practices or processes • receive and follow routine instructions • provide written and oral reports • listen and carry out instructions • speak clearly and directly with other team members • share information within groups activities
Teamwork	<ul style="list-style-type: none"> • work as part of a team • identify and describe own role and the role of others • receive feedback and evaluate own contribution • work with diverse individuals/groups
Problem solving	<ul style="list-style-type: none"> • recognise routine faults that occur during a process or operation • identify and take action on causes of simple faults • respond to routine engineering related problems • use numeracy skills to solve basic engineering tasks such as calculating the circumference of a circle or the area of a rectangle
Initiative and enterprise	<ul style="list-style-type: none"> • determine issues or problems needing action in an engineering workshop situation • raise questions regarding an engineering work task requirements and fulfilling expectations • distinguish between causes of simple faults • safely shut down equipment in abnormal circumstances
Planning and organising	<ul style="list-style-type: none"> • plan and organise work tasks • recognise hazards and follow appropriate hazard control methods • organise competing priorities to fulfil work task requirements
Self-management	<ul style="list-style-type: none"> • operate within appropriate time constraints and work standards • select and use appropriate equipment, materials, processes and procedures • identify task outcomes and work role • monitor and evaluate own performance • take responsibility for own work output

	<ul style="list-style-type: none"> • ask questions to gain information • seek clarification to confirm own understanding or expectation • participate in improvement procedures • learn in a range of settings e.g. formal training in the workplace • learn new machine operation skills and metal fabrication techniques
Technology	<ul style="list-style-type: none"> • carry out pre-operational checks • monitor equipment operation • apply WHS/OHS requirements when using technology • use workplace machinery
4.3 Recognition given to the course	<i>Standard 5 AQTF Standards for Accredited Courses</i> Not applicable
4.4 Licensing/ regulatory requirements	<i>Standard 5 AQTF Standards for Accredited Courses</i> No licensing, legislative, regulatory or certification requirements apply to this course at the time of publication.
5. Course rules Standards 2, 6,7 and 9 AQTF Standards for Accredited Courses	
<p>5.1 Course structure</p> <p>To be awarded the qualification, Certificate II in Engineering Studies, participants must successfully complete eleven (11) units consisting of the following:</p> <ul style="list-style-type: none"> – seven (7) core units <i>and</i> – four (4) elective units <p>The four (4) elective units may be selected from the elective unit list.</p> <p>Alternately, a maximum of two (2) of the four (4) electives units may be selected from any endorsed training package or accredited course provided they are consistent with the course outcomes and the AQF level of the qualification.</p> <p>Should a vocational pathway wish to be followed when selecting the four (4) elective units refer Table 3 for guidance.</p> <p>Learners who do not complete the required number of units to be awarded the qualification will be issued with a Statement of Attainment for the units successfully completed.</p>	

Course units and nominal hours				
Unit code	Field of Education code	Unit Title	Pre-requisite	Nominal hours
Core units				
MEM13014A		Apply principles of Occupational Health & Safety in work environment	None	10
MEM18001C		Use hand tools	None	20
VU22329	030199	Report on a range of sectors in the manufacturing, engineering and related industries	None	30
VU22330	030199	Select and interpret drawings and prepare three dimensional (3D) sketches and drawings	None	20
VU22331	030707	Perform basic machining processes	None	40
VU22332	030711	Apply basic fabrication techniques	None	40
MEMPE006A		Undertake a basic engineering project	None	80
Total nominal hours for core unit =				240
Unit code	Field of Education code	Unit Title	Pre-requisite	Nominal hours
Electives units:				
MEM18002B		Use power tools/hand held operations	None	20
MEM30011A		Set up basic pneumatic circuits	None	40
VU22333	030199	Perform intermediate engineering computations	None	40
VU22334	030707	Produce basic engineering components and products using fabrication and machining operations	VU22331 VU22332	60
VU22335	030707	Perform metal machining operations	VU22331	60
VU22336	030707	Perform metal fabrication operations	VU22332	60
VU22337	030711	Perform basic welding and thermal cutting processes to fabricate	VU22332	60

		engineering structures		
VU22338	030199	Configure and program a basic robotic system	None	60
VU22339	030199	Create engineering drawings using computer aided systems	VU22330	60
VU22340	030199	Use 3D printing to create products	None	40
VU22341	030199	Apply basic computer networking concepts and practices	None	40
Total nominal hour range for elective units =				140 - 240
Total course nominal hour range =				380 - 480

5.1 (cont.)	Table 3 Vocational pathways	
	Fabrication pathway	
	MEM18002B	Use power tools/hand held operations
	VU22333	Perform intermediate engineering computations
	VU22334	Produce basic engineering components and products using fabrication and machining operations
	VU22336	Perform metal fabrication operations
	VU22337	Perform basic welding and thermal cutting processes to fabricate engineering structures
	Machining pathway	
	MEM18002B	Use power tools/hand held operations
	VU22333	Perform intermediate engineering computations
	VU22334	Produce basic engineering components and products using fabrication and machining operations
	VU22335	Perform metal machining operations
	VU22337	Perform basic welding and thermal cutting processes to fabricate engineering structures
	Engineering technical pathway	
	MEM30011A	Set up basic pneumatic circuits

	VU22333	Perform intermediate engineering computations
	VU22338	Configure and program a basic robotic system
	VU22339	Create engineering drawings using computer aided systems
	VU22340	Use 3D printing to create products
	VU22341	Apply basic computer networking concepts and practices
5.2 Entry requirements	<i>Standard 9 AQTF Standards for Accredited Courses</i> It is recommended learners have as a minimum; language, literacy and numeracy skills that are equivalent to Level 2 of the Australian Core Skill Framework (ACSF). Full details,descriptors and tests of the ACSF can be found on website here . Learners who have lower levels of language and literacy may require additional support to complete the course.	
6. Assessment Standards 10 and 12 AQTF Standards for Accredited Courses		
6.1 Assessment strategy	All assessment, including Recognition of Prior Learning (RPL) must be compliant with the requirements of: <ul style="list-style-type: none">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 Providersorthe Standards for Registered Training Organisations 2015 (SRTOs)orthe relevant standards and guidelines for Registered Training Organisations in effect at the time of assessment Assessment strategies must therefore ensure that: <ul style="list-style-type: none">all assessments are valid, reliable, flexible and fairlearners are informed of the context and purpose of the assessment and the assessment processfeedback is provided to learners about the outcomes of the assessment process and guidance given for future optionstime allowance to complete a task is reasonable and reflect the industry expectations of a junior operator Assessment strategies should be designed to: <ul style="list-style-type: none">cover a range of skills and knowledge required to demonstrate achievement of the course aim	

	<ul style="list-style-type: none"> • collect evidence on a number of occasions to suit a variety of contexts and situations • be appropriate to the knowledge, skills, methods of delivery and needs and characteristics of learners • assist assessors to interpret evidence consistently • be equitable to all groups of learners <p>Assessment methods are included in each unit and include:</p> <ul style="list-style-type: none"> • oral and/or written questioning • inspection of final process/product outcomes • portfolio of documented evidence • demonstration of required physical tasks <p>A holistic approach to assessment is encouraged. This may be achieved by combining the assessment of more than one unit where it better replicates working practice.</p> <p>Assessment of the imported MEM units must reflect the requirements of the Assessment Guidelines in the MEM05 Metals and Engineering Training Package.</p>
6.2 Assessor competencies	<p><i>Standard 12 AQTF Standards for Accredited Courses</i></p> <p>Assessment must be undertaken by a person or persons with competencies compliant 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 Registered Training Organisations in effect at the time of assessment <p>Assessors of the imported MEM units must meet the requirements for assessors specified in the MEM05 Metals and Engineering Training Package.</p>
7. Delivery Standards 11 and 12 AQTF Standards for Accredited Courses	
7.1 Delivery modes	<p><i>Standard 11 AQTF Standards for Accredited Courses</i></p> <p>These courses are available for full or part-time study. Providers should endeavor to be flexible in the way the training is delivered to ensure they meet the needs of the learner cohort.</p> <p>This course will primarily be delivered in a dedicated training environment rather than on-the-job. Therefore, it is important the facilities within the training environment reflect as close as possible, realistic workplace conditions for the benefit of the students</p>

	<p>Teaching and learning strategies must be selected to reflect the varying learning requirements, educational backgrounds and preferred learning styles of the individual students and the specific requirements of each unit. Some areas of content may be common to more than one unit and therefore integration may be appropriate.</p> <p>Although the core unit MEMPE006A Undertake a basic engineering project has no prerequisites, it is strongly recommended it is delivered and assessed in the later stage of the course. Students need to have gained sufficient background knowledge and skills in planning, drawing, engineering technical skills, machining and/or fabrication techniques to enable them to achieve the assessment outcomes on this unit.</p>
7.2 Resources	<p><i>Standard 12 AQTF Standards for Accredited Courses</i></p> <p>For the delivery of this course access to an appropriately equipped engineering training facility is mandatory: The facility should be equipped with the following</p> <ul style="list-style-type: none"> - metalworking machines - metal fabrication equipment - hand tools and hand held power tools used for metalwork - measuring equipment used in engineering workshop - reference charts/technical specifications <p>In addition to the above facility, access to a technical drawing area equipped with manual drafting and computer aided drafting hardware and software facilities.</p> <p>Students are expected to supply and wear their own personal protective equipment such safety glasses, protective clothing and appropriate footwear while in the engineering training facility.</p> <p>Training must be undertaken by a person or persons with competencies compliant 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, or • the Standards for Registered Training Organisations 2015 (SRTOs), or • the relevant standards and guidelines for Registered Training Organisations in effect at the time of assessment. <p>Units imported from the MEM05 Metals and Engineering Training Package must comply with the requirements for teachers/trainers specified in the endorsed training package.</p>
8. Pathways and articulation	<p><i>Standard 8 AQTF Standards for Accredited Courses</i></p> <p>There are no formal arrangements for articulation to other accredited courses or the higher education sector.</p> <p>When arranging articulation providers should refer to the:</p> <p><u>AQF Second Edition 2013 Pathways Policy</u></p>

	<p>Participants must negotiate individual pathway arrangements directly with the training provider.</p> <p>This course contains units from the MEM05 Metals and Engineering Training Package. Participants who successfully complete any of these units will be able to gain credit into other qualifications containing these units in any future studies.</p> <p>This course may be used as a pathway into a range of qualifications in manufacturing, engineering or related industries.</p> <p>Examples include:</p> <ul style="list-style-type: none"> • MEM30105 Certificate III in Engineering – Production Systems • MEM30205 Certificate III in Engineering – Mechanical Trade • MEM30305 Certificate III in Engineering – Fabrication Trade • MEM30405 Certificate III in Engineering – Electrical/Electronics Trade • MEM30605 Certificate III in Jewellery Manufacture • MEM30705 Certificate III in Marine Craft Construction • MEM30805 Certificate III in Locksmithing • MEM31010 Certificate III in Watch and Clock Service and Repair • MEM31112 Certificate III in Engineering – Composites Trade • MSS30312 Certificate III in Competitive Systems and Practices • MSM30116 Certificate III in Process Manufacturing.
<p>9. Ongoing monitoring and evaluation</p>	<p><i>Standard 13 AQTF Standards for Accredited Courses</i></p> <p>The Certificate II in Engineering Studies is monitored and maintained by the Curriculum Maintenance Manager (CMM) - Engineering Industries.</p> <p>A formal review will take place at the mid-point during the accreditation period. The review will be informed through feedback and consultation with users of the course curriculum and will also consider any changes required to meet emerging technologies or developing needs in the manufacturing, engineering and related industries.</p> <p>Any significant changes to the course resulting from course monitoring and evaluation procedures will be reported to the VRQA.</p>

Section C: Units of competency

Imported units of competency from the MEM05 Training Package are available from the national register [here](#).

MEM13014A	Apply principles of Occupational Health & Safety in work environment
MEM18001C	Use hand tools
MEM18002B	Use power tools/hand held operations
MEM30011A	Set up basic pneumatic circuits
MEMPE006A	Undertake a basic engineering project

Victorian units of competency:

VU22329	Report on a range of sectors in the manufacturing, engineering and related industries
VU22330	Select and interpret drawings and prepare three dimensional (3D) sketches and drawings
VU22333	Perform intermediate engineering computations
VU22331	Perform basic machining processes
VU22332	Apply basic fabrication techniques
VU22334	Produce basic engineering components and products using fabrication and machining operations
VU22335	Perform metal machining operations
VU22336	Perform metal fabrication operations
VU22337	Perform basic welding and thermal cutting processes to fabricate engineering structures
VU22338	Configure and program a basic robotic system
VU22339	Create engineering drawings using computer aided systems
VU22340	Use 3D printing to create products
VU22341	Apply basic computer networking concepts and practices

VU22329 – Report on a range of sectors in the manufacturing, engineering and related industries

Unit Descriptor

This unit describes the knowledge and skills required to locate information and report on the breadth of coverage and degree of diversity found in the manufacturing, engineering and related industries.

The information includes the identification of the major sectors of the industry, products produced and manufacturing processes including advanced manufacturing processes. The range of occupations found in the major sectors of the industry and career opportunities are also included.

The unit also includes the preparation of a report using a suitable IT software package.

No licensing, legislative, regulatory or certification requirements apply to this unit of competency at the time of publication.

Employability Skills

This unit contains Employability Skills.

Application of the Unit

This unit of competency is intended for use in an entry level qualification and applies to a person with limited knowledge of the manufacturing, engineering and related industries.

ELEMENT

Elements describe the essential outcomes of a unit of competency.

PERFORMANCE CRITERIA

Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.

- | | |
|--|---|
| 1. Research the coverage and diverse nature of the manufacturing, engineering and related industries | <p>1.1 <i>Sources of information</i> on the <i>manufacturing, engineering and related industries</i> are identified.</p> <p>1.2 Major sectors and function of the manufacturing engineering and related industries are recognised.</p> <p>1.3 The activities and products produced by each major sector are described.</p> <p>1.4 Industries/industry sectors using <i>advanced manufacturing</i> technologies are identified.</p> |
| 2. Gather information on the range of occupations and career pathways found in the major sectors of the industry | <p>2.1 Information on employment numbers and <i>occupations/roles</i> of personnel within each of the major industry sectors is gathered.</p> <p>2.2 Required <i>training and qualifications</i> for the various occupational roles are identified.</p> <p>2.3 Information on employment needs, career progression opportunities and annual incomes for the range of occupations within each industry sector is collated.</p> |
| 3. Prepare a report from the gathered information | <p>3.1 Collected information is assembled and the report layout is planned.</p> |

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| | 3.2 | IT software package is selected and the collected information is keyed in, arranged in a report format and enhanced as required for presentation. | |
| | 3.3 | Report is printed and the electronic copy is saved on a storage device . | |
| 4 | Finalise and submit report. | 4.1 | Hard copy of the report is reviewed and stored copy amended as required. |
| | | 4.2 | Final report is submitted in the required format and timeframe. |

REQUIRED SKILLS AND KNOWLEDGE

Required skills:

- reading and interpreting documentation including diagrams, flow charts, graphs and related data
- using various gather techniques to access and gather information for a given topic
- planning, assembling and organising information and data for a report
- using a personal computer and software package to format and prepare a report on a given topic
- completing a set task in a given timeframe

Required knowledge:

- sources of information on the manufacturing, engineering and related industries
- advanced manufacturing technologies
- diversity of the manufacturing, engineering and related industries including key sectors and structure
- roles, occupations and employments opportunities in the manufacturing, engineering and related industries
- qualifications/courses (VET and university) and training pathways available for manufacturing, engineering and related industries
- personnel computer operations and software for producing written reports

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 in the Performance Criteria is detailed below.

Sources of information may include but not limited to:

- internet
- trade exhibitions and displays
- company visits
- written/telephone/email requests to enterprises and companies
- library
- face to face contact with industry personnel

Manufacturing engineering and related industries may include but limited to:

- advanced manufacturing
- aerospace
- automotive

- electrical/electronics
- biotech
- heavy engineering
- production manufacturing
- maintenance and installation
- metals
- mineral products
- plastics, rubber, cables
- textiles, clothing and footwear
- furniture
- whitegoods
- boating

Advanced manufacturing may include but not limited to:

- rapid prototyping
- advanced robotics
- automation sensors
- control systems
- Industry 4.0 and 5.0

Occupation/roles may include but not limited to:

- production worker
- trainees/apprentices
- tradespersons
- technicians
- cadets
- para-professionals
- professionals (eg engineers)
- administrative
- sales/marketing
- information technology
- warehousing/logistics

Training and qualifications may include but not limited to:

- traineeships
- apprenticeships
- cadetships
- certificates
- diplomas/advanced diplomas/degrees
- graduate qualifications

Software packages may include but not limited to:

- Microsoft Office
 - Word
 - Excel
 - Power Point
 - Publisher

Storage device may include but not limited to:

- Flash drives
- CD
- Thumb drives
- USB

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 section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria

Specifically they must be able to demonstrate the ability to:

- gather and interpret information which shows the diversity of the manufacturing, engineering and related industries
- locate information on at least three (3) sectors** of the industry which includes:
 - size/structure of the industry
 - products/activities/services
 - employment numbers, job roles/classifications employment/career opportunities
 - training pathways into and within each sector
- use computer technology to prepare and present a report within a required timeframe.

**One of the industry sectors must be utilising advanced manufacturing technology/ies in its' processes or products

Context of and specific resources for assessment

Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to a library, IT equipment and internet, resource materials and references. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and related documentation.

Method of assessment

Evidence can be gathered through a variety of ways including:

- observation of processes and procedures
- oral and/or written questioning
- testimony from supervisors, colleagues, clients and/or other appropriate persons
- inspection of the final report
- portfolio of documented evidence.

Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons.

VU22330 – Select and interpret drawings and prepare three dimensional (3D) sketches and drawings

Unit Descriptor

This unit of competency describes the knowledge and skills required to select and interpret drawings to plan and complete an engineering task.

The unit also includes the knowledge and skills required to prepare three dimensional (3D) sketches and drawings of simple engineering components for communication requirements.

No licensing, legislative, regulatory or certification requirements apply to this unit of competency at the time of publication.

Employability Skills

This unit contains Employability Skills.

Application of the Unit

This unit would be applied by entry level engineering workers required to undertake a range of basic engineering sketches and drawings using traditional drawing and drafting skills.

ELEMENT

Elements describe the essential outcomes of a unit of competency

PERFORMANCE CRITERIA

Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.

1. Identify and select correct sketches or drawings to plan and complete engineering tasks.

- 1.1 Required sketches or drawings are obtained from documentation, files systems or local sources in accordance with ***enterprise procedures***.
- 1.2 ***Sketches and drawings*** are checked for containing all necessary information related to job requirements.
- 1.3 Notes, drawing versions and dates for sketches or drawings are assessed as current and appropriate.
- 1.4 Communications with others involved in the work is maintained to ensure efficient progress and completion of tasks and that safety is maintained at all times.

2. Interpret sketch or drawing details to plan and complete engineering tasks.

- 2.1 Components are identified from sketches and drawings.
- 2.2 Views and projections are interpreted to reconstruct a three dimensional (3D) image of components, assemblies and structures.
- 2.3 ***Drawing symbols***, dimensions and tolerances are interpreted and applied to the work task.
- 2.4 Materials requirements for work tasks are obtained from sketches and drawings.
- 2.5 Insufficient sketch/drawing details are identified and reported to the ***appropriate personnel*** in accordance with enterprise procedures.

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| 3. Prepare sketches or drawings to plan and complete engineering tasks. | 3.1 Objects are sketched and/or drawn for clear communications of requirements and in accordance with Australian drawing standards.
3.2 Sketches and drawings are prepared to present the required information with minimal complexity.
3.3 Dimension and notes are added to fully describe requirements in accordance with enterprise procedures.
3.4 Completed sketches and drawings are checked for compliance with requirements and reviewed with the appropriate personnel. |
|---|---|

REQUIRED SKILLS AND KNOWLEDGE

Required skills:

- reading, interpreting and communicating information from engineering drawings and sketches
- applying sketching skills to produce detail drawing in 3rd angle orthogonal and isometric projection

Required knowledge:

- types and functions of technical drawings
- engineering drawing conventions and symbols
- drafting methods for preparing original drawings
- drawing standards and conventions (eg AS1100)

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 in the Performance Criteria is detailed below.

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| <i>Enterprise procedures</i> may include but not limited to: | <ul style="list-style-type: none"> • the use of tools and equipment • instructions, including job sheets, cutting lists, plans, drawings and designs • reporting and communication • manufacturers' specifications and operational procedures |
|---|---|

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| <i>Sketches and drawings</i> may include but not limited to: | <ul style="list-style-type: none"> • free hand • manual drafting in one, two or three projections • to scale or not-to-scale • for selecting, preparing, or assembling components or products |
|---|---|

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|---|---|
| <i>Drawing symbols</i> may include but not limited to: | <ul style="list-style-type: none"> • lines types <ul style="list-style-type: none"> – outlines (visible/hidden) – dimensioning lines – centre lines • electrical • engineering: <ul style="list-style-type: none"> – mechanical – fabrication |
|---|---|

Appropriate personnel
may include but not limited
to:

- supervisor
- leading hand
- foreman
- trainer/coach
- teacher

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Elements, Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the Accreditation Submission.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria

Specifically they must be able to demonstrate the ability to:

- read and interpret views and projections of an engineering component drawing to reconstruct a three dimensional image
- prepare a scaled three dimensional sketch or drawing of a simple engineering component.

Context of and specific resources for assessment

Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all drawings, drawing equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Methods of assessment

Evidence can be gathered through a variety of ways including:

- observation of processes and procedures
- oral and/or written questioning on required knowledge and skills
- inspection of the final product or outcome
- portfolio of documented evidence.

Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons.

VU22333 - Perform intermediate engineering computations

Unit Descriptor

This unit of competency describes the skills and knowledge required to prepare and apply intermediate level engineering computations. It includes the use of trigonometry, the application of sine and cosine rules, formulae and geometric principles relevant to the engineering and the calculation of areas and volumes of common engineering shapes.

No licensing or certification requirements apply to this unit at the time of accreditation.

Employability Skills

This unit contains Employability Skills.

Application of the Unit

This unit would be applied by entry level engineering students/workers required to undertake a range of intermediate level engineering computations.

ELEMENT

Elements describe the essential outcomes of a unit of competency

PERFORMANCE CRITERIA

Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.

1. Determine job computation requirements

1.1 ***Job requirements*** are identified from specifications, drawings, job sheets or work instructions.

1.2 ***Required calculations*** are determined from job instructions.

2. Determine and apply required formulae and establish estimate

2.1 ***Relevant formulae*** to suit the job requirement is determined.

2.2 An estimation of the expected results, including rounding off is undertaken

3. Perform computation and confirm estimate

3.1 ***Standard Operating Procedures (SOPs)*** are followed at all times.

3.2 ***Calculation method*** is made to obtain accurate answer.

3.3 Answer is checked against estimation.

REQUIRED SKILLS AND KNOWLEDGE

Required Skills:

- following work instructions, standard operating procedures
- obtaining and interpreting data from specifications, drawings, job sheets or work instructions to establish required outcomes
- determining the appropriate calculation method to suit the application
- performing calculations using:
 - trigonometric ratios
 - sine and cosine rules
 - pythagoras theorem
 - geometric formulae
- manipulating of formulae to change the subject
- checking answers using estimations

Required Knowledge:

- formulae applicable to the determination of perimeter, area and volume of simple geometric shapes
- the reasons for ensuring calculations are carried out using the same units of measurement
- nomenclature used in trigonometry, pythagoras' theorem and geometry
- mathematical principles and order of operations
- techniques and procedures for rounding off figures when estimating approximate answers
- applications of geometric calculations in manufacturing and engineering situations

RANGE STATEMENT

This describes the essential skills and knowledge and their level, required for this unit. Bold italicised wording in the Performance Criteria is detailed below.

- Job requirements*** may include but not limited to:
- timeframe for task
 - tools and equipment
 - working with others
 - materials, parts and other resources
 - specifications
 - procedures
 - special reporting requirements
 - quality measures

- Required calculation*** may include but not limited to:
- angles
 - lengths
 - areas
 - perimeters
 - volumes

- Relevant formulae*** may include but not limited to:
- trigonometry:
 - o basic functions eg trigonometry ratios
 - o sine rule
 - o cosine rule
 - pythagoras theorem
 - geometric formulae

- Standard operating procedures (SOPs)*** may include but not limited to:
- the use of tools and equipment
 - instructions, including job sheets, cutting lists, plans, drawings and designs
 - reporting and communication
 - manufacturers' specifications and operational procedures

- Calculation method*** may include but not
- subtraction
 - addition

limited to:

- multiplication
- division
- manipulation of formulae

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 this Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria

Specifically they must be able to:

- perform calculations using:
 - trigonometric ratios
 - sine and cosine rules
 - pythagoras theorem
 - geometric formulae
- select the correct formulae for a given task and complete the required calculation/s on a number of occasions.

Context of and specific resources for assessment

Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Methods of assessment

Evidence can be gathered through a variety of ways including:

- observation of processes and procedures
- oral and/or written questioning
- testimony from supervisors, colleagues, clients and/or other appropriate persons
- inspection of the final outcome
- portfolio of documented evidence.

Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons.

VU22331 - Perform basic machining processes

Unit Descriptor

This unit of competency describes the knowledge and skills required to perform basic machining operations.

The unit includes setting up and machining components using various machinery such as; lathes, milling machines, cut off saws, pedestal grinders and fixed position drilling machines.

This unit also includes performing basic computations related to machining processes.

No licensing, legislative, regulatory or certification requirements apply to this unit of competency at the time of publication.

Employability Skills

This unit contains Employability Skills.

Application of the Unit

This unit would be applied by entry level engineering workers required to undertake a range of basic machining activities.

ELEMENT

Elements describe the essential outcomes of a unit of competency.

PERFORMANCE CRITERIA

Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.

1. Plan and set up machining operations

- 1.1 The machining work is determined through request, work orders or equivalent and clarified with the ***appropriate personnel***.
- 1.2 ***Workplace Health and Safety/Occupational Health and Safety (WHS/OHS) requirements***, relevant Australian standards, codes of practice, manufacturer's specifications, ***environmental requirements*** and ***enterprise procedures*** are identified and followed.
- 1.3 ***Resources*** required are identified, obtained and checked as fit for purpose.
- 1.4 Environmental requirements for resources used are identified and used in line with enterprise procedures.
- 1.4 Relevant plans, drawings and instructions are identified and interpreted.
- 1.5 A work plan is prepared showing the correct sequence of operation.
- 1.6 Machining operation is set up by selecting appropriately sharpened ***tools*** for the required task.

2. Perform calculations

- 2.1 Required outcomes are established from job instructions.
- 2.2 Data is obtained from relevant sources and interpreted.
- 2.3 Required ***calculation method*** and/or ***formulae*** are determined to suit the application.
- 2.4 Expected results are estimated, including rounding off, as appropriate.
- 2.5 Calculation method is applied and a result obtained.

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| | 2.6 | Result is checked against estimation. |
| 3. Conduct machining operations | 3.1 | Basic marking out techniques are used where required. |
| | 3.2 | Machining equipment is used in a manner that optimises tool life. |
| | 3.3 | Work is appropriately secured throughout the entire machining operation. |
| | 3.4 | Specific safety requirements are explained and met throughout the task. |
| | 3.5 | Machine feeds and speeds are selected correctly throughout the machining operation. |
| | 3.6 | Correct cutting lubricant is selected and used throughout the machining operation. |
| | 3.7 | Completed work piece is inspected for compliance with specifications and job requirements. |
| | 3.8 | Unexpected situations are dealt with safely and reported to the appropriate personnel. |
| 4. Complete work requirements | 4.1 | Completed work is reported to appropriate personnel according to enterprise procedures. |
| | 4.2 | Work area cleaning and clearance of waste is conducted in line with enterprise's environmental requirements. |
| | 4.3 | Machines , tools and equipment are maintained and/or stored in accordance with enterprise procedures. |

REQUIRED SKILLS AND KNOWLEDGE

Required skills:

- setting up and safely performing a range of basic machining tasks to meet job requirements including:
 - planning and sequencing machining operations
 - marking out of materials using appropriate marking medium and tools
 - selecting and applying clamping devices for holding work
 - mounting and positioning cutting tools
 - adjusting machine settings
 - selecting and using lubricants
- cutting and grinding a range of materials
- identifying worn or damaged cutting tools
- reshaping, sharpening cutting tools
- using common abrasives
- loading and glazing a grinding wheel
- selecting drill bits and drilling speeds
- setting-up and operating a pedestal drill
- following enterprise environmental requirements for the disposal of waste materials
- performing calculations involving additions, subtractions, multiplication and divisions
- expressing numerical information in the form of fractions, decimal format or percentages
- selecting appropriate formulae for calculating length, perimeter, area, volume and angles

- checking calculated answers for accuracy
- rounding off estimated answers

Required knowledge:

- safe practices and procedures in an engineering workshop environment
- machine types as listed in the range statement and the operations relevant to those machines
- safe operation of individual machines as listed in the range statement
- common materials used in the manufacture of engineering components
- types of grinding wheel dressers and procedures for wheel dressing
- methods of clamping and securing work during machining operation
- techniques and tools for measuring and marking out materials for machining operations
- environmental consideration and disposal of engineering workshop waste
- formula applicable to the determination of perimeter, area and volume of simple geometric shapes
- procedures and techniques for rounding off figures when estimating approximate answers
- application and conversion of mixed numbers, decimals, fractions and whole numbers

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 in the Performance Criteria is detailed below.

Appropriate personnel may include but are not limited to:

- supervisor
- leading hand
- foreman
- trainer
- teacher

Workplace Health and Safety/Occupational Health & Safety requirements may include but not limited to:

- legislation
- protective equipment
- material safety management systems
- hazardous substances and dangerous goods code
- local safe operating procedures
- awards provisions

Environmental requirements may include but not limited to:

- liquid waste
- solid waste
- gas, fume, vapour, smoke emissions, including fugitive emissions
- excessive energy and water use
- excessive noise

Enterprise procedures may include but not limited to:

- the use of tools and equipment
- instructions, including job sheets, cutting lists, plans, drawings and designs

- reporting and communication
- manufacturers' specifications and operational procedures

Resources may include but not limited to:

- work requests sheets/orders
- personal protective equipment
- plans, drawings and sketches
- marking out equipment
- measuring equipment
- ferrous and non-ferrous materials
- tools
- machinery
- consumables

Tools may include but are limited to:

- screwdriver
- spanners
- hammers
- files
- jigs
- cutting tools
- scribes
- chisels
- centre punches
- measurement instruments
- gauges

Calculation method may include but not limited to:

- addition
- subtraction
- multiplication
- division
- manipulation of a formula

Formulae may include but not limited to:

- perimeters
- areas
- volumes
- angles
- other simple geometric shapes

Specific safety requirements may include but not limited to:

- working safely around machinery
- working safely with tools and equipment
- risk and hazard recognition
- emergency procedures
- awareness of electrical hazards
- follow confined spaces procedures

- first aid

Machines may include but not limited to:

- cut off machines
- surface grinders
- drills
- lathes
- mills

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 section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria

Specifically they must be able to demonstrate the ability to:

- perform basic computations related to machining operations on at least five (5) occasions
- plan and safely set up for basic machining tasks on at least two (2) different types of machines
- perform basic machining operations in accordance with job requirements on at least two (2) occasions
- apply workplace cleaning and waste disposal procedures at all times.

Context of and specific resources for assessment

Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Method of assessment

Evidence can be gathered through a variety of ways including:

- observation of processes and procedures
- oral and/or written questioning
- testimony from supervisors, colleagues, clients and/or other appropriate persons
- inspection of the final product or outcome
- portfolio of documented evidence.

Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons.

VU22332 - Apply basic fabrication techniques

Unit Descriptor This unit of competency describes the knowledge and skills required to perform basic fabrication tasks.

The unit includes setting up and operating machinery used for fabrication processes and assembly techniques.

This unit also includes carrying out basic computations and marking out skills related to fabrication techniques.

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

Employability Skills The unit contains Employability Skills.

Application of the Unit This unit would be applied by entry level engineering workers required to undertake a range of basic fabrication activities.

ELEMENT

Elements describe the essential outcomes of a unit of competency.

PERFORMANCE CRITERIA

Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.

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| 1. Plan and set up fabrication operations | 1.1 The fabrication work is determined through request, work orders or equivalent and clarified with the <i>appropriate personnel</i> . |
| | 1.2 <i>Workplace Health and Safety/Occupational Health and Safety (WHS/OHS) requirements</i> , relevant Australian standards, codes of practice, manufacturer's specifications, <i>environmental requirements</i> and <i>enterprise procedures</i> are identified and followed. |
| | 1.3 <i>Resources</i> required are identified, obtained and checked as fit for purpose. |
| | 1.4 Environmental requirements for resources used are identified and used in line with enterprise procedures. |
| | 1.4 Relevant plans, drawings and instructions are identified, interpreted and understood. |
| | 1.5 A work plan is prepared showing the correct sequence of operation. |
| | 1.6 <i>Fabrication</i> operation is set up by selecting appropriate techniques and tools for the required task. |
| 2. Perform calculations | 2.1 Required outcomes are established from job instructions. |
| | 2.2 Data is obtained from relevant sources and interpreted. |
| | 2.3 Required <i>calculation method</i> and/or <i>formulae</i> are determined to suit the application. |
| | 2.4 Expected results are estimated, including rounding off, as appropriate. |
| | 2.5 Calculation method is applied and a result obtained. |
| | 2.6 Result is checked against estimation. |

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| 3. Conduct fabrication operations | 3.1 Basic marking out techniques are used where required.
3.2 Fabrication equipment is used in a manner that optimises efficiency.
3.3 Fabrication is conducted without damage to any component and system.
3.4 Specific safety requirements are met throughout the task and can be explained.
3.5 Work plan is followed during fabrication process.
3.6 Work output is inspected for compliance with specifications and requirements.
3.7 Product is tagged and stored according to work plan.
3.8 Unexpected situations are dealt with safely and reported to the appropriate personnel. |
| 4. Complete work requirements | 4.1 Completed work is reported to appropriate personnel according to enterprise procedures.
4.2 Work area cleaning and clearance of waste is conducted in line with enterprise environmental requirements.
4.3 Equipment is cleaned, maintained and stored in accordance with manufacturers' specifications and enterprise procedures. |

REQUIRED SKILLS AND KNOWLEDGE

Required skills:

- setting up and safely performing a range of fabrication tasks to meet job requirements including:
 - interpreting drawings for fabrication tasks
 - performing calculations and marking out materials for fabrication tasks according to job instructions
 - planning and sequencing fabrication tasks
 - selecting appropriate tools and equipment for fabrication tasks
 - carrying out fabrication tasks inline with job specifications
- following enterprise environmental requirements for the disposal of waste materials
- performing calculations involving additions, subtractions, multiplication and divisions
- expressing numerical information in the form of fractions, decimal format or percentages
- selecting appropriate formulae for calculating length, perimeter, area, volume and angles
- checking calculated answers for accuracy
- rounding off estimated answers

Required knowledge:

- safe work practices and procedures in an engineering workshop environment
- fabrication tools and machinery in common use
- purpose and function of machinery safety guards
- basic fabrication processes and techniques
- common materials used for fabrication tasks
- workshop cleaning and engineering materials waste disposal requirements

- formula applicable to the determination of perimeter, area and volume of simple geometric shapes
- procedures and techniques for rounding off figures when estimating approximate answers
- application and conversion of mixed numbers, decimals, fractions and whole numbers

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 in the Performance Criteria is detailed below.

Appropriate personnel may include but not limited to:

- supervisor
- leading hand
- foreman
- trainer
- teacher

Workplace Health and Safety/Occupational Health and Safety (WHS/OHS) requirements may include but not limited to:

- legislation
- protective equipment
- material safety management systems
- hazardous substances and dangerous goods code
- local safe operating procedures
- awards provisions

Environmental requirements may include but not limited to:

- liquid waste
- solid waste
- gas, fume, vapour, smoke emissions, including fugitive emissions
- excessive energy and water use
- excessive noise

Enterprise procedures may include but not limited to:

- the use of tools and equipment
- instructions, including job sheets, cutting lists, plans, drawings and designs
- reporting and communication
- manufacturers' specifications and operational procedures

Resources may include but not limited to:

- work requests/sheets
- personal protective equipment
- plans, drawings and sketches
- marking out equipment
- measuring equipment
- ferrous and non-ferrous materials
- tools
- machinery
- consumables

Fabrication may include but not limited to:

- marking
- cutting
- forming
- fastening
- gluing
- assembling

Calculation method may include but not limited to:

- addition
- subtraction
- multiplication
- division
- manipulation of a formula

Formulae may include but not limited to:

- perimeters
- areas
- volumes
- angles
- other simple geometric shapes

Fabrication equipment may include but not limited to:

- nibblers
- metal shears
- guillotines
- pedestal drills
- power saws
- rivet fastening equipment
- pan brake
- press brake
- universal metal working machine

Specific safety requirements may include but not limited to:

- working safely around machinery
- working safely with tools and equipment
- risk and hazard recognition
- emergency procedures
- awareness of electrical hazards
- follow confined spaces procedures
- first aid

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 section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria

Specifically they must be able to demonstrate the ability to:

- perform basic computations and marking out skills related to fabrication tasks on at least five (5) occasions
- plan and set up for fabrication tasks using at least three (3) different types of equipment
- perform safely a least three (3) fabrication operations in accordance with job requirements
- apply workplace cleaning and waste disposal procedures at all times.

Context of and specific resources for assessment

Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Method of assessment

Evidence can be gathered through a variety of ways including:

- observation of processes and procedures
- oral and/or written questioning
- testimony from supervisors, colleagues, clients and/or other appropriate persons
- inspection of the final product or outcome
- portfolio of documented evidence.

Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons.

VU22334 - Produce basic engineering components and products using fabrication and machining operations

Unit Descriptor This unit of competency describes the knowledge and skills required to produce a range of basic engineering components and products using basic fabrication and machining techniques. This involves identifying the required manufacturing methods, planning the operations, preparing materials and tooling, producing components and assembling components.

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

Employability Skills This unit contains Employability Skills.

Prerequisite Unit(s) VU22331 Perform basic machining processes
VU22332 Apply basic fabrication techniques

Application of the Unit This unit would be applied by entry level engineering workers required to undertake a range of well-defined fabrication and machining activities.

ELEMENT

Elements describe the essential outcomes of a unit of competency.

PERFORMANCE CRITERIA

Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.

- | | |
|---|--|
| 1. Plan to produce basic engineering components | <p>1.1 Task requirements and specifications are determined through request, work orders or equivalent and clarified with the appropriate personnel.</p> <p>1.2 Workplace Health and Safety/Occupational Health and Safety (WHS/OHS) requirements, relevant Australian standards, codes of practice, manufacturer's specifications, environmental requirements and enterprise procedures are identified and followed.</p> <p>1.3 Relevant plans, drawings and instructions are identified, interpreted and understood.</p> <p>1.4 A work plan is prepared for required operations showing optimal use of time and resources.</p> <p>1.5 Required cutting equipment and fabrication equipment, fabrication techniques and assembly and joining techniques are identified and selected for the task.</p> |
| 2. Prepare materials and equipment | <p>2.1 Materials and resources are identified, obtained and checked as fit for purpose.</p> <p>2.2 Components are marked out with appropriate allowances and tolerances for cutting, machining, forming and assembly.</p> <p>2.3 Hand tools and accessories are selected and prepared appropriate to the manufacturing task.</p> |

- | | | |
|---|-----|--|
| | 2.4 | Machines and equipment are set up for correct operation. |
| 3. Cut, machine and form basic engineering components | 3.1 | Work is held or clamped correctly according to engineering principles and safe work practices. |
| | 3.2 | Machines and tooling are used in a manner that optimises tool life. |
| | 3.3 | Specific safety requirements and procedures are followed and hazard control measures implemented where practicable. |
| | 3.4 | Machine and equipment settings are selected correctly based on engineering principles and relevant calculations/formulae. |
| | 3.5 | Completed work piece is inspected for and compliance with specifications and requirements. |
| | 3.6 | Unexpected situations are dealt with safely and reported to the appropriate personnel. |
| 4. Ensure quality of products and components | 4.1 | Regular quality checks are applied throughout the manufacturing operation. |
| | 4.2 | Product quality problems are identified and rectified. |
| 5. Assemble basic engineering components | 5.1 | Assembly tools and equipment appropriate to the task are selected and prepared. |
| | 5.2 | Components are assembled using basic assembly and joining techniques. |
| | 5.3 | Assembly is checked for operational performance and compliance with job specifications. |
| 6. Complete work requirements | 6.1 | Completed work is reported to appropriate personnel according with enterprise requirements. |
| | 6.2 | Work area cleaning and clearance of waste is carried out according to enterprise procedures. |
| | 6.3 | Machines, tools and equipment are maintained and stored following enterprise procedures. |

REQUIRED SKILLS AND KNOWLEDGE

Required skills:

- planning and sequencing the manufacturing of a component using basic machining operations and fabrication techniques
- safely setting up, operating and shutting down various machines commonly used in an engineering workshop
- safely handling various engineering materials
- marking out materials using appropriate marking medium and tools

- applying techniques for holding and clamping work when undertaking machining and fabricating operations
- performing cutting operation of a range of materials
- identifying worn or damaged cutting tools
- reshaping and/or sharpening cutting tools
- using common abrasives
- selecting and applying appropriate lubricants when undertaking machining and fabrication operations

Required knowledge:

- safe working practices and procedures in an engineering workshop environment
- environment considerations and disposal of engineering workshop waste
- marking out techniques for a range of fabrication tasks
- engineering computation for machining operations
- marking tools and measuring equipment for fabrication tasks
- types and basic properties of materials used for fabrication tasks and machining operations
- safe use and care of hand tools and hand held power tools
- operation and maintenance of machinery used for cutting, grinding, drilling, turning and milling
- techniques and clamping methods for securing work during machining and fabrication operations

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 in the Performance Criteria is detailed below.

Task requirements may include but not limited to:

- timeframe for task
- tools and equipment
- working with others
- materials, parts and other resources
- specifications
- procedures
- special reporting requirements
- quality measures

Appropriate personnel may include but not limited to:

- supervisor
- leading hand
- foreman
- trainer/coach
- teacher

Workplace Health and Safety/Occupational Health and Safety (WHS/OHS) requirements, may include but not limited to:

- legislation
- protective equipment
- material safety management systems

- hazardous substances and dangerous goods code
- local safe operating procedures
- awards provisions

Environmental requirements may include but not limited to:

- liquid waste
- solid waste
- gas, fume, vapour, smoke emissions, including fugitive emissions
- excessive energy and water use
- excessive noise
- proximity to other personnel

Enterprise procedures may include but not limited to:

- the use of tools and equipment
- instructions, including job sheets, cutting lists, plans, drawings and designs
- reporting and communication
- manufacturers' specifications and operational procedures

Resources may include but not limited to:

- work request/orders
- personal protective equipment
- plans, drawings and sketches
- marking out equipment
- measuring equipment
- ferrous and non-ferrous sheet, plate, and bar
- tools
- machinery
- thermal cutting equipment
- consumables

Cutting equipment includes but not limited to:

- mechanical
 - cut off machines
 - surface grinders
 - drills
 - lathes,
 - mills,
- thermal
 - fuel gas cutting torch

Fabrication equipment may include but not limited to:

- forming, shaping and bending equipment:
 - universal plate clamps
 - rolling and forming machine
 - pyramid and pinch rollers

- folding and pressing machine
- sheet metal press-brake and pan brake
- cutting equipment:
 - fixed:
 - band saw/power hack saw
 - guillotine
 - set of rolls
 - bench folder/press
 - shear crop and punch machine
 - pedestal grinder
 - pedestal drill
 - hand held:
 - nibbler
 - nibblers/notchers
 - punches
 - shears
 - grinders
 - drills

Fabrication techniques may include but not limited to:

- marking
- cutting
- forming
- fastening
- glueing
- assembling

Assembly and joining techniques may include but not limited to:

- fasteners
- bolts, nuts, washers, rivets
- adhesives
- soldering
- welding

Hand tools may include but not limited to:

- screwdriver
- spanners
- hammers
- files
- scribes
- chisels
- centre punches
- measurement instruments
- gauges

Accessories may include but not limited to

- jigs and fixtures
- cutting tools
- clamping devices

Specific safety requirements may include but not limited to:

- working safely around machinery
- working safely with tools and equipment
- risk and hazard recognition
- emergency procedures
- awareness of electrical hazards
- follow restricted spaces procedures
- first aid

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 section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria

Specifically they must be able to:

- plan and sequence the production of components using basic machining operations and fabrication techniques on at least two (2) occasions
- set out and produce basic engineering components using machining operations, fabrication and assembling techniques to meet job specifications and requirements on at least two (2) occasions
- safely use and maintain engineering workshop tools and equipment at all times
- apply workplace cleaning and waste disposal procedures at all times.

Context of and specific resources for assessment

Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Method of assessment

Evidence can be gathered through a variety of ways including:

- observation of processes and procedures
- oral and/or written questioning
- testimony from supervisors, colleagues, clients and/or other appropriate persons
- inspection of the final product or outcome

- portfolio of documented evidence.

Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons.

VU22335 - Perform metal machining operations

Unit Descriptor

This unit of competency describes the knowledge and skills required to produce basic engineering components and products by metal machining operations such as cutting, grinding, turning and drilling. The unit includes identifying the required manufacturing methods, planning and sequencing the operations, preparing materials and equipment, producing components and assembling components. No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

Employability Skills

This unit contains Employability Skills.

Prerequisite Units

VU22331 Perform basic machining processes

Application of the Unit

This unit would be applied by entry level engineering workers required to undertake a range of well defined cutting, grinding, turning and drilling activities.

ELEMENT

Elements describe the essential outcomes of a unit of competency.

PERFORMANCE CRITERIA

Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.

1. Plan cutting, grinding, turning and drilling of engineering materials

- 1.1 ***Documentation, task requirements and specifications*** are identified and clarified with the ***appropriate personnel***.
- 1.2 ***Safe work practices and procedures*** are followed and hazard control measures implemented where practicable.
- 1.3 ***Materials, resources and machining operations*** appropriate for the task requirements are identified.
- 1.5 Work plan is prepared including sequence of operations taking into account ***environmental requirements***.
- 1.6 ***Factors affecting performance*** of the task are identified and addressed where required.

2. Prepare materials and select equipment

- 2.1 Materials and resources are obtained and checked as fit for purpose.
- 2.2 Calculations are made and component materials are marked out with appropriate allowances and tolerances for cutting, grinding or machining.
- 2.3 Machine ***tooling and accessories*** are selected and set up for the manufacturing operation.

3. Perform cutting, grinding, turning and drilling operations

- 3.1 Work and tooling is secured and aligned or trued according to engineering principles, manufacturer recommendations and safe work practices.
- 3.2 Machines and tooling are used in a manner that optimises tool life.

- | | | |
|----|--------------------------------------|---|
| | 3.3 | Other machining operations are performed, utilising safety guards, safe work practices and personal protective clothing and equipment. |
| | 3.4 | Machining parameters are applied according to engineering principles and relevant calculations/formulae. |
| | 3.5 | Work piece is checked for conformance to job specifications and requirements using the appropriate measuring equipment . |
| | 3.6 | Non compliance is reported to the appropriate personnel and corrective action is implemented. |
| 4. | Check and complete work requirements | <p>4.1 Completed work is reported to appropriate personnel according with enterprise procedures.</p> <p>4.2 Work area is cleared of waste, cleaned and secured following enterprise procedures.</p> <p>4.3 Machines, tooling and accessories are cleaned, maintained and stored according to enterprise procedures and accepted engineering practice.</p> |

REQUIRED SKILLS AND KNOWLEDGE

Required skills:

- planning and sequencing cutting, grinding, turning and drilling operations to meeting job requirements
- completing calculations to meet specified dimensions and tolerances within job specifications
- selecting and preparing machines and accessories for use
- setting-up and operating cutting machines, grinding machines, turning lathes and drilling machines
- cutting, grinding, turning and drilling materials to specified dimensions and tolerances
- securing and clamping work for cutting, grinding or turning
- cleaning and maintaining cutting machines, grinding machines and lathes
- calculating work speeds and feed rates
- applying recommend tool angles from charts/tables for different material types
- applying quality procedures
- reading and interpreting routine job information such job instructions and specifications, work procedures, charts, lists, technical drawings
- following oral instructions and standard operating procedures
- checking and clarifying job related information
- checking conformance to job specifications and managing non-conformance
- measuring to specified tolerances and dimensions

Required knowledge:

- major parts and components of machinery used for cutting, grinding, drilling and turning
- capabilities and safe operating parameters for cutting machines, grinding machines, drilling machines and centre lathes
- factors influencing feeds and speeds and depth of cut or material removal when operating a centre lathe
- principles of chip formation and control for centre lathe operation
- cutting fluids and coolants and their application for machining operations
- basic maintenance requirements of cutting, grinding, drilling machines and centre lathes
- hand tools and hand held power tools use in conjunction with machining operations
- safe work practices and procedures including hazards and risk control measure applicable to an engineering workshop environment

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 in the Performance Criteria is detailed below.

Documentation may include but not limited to::

- task lists
- instructions
- work procedures
- manufacturer manuals
- technical drawings and sketches

Task requirements may include but not limited to::

- timeframe for task
- tools and equipment
- working with others
- materials, parts and other resources
- specifications
- procedures
- special reporting requirements
- quality measures

Specifications may include but not limited to:

- dimensions and tolerances
- tool geometry
- surface finish

Appropriate personnel may include but not limited to:

- supervisor
- leading hand
- foreman
- trainer
- teacher

Safe work practices and procedures may include but not limited to:

- working safely around machinery
- working safely with tools and equipment
- risk and hazard recognition and control
- emergency procedures
- first aid
- housekeeping
- personnel - self, others
- protective equipment
- material safety management systems
- local safe operating procedures
- award provisions

Materials may include but not limited to:

- ferrous and non ferrous:
 - bar
 - section
 - plate
 - sheet

Resources may include but not limited to:

- work requests/orders
- personal protective equipment
- plans, drawings and sketches
- marking out equipment
- measuring equipment
- ferrous and non-ferrous materials
- tools
- cutting and grinding equipment
- consumables

Machining operations may include but not limited to:

- cutting:
 - band saw/power hack saw
 - guillotine
 - shear crop and punch machine
 - cold saw
 - band saw
- turning:
 - centre lathe
- grinding:
 - surface
 - cylindrical
 - bench grinder
- drilling:
 - pedestal drill
 - radial drill

Environmental requirements

may include but not limited to:

- solid waste
- gas, fume, vapour, smoke emissions, including fugitive emissions
- excessive energy use
- excessive noise
- proximity to other personnel

Factors affecting performance

may include but not limited to:

- wrong or damaged parts
- unexpected or potential delays
- environmental factors – weather, noise, dust etc.
- hazards
- insufficient or incorrect information
- material shortages

Tooling and accessories

may include but not limited to:

- high speed steel, carbide tips cutting tools, boring bars
- drills
- blades
- reamers
- thread chasers
- tapping heads, taps etc.,
- chucks and arbors
- live and dead centres,
- face plate
- steadies
- cross slide
- tailstock
- measuring devices
- abrasive wheels
- coolant

Other machining operations

may include but not limited to:

- parallel cutting
- drilling
- knurling
- boring
- reaming
- single start thread cutting
- parting off
- internal and external grinding

Machining parameters

may include but not limited to:

- speeds
- feeds
- depth of cut
- stops
- coolant
- cutting lubricants

Measuring equipment may include but not limited to:

- verniers
- inside/outside micrometers
- dial indicators
- telescopic gauges

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 section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria

Specifically they must be able to:

- plan and sequence the production of basic engineering components and product which includes cutting, grinding, turning and drilling operations on at least one (1) occasion
- produce basic engineering components and product to conform with job specifications by using cutting, grinding, turning and drilling operations on at least one (1) occasion
- demonstrate safe work practices when using metalworking machines, tools and equipment at all times
- clean work area and dispose of waste according to enterprise procedures at all times.

Context of and specific resources for assessment

Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Method of assessment

Evidence can be gathered through a variety of ways including:

- observation of processes and procedures
- oral and/or written questioning
- testimony from supervisors, colleagues, clients and/or other appropriate persons
- inspection of the final product or outcome
- portfolio of documented evidence.

Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons.

VU22336 – Perform metal fabrication operations

Unit Descriptor This unit of competency describes the knowledge and skills required to perform various fabrication operations such as cutting, forming, bending and shaping to produce components and products.

This involves identifying the required manufacturing methods, planning the operations, preparing materials and equipment, producing and assembling components.

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

Employability Skills This unit contains Employability Skills.

Prerequisite Unit/s VU22332 Apply basic fabrication techniques

Application of the Unit This unit would be applied by entry level engineering workers required to perform a range of basic metal fabrication operation.

ELEMENT

Elements describe the essential outcomes of a unit of competency.

PERFORMANCE CRITERIA

Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.

- | | |
|---|--|
| 1. Plan and sequence fabrication operations | <p>1.1 <i>Documentation, task requirements</i> and specifications are identified and clarified with the <i>appropriate personnel</i>.</p> <p>1.2 <i>Workplace Health and Safety/Occupational Health and Safety (WHS/OHS) requirements</i>, safe work practices and procedures are identified and followed.</p> <p>1.3 <i>Materials</i> and <i>resources</i> required for the job are determined.</p> <p>1.4 A work plan showing the sequencing of tasks is prepared and approved by appropriate personnel.</p> <p>1.5 <i>Factors affecting task performance</i> are identified and accounted for where possible.</p> |
| 2. Prepare materials and select equipment | <p>2.1 Materials and resources are obtained and checked as fit for purpose.</p> <p>2.2 Calculations are made as required and component materials are marked out with appropriate allowances and tolerances for cutting, forming, bending and assembly operations.</p> <p>2.3 Appropriate tools and accessories are selected for the fabrication tasks.</p> <p>2.4 <i>Fabrication equipment</i> is selected and set up according to manufacturer requirements and safe operating procedures.</p> |

- | | |
|--|--|
| 3. Fabricate components | <p>3.1 Component materials are secured or clamped according to engineering principles and safe work practices.</p> <p>3.2 Cutting, forming, bending and shaping tasks are performed inline with work plan and job specifications.</p> <p>3.3 Safe work practices and procedures are followed and hazard control measures implemented where practicable.</p> <p>3.4 Work pieces are inspected for compliance with job specifications using appropriate measuring equipment and product quality procedures.</p> <p>3.5 Non compliance is reported to the appropriate personnel and corrective action is implemented.</p> |
| 4. Ensure quality of fabricated components | <p>4.1 Regular quality checks are applied throughout the manufacturing operation.</p> <p>4.2 Product quality problems are identified and rectified.</p> |
| 5. Assemble fabricated components | <p>5.1 Tools and equipment appropriate to the task are selected and prepared.</p> <p>5.2 Components are assembled using basic assembly techniques.</p> <p>5.3 Assembly is checked for operational performance and compliance with job specifications.</p> |
| 6. Complete work requirements | <p>6.1 Completed work is reported to appropriate personnel according with enterprise procedures.</p> <p>6.2 Work area is cleared of waste, cleaned and secured following enterprise procedures.</p> <p>6.3 Machines, tools and equipment are maintained and stored following enterprise procedures.</p> |

REQUIRED SKILLS AND KNOWLEDGE

Required skills:

- reading and interpreting routine information such as job instructions, specifications and standard operating procedures, technical drawings for a fabrication operations
- following and responding to oral instructions in a workshop environment
- preparing a work plan and task sequencing for a fabrication operation
- preparing calculations and marking out materials for cutting, forming, bending and shaping operations
- securing and clamping work for cutting and forming operations
- setting up and operating cutting, forming, bending and shaping equipment
- applying metal joining methods
- applying quality compliance checks and procedures
- checking conformance of work to job specifications

Required knowledge:

- metal fabrication equipment, techniques and processes such as cutting, forming, bending and shaping
- marking out medium and tools for fabrication processes
- calculations for fabrication processes
- bend allowance/neutral axis
- sequence of fabrication operations
- hand tools and measuring equipment use in fabrication operations
- assembly techniques and processes
- metal joining methods

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 in the Performance Criteria is detailed below.

Documentation includes but not limited to:

- task lists
- instructions
- work procedures
- manufacturer manuals
- technical drawings and sketches

Task requirements includes but not limited to:

- timeframe for task
- tools and equipment
- working with others
- materials, parts and other resources
- specifications
- procedures
- special reporting requirements
- quality measures

Appropriate personnel includes but not limited to:

- supervisor
- leading hand
- foreman
- trainer
- teacher

Workplace Health and Safety/Occupational Health and Safety (WHS/OHS) requirements includes but not limited to:

- legislation
- protective equipment
- material safety management systems
- hazardous substances and dangerous goods code
- local safe operating procedures

Materials includes but not limited to:

- plate, section or sheet, including tube to 5mm
- ferrous and non ferrous metals and non-metallic substances

Resources includes but not limited to:

- work requests/orders

- personal protective equipment
- plans, drawings and sketches
- marking out equipment
- measuring equipment
- ferrous and non-ferrous sheet, plate, section and tube
- tools
- cutting and fabrication equipment
- consumables

Factors affecting task

performance includes but not limited to:

- wrong or damaged parts
- unexpected or potential delays
- environmental factors – weather, noise, dust etc
- hazards
- insufficient or incorrect information
- material shortages

Fabrication equipment

includes but not limited to:

- forming, shaping and bending equipment:
 - universal plate clamps
 - rolling and forming machine
 - pyramid and pinch rollers
 - folding and pressing machine
 - sheet metal press-brake and pan brake
- cutting equipment:
 - fixed:
 - band saw/power hack saw
 - guillotine
 - set of rolls
 - bench folder/press
 - shear crop and punch machine
 - pedestal grinder
 - pedestal drill
 - hand held:
 - nibbler
 - nibblers/notchers
 - punches
 - shears
 - grinders
 - drills

Safe work practices and

procedures includes but not limited to:

- working safely around machinery
- working safely with tools and equipment

- risk and hazard recognition
- emergency procedures
- first aid
- workshop safety
- housekeeping
- personnel - self, others
- material handling

Measuring equipment

includes but not limited to:

- verniers
- inside/outside micrometers
- dial indicators
- telescopic gauges

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 section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria

Specifically they must be able to:

- plan and sequence the production of basic metal components or products using a range of fabrication operations such as cutting, forming, bending and shaping techniques on at least one (1) occasion
- fabricate and assemble a range of basic metal components or products to conform with quality standards and job specifications on at least one (1) occasion
- demonstrate safe work practice when using metalworking machines, tools and equipment at all times
- clean work area and dispose of waste according enterprise procedures at all times.

Context of and specific resources for assessment

Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Method of assessment

Evidence can be gathered through a variety of ways including:

- observation of processes and procedures

- oral and/or written questioning
- testimony from supervisors, colleagues, clients and/or other appropriate persons
- inspection of the final product or outcome
- portfolio of documented evidence.

Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons.

VU22337 - Perform basic welding and thermal cutting processes to fabricate engineering structures

Unit Descriptor	<p>This unit of competency describes the knowledge and skills required to perform:</p> <ul style="list-style-type: none"> • basic welding using manual metal arc welding (MMAW) • basic welding using gas metal arc welding (GMAW) • basic thermal cutting using fuel gas equipment <p>The unit includes identifying the welding and thermal cutting equipment and consumables, preparing materials and equipment, welding and thermal cutting process and safe welding and thermal cutting practices</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.</p>
Employability Skills	This unit contains Employability Skills.
Prerequisite Unit/s	VU22332 Apply basic fabrication techniques
Application of the Unit	<p>This unit would be applied by entry level engineering workers required to undertake a range of basic welding and thermal cutting processes to fabricate engineering structures.</p> <p>Welding is routine and the weld quality is not required to meet an Australian Standard. Fillet and butt welds would typically be performed on low carbon/mild steels. Thermal cutting is manual straight line cutting.</p>

ELEMENT

Elements describe the essential outcomes of a unit of competency.

PERFORMANCE CRITERIA

Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.

1. Plan welding and thermal cutting tasks	<p>1.1 <i>Documentation, task requirements</i> and specifications are determined through request, work orders or instructions and clarified with the <i>appropriate personnel</i>.</p> <p>1.2 <i>Workplace Health and Safety/Occupational Health and Safety (WHS/OHS) requirements</i>, relevant Australian standards, codes of practice, manufacturer's specifications, <i>environmental requirements</i> and <i>enterprise procedures</i> are identified and followed.</p> <p>1.3 Weld requirements are identified from job instructions and <i>resources</i> are identified.</p> <p>1.4 <i>Factors affecting task performance</i> are identified and addressed as required.</p> <p>1.5 Locations of welds are determined in accordance with job specifications.</p>
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| | 1.6 | Safe work practices and procedures are followed and hazard control measures implemented. |
| 2. Prepare materials and equipment for welding and thermal cutting | 2.1 | Materials are prepared according to task and process requirements. |
| | 2.2 | Welding and thermal cutting equipment are set up according to operational requirements. |
| | 2.3 | Settings and consumables are selected to suit given application. |
| 3. Perform routine welding using MMAW and GMAW | 3.1 | Safe welding practices are applied. |
| | 3.2 | Equipment adjustments are made using standard operating procedures. |
| | 3.3 | Materials are welded to job requirements. |
| | 3.4 | Welds are cleaned according to standard operating procedures. |
| | 3.5 | Completed work piece is checked for conformance to specifications and job requirements. |
| | 3.6 | Unexpected situations are dealt with safely and reported to the appropriate personnel. |
| 4. Perform thermal cutting | 4.1 | Safe thermal cutting practices are applied. |
| | 4.2 | Equipment adjustments are made using standard operating procedures. |
| | 4.3 | Appropriate cutting allowances are made and materials are used in the most economical way. |
| | 4.4 | Cutting process and/or procedure appropriate for material is determined and applied. |
| 5. Complete work requirements | 5.1 | Welds and thermal cutting work are inspected and defects and causes are identified. |
| | 5.2 | Completed work is reported to appropriate personal according with enterprise procedures. |
| | 5.3 | Work area is cleaned and waste is disposed of according to enterprise procedures. |
| | 5.4 | Tools and equipment are maintained and stored following enterprise procedures. |

REQUIRED SKILLS AND KNOWLEDGE

Required skills:

- identifying and clarifying job requirements
- planning a job and sequencing tasks
- confirming specifications and required resources
- selecting and applying appropriate personal protective equipment (PPE)

- applying safe MMAW and GMAW welding practices
- checking and revising outcomes against task requirement
- identifying reasons why task/s was/was not met
- determining how the task/s could be done better
- adjusting MMAW and GMAW welding equipment to operating specifications
- setting up and adjusting heating and cutting equipment
- heating and cutting materials to specifications
- making cutting allowances
- minimising material wastage
- identifying cutting defects and taking corrective action

Required knowledge:

- MMAW and GMAW welding processes which includes:
 - different current and voltage settings, consumables and other variable to suit different situations
 - materials and process preparation
 - welding consumables
 - preparation and equipment set-up
 - hand and power tools used in conjunction with welding process
 - basic properties and characteristics of common joining metal materials
 - weld characteristics and post-welding treatment
- thermal cutting processes which include:
 - fuel gas properties and applications
 - materials commonly used
 - equipment, accessories and assembly procedures
 - cutting skills including allowances and reasons for applying them
 - procedures for minimising material wastage
 - cutting defects and their causes
 - safe use of equipment

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 in the Performance Criteria is detailed below.

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| <p><i>Documentation</i> may include but not limited to:</p> | <ul style="list-style-type: none"> • task lists • instructions • work procedures • manufacturer manuals • technical drawings and sketches |
| <p><i>Task requirements</i> may include but not limited to:</p> | <ul style="list-style-type: none"> • timeframe for task • tools and equipment • working with others • materials, parts and other resources • specifications • procedures • special reporting requirements |

- quality measures

Appropriate personnel
may include but not limited to:

- supervisor
- leading hand
- foreman
- trainer
- teacher

Workplace Health and Safety/Occupational Health and Safety (WHS/OHS) requirements
may include but not limited to:

- legislation
- protective equipment
- material safety management systems
- hazardous substances and dangerous goods code
- local safe operating procedures

Environmental requirements may include but not limited to:

- solid waste
- gas, fume, vapour, smoke emissions, including fugitive emissions
- excessive energy use
- excessive noise
- proximity to other personnel

Enterprise procedures
may include but not limited to:

- the use of tools and equipment
- instructions, including job sheets, cutting lists, plans, drawings and designs
- reporting and communication
- manufacturers' specifications and operational procedures

Resources may include but not limited to:

- work requests/order sheets
- personal protective equipment
- plans, drawings and sketches
- marking out equipment
- measuring equipment
- ferrous and non-ferrous sheet, plate, and bar
- tools
- MMAW and GMAW welding equipment
- thermal cutting equipment
- consumables

Factors affecting task performance may include but not limited to:

- wrong or damaged parts
- unexpected or potential delays
- environmental factors – weather, noise, dust etc
- hazards
- insufficient or incorrect information
- material shortages

Safe work practices and procedures may include but not limited to:

- working safely around machinery
- correct use of personal protective equipment (PPE)
- working safely with tools and equipment
- risk and hazard recognition
- emergency procedures
- first aid

Materials may include but not limited to:

- low and mild carbon steel or similar

Prepared may include but not limited to:

- cleaning
- preheating
- joint preparation
- setting up of jigs and fixtures
- application of clamps

Welding and thermal cutting equipment may include but not limited to:

- hoses, welding leads, gas shrouds, gas regulators, liners, contact tips (GMAW)
- welding leads, welding machines, electrode holder etc. (MMAW)
- fuel gas and hand held thermal cutting equipment (thermal cutting)

Consumables include but not limited to:

- filler wire
- shielding gas
- electrodes

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 section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria

Specifically they must be able to:

- select resources and set up manual metal arc welding and gas metal arc welding equipment for a welding task
- perform welding task using manual metal arc welding and gas metal arc welding equipment to meet job specifications
- set up and carry out thermal cutting task according to job requirements
- demonstrate safe work practices and environment considerations when carrying out welding and thermal cutting tasks.

Context of and specific resources for assessment

Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Method of assessment

Evidence can be gathered through a variety of ways including:

- observation of processes and procedures
- oral and/or written questioning
- testimony from supervisors, colleagues, clients and/or other appropriate persons
- inspection of the final product or outcome
- portfolio of documented evidence.

Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons.

VU22338 - Configure and program a basic robotic system

Unit Descriptor

This unit of competency describes the knowledge and skills required to configure and program a basic robotic system. Typical tasks for basic robotic system operation include pick and place, motion and navigation. Code development will include testing code and producing code to control robotic systems.

No licensing or certification requirements apply to this unit at the time of accreditation.

Employability Skills

This unit contains Employability Skills.

Application of the Unit

This unit would be applied by entry level engineering workers required to undertake basic operations with robotic systems for a range of repetitive and routine tasks.

This unit does not include large, complex industrial robotic systems used in manufacturing operations.

ELEMENT

Elements describe the essential outcomes of a unit of competency

1. Plan the configuration and programming of a basic robotic system

PERFORMANCE CRITERIA

Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.

- 1.1 **Workplace Health and Safety/Occupational, health and safety (WHS/OHS) requirements** and **environmental requirements** for a given work area are obtained and understood.
 - 1.2 Established WHS/OHS requirements and risk control measures and procedures in preparation for the work area are followed.
 - 1.3 Safety hazards, which have not previously been identified, are documented and risk control measures devised and implemented in consultation with **appropriate personnel**.
 - 1.4 Routine tasks that may be performed by a robotic system are analysed, documented and discussed with appropriate personnel.
 - 1.5 **Robotic system** configuration and programming requirements are determined from documentation, construction briefs and discussions with appropriate personnel.
 - 1.6 Appropriate personnel are consulted to ensure the work is coordinated effectively with others involved at the work site.
 - 1.7 **Resources and equipment** needed for the task are obtained in accordance with enterprise procedures and checked for correct operation and safety.
- 2.1 WHS/OHS requirements for carrying out the work are followed.
 - 2.2 Equipment/machines/plant is checked as being isolated where necessary in strict accordance with WHS/OHS requirements.
 - 2.3 Robotic system is constructed and programmed in accordance with requirements, manufacturers' specifications and **enterprise procedures**.
 - 2.4 Robotic system is programmed and configured for the intended

- task according to manufacturers' specifications and enterprise procedures.
- 2.5 Robotic system is tested for correct operation and, if required, incorrect hardware and software functions are identified and rectified.
- 2.6 Decisions for dealing with unexpected situations are made from discussions with appropriate personnel, job specifications and enterprise procedures.
- 2.7 Methods for dealing with unexpected situations are selected on the basis of safety and specified work outcomes.
3. Verify and document robotic system
- 3.1 WHS/OHS requirements for completing the work are followed.
- 3.2 Work site is made safe in accordance with established safety procedures.
- 3.3 Hardware and software tools used in configuration and programming tasks are maintained and stored according to enterprise procedures.
- 3.4 Robotic system overall function and requirements are verified, documented and information stored according to enterprise procedures.
- 3.5 Appropriate personnel are informed of the completion of work and, if required, provided with a demonstration of the operation of hardware and software aspects of the robotic system.

REQUIRED SKILLS AND KNOWLEDGE

Required skills:

- using tools and equipment configure and program a robotic system
- following enterprise and WHS/OHS procedures
- reading and interpreting robotics equipment manuals
- completing workplace documentation
- making decisions within a limited range of options
- installing and configuring integrated programming environments (IPE)
- saving, editing, documenting and compiling code
- defining and documenting a basic robotic task including requirement list; task steps; input requirements; output requirement; logic states
- testing code including systematic fault finding and documentation; debuggers and simulation; fault isolation; input checking; output checking; diagnostic code
- troubleshooting robotic system operation

Required knowledge:

- types of robotic devices including mobile robots; autonomous robots; robotic arms
- robot axis and degrees of movement
- robot power requirements and movement e.g. stationary robots with mains derived power; mobile robots with batteries; battery duration and recharging
- DC motor types including permanent magnet DC motors; brushed motors; brushless motors; stepping motor
- DC motor controls including speed control (pulse width modulation); forward and reverse control; 'H' drive

- positional feedback and servo systems including potentiometers; encodes (incremental and absolute)
- solenoid actuators
- input basic transducers including switches; potentiometers; IR infra-red sensors; ultra-sonic sensors
- robot electronics fundamentals including CPU/controller; input interfaces, analogue, digital; output interfaces, analogue, digital, drive capabilities protection
- drive mechanisms including gearboxes; belts; chains
- robot construction materials including metal; wood; plastics; composites
- download interfaces such as RS232; USB; IEEE1394 or similar
- flowchart symbols
- flowchart decisions and logic
- program code including input statements; output statements; logical operators (AND, OR, NOT, XOR, SHiFT); mathematical operators; flow control (IF THEN, FOR, WHILE); program modules (CALL, RETURN)
- code download including programming interfaces; isolation; programming mode; operational mode. eg Programming Raspberry Pi with Python and Open Computer Vision (CV)
- WHS/OHS considerations applicable to robotic systems

RANGE STATEMENT

This describes the essential skills and knowledge and their level, required for this unit. Bold italicised wording in the Performance Criteria is detailed below.

Workplace Health and Safety/Occupational, health and safety (WHS/OHS) requirements may include but not limited to:

- legislation
- protective equipment
- material safety management systems
- hazardous substances and dangerous goods code
- local safe operation procedures

Environmental requirements may include but not limited to:

- liquid waste
- solid waste
- gas, fume, vapour, smoke emissions, including fugitive emissions
- excessive energy and water use
- excessive noise

Appropriate personnel may include but not limited to:

- supervisor
- leading hand
- foreman
- manager
- site engineer
- trainer
- mentor
- teacher
- team member

Robotic system may include but not limited to:

- mobile robots
- autonomous robots
- robotic arms

Resources and equipment may include but not limited to:

- appropriate tools
- test equipment
- consumables
- appropriate software licences
- manufacturers' specifications and manuals
- diagnostics software
- personal computer
- programming tools

Enterprise procedures may include but not limited to:

- the use of tools and equipment
- instructions, including job sheets, cutting lists, plans, drawings and designs
- reporting and communication
- manufacturers' specifications and operational procedures

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 this Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria

Specifically they must be able to:

- plan, and construct a robotic system for a routine task using hardware and software tools
- configure, program, test and rectify robotic system to achieve optimum performance of routine task
- apply relevant WHS/OHS procedures and safe work practices during construction, programming and testing of a robotic system.

Context of and specific resources for assessment

Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Methods of assessment

Evidence can be gathered through a variety of ways including:

- observation of processes and procedures
- oral and/or written questioning

- testimony from supervisors, colleagues, clients and/or other appropriate persons
- inspection of the final product or outcome
- portfolio of documented evidence.

Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons.

VU22339 - Create engineering drawings using computer aided systems

Unit Descriptor

This unit of competency describes the knowledge and skills required to produce engineering drawings using a computer aided drafting (CAD) system.

The unit includes the use of CAD software commands to generate drawing elements used in the development of a detailed drawing and familiarisation with the use of macros, menus, default settings and file management functions.

The unit covers the development of simple two dimensional (2D) drawings and simple three dimensional (3D) drawings consistent with the conventions and general requirements of Australian Standard AS1100.

No licensing or certification requirements apply to this unit at the time of accreditation.

Employability Skills

This unit contains Employability Skills.

Prerequisite Unit/s

VU22330 Select and interpret drawings and prepare three dimensional (3D) sketches and drawings

Application of the Unit

This unit would be applied to entry level engineering workers required to undertake a range of well-defined drawing activities using a computer aided system.

ELEMENT

Elements describe the essential outcomes of a unit of competency

PERFORMANCE CRITERIA

Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.

1. Prepare CAD environment

- 1.1 Drawing requirements and specifications are identified and clarified with the ***appropriate personnel***.
- 1.2 ***CAD system*** is started in accordance to ***enterprise procedures***.
- 1.3 Screen display areas and basis files are accessed using basic menus and commands.
- 1.4 Basic parameters are set for the given task.

2. Create and modify drawings

- 2.1 Simple ***2D and 3D drawings*** are developed using basic features of the software.
- 2.2 Dimensions, symbols and text are applied according to task requirements.
- 2.3 Completed drawings are checked for conformance to specifications, and modified as required.

3. Complete CAD operations and close system

- 3.1 Drawing files are saved in the appropriate format in accordance with operating procedures.
- 3.2 Drawing files are exported in the required format for presentation.
- 3.3 CAD system is closed down in accordance with workplace procedures.

REQUIRED SKILLS AND KNOWLEDGE

Required skills:

- Starting up and shutting down a CAD system
- Using menus and accessing files
- setting basic parameters and selecting commands
- setting system default functions
- saving, transferring and printing drawing files to a specified drive or directory
- developing basic macros
- creating, editing and modifying simple 2D and 3D drawings using basic drawing features of the software system
- hatching or filling areas for visual affect
- applying the conventions and requirements of AS1100 to drawing presentations

Required knowledge:

- functions and features of CAD software system
- screen display areas and their functions
- reasons for basic parameters
- drawing scales
- basic system variables and their customisation
- basic drafting standards/procedures including AS1100

RANGE STATEMENT

This describes the essential skills and knowledge and their level, required for this unit. Bold italicised wording in the Performance Criteria is detailed below.

Appropriate personnel
may include but not limited
to:

- supervisor
- leading hand
- foreman
- trainer/coach
- teacher

CAD system may include
but not limited to:

- hardware and peripherals
- CAD software
- Printing system

Enterprise procedures
may include but not limited
to:

- the use of CAD equipment
- instructions, including job sheets, cutting lists, plans, drawings and designs
- reporting and communication
- manufacturers' specifications and operational procedures

2D and 3D drawings may
include but not limited to:

- 2D drawings:
 - plans
 - charts
 - diagrams

- schematics
- 3D drawings:
 - spheres
 - cones
 - cylinders
 - boxes

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 this Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria

Specifically they must be able to demonstrate the ability to:

- start up, operate the basic functions and shut down a CAD system in accordance to enterprise procedures
- produce simple 2D and 3D drawings to conform with work instructions and AS1100 conventions and specifications.

Context of and specific resources for assessment

Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to CAD, equipment, and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Methods of assessment

Evidence can be gathered through a variety of ways including:

- observation of processes and procedures
- oral and/or written questioning
- testimony from supervisors, colleagues, clients and/or other appropriate persons
- inspection of the final product or outcome
- portfolio of documented evidence.

Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons.

VU22340 - Use 3D printing to create products

Unit Descriptor

This unit describes the skills and knowledge to utilise a three dimensional (3D) printer to produce basic products.

It encompasses the use of current 3D printing software applications, manipulation of hardware and software features, managing files and directories, file storage requirements and relevant safety procedures.

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

Employability Skills

This unit contains Employability Skills.

Application of the Unit

This unit applies to persons preparing to enter the manufacturing and engineering industry and may be used in school based programs under appropriate supervision.

ELEMENT

Elements describe the essential outcomes of a unit of competency.

1. Determine the job requirements

PERFORMANCE CRITERIA

Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold/italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide

- 1.1 **Requirements** and **purpose** for 3D printing are clarified by referring to the job specifications.
- 1.2 Relevant **Workplace Health and Safety/Occupational Health and Safety (WHS/OHS)** procedures are accessed and followed.
- 1.3 **Relevant personnel** are consulted to organise work flow sequences.
- 1.4 Computer software that suits the type of 3D printing product being created is selected.
- 1.5 **3D printer** suitable for the product being created and the material being used is selected.
- 1.6 Relevant **reference materials** to help with the visualisation of the 3D product are accessed and analysed.

2. Create the 3D printing product

- 2.1 Models are blocked out using software features to determine correct proportions in relation to the reference materials.
- 2.2 Lighting and shading software features are manipulated as required.
- 2.3 **Integrity** of the product design is **refined** and checked against the job requirements and specifications.
- 2.4 Product design is rendered and output is downloaded in the required **format**.

3. Produce and evaluate the 3D printed product

- 3.1 Product design is tested to identify any faults and modified as required.

- 3.2 Product design is submitted to relevant personnel for approval and final adjustments to the 3D printing program are made.
- 3.3 Sample 3D product is produced and checked for faults.
- 3.4 Computer files are saved and back-up copies are made in accordance with enterprise procedures.
- 3.5 Complete workplace documentation is completed in accordance to enterprise procedures.

REQUIRED SKILLS AND KNOWLEDGE

Required skills:

- manipulating industry-current 3D digital printing hardware and software application to create and produce a product
- managing 3D digital printing files and directories by applying standard naming conventions and version control protocols
- making back-up copies of files and storing them appropriately
- interpreting and clarifying written or verbal instructions for the production of a 3D digital printed product
- seeking expert assistance to address problems and responding constructively to feedback
- using relevant materials/resources to assist with the development and visualisation of a 3D digital printed product

Required knowledge:

- 3D digital printing techniques
- functions and features of a range of delivery platforms
- stages in the production process from initial design through to finished product
- issues and challenges in the context of creating 3D digital printed products
- WHS/OHS standards and procedures relevant to 3D digital printing operations
- resources useful for the development and creation of 3D digital printed products
- quality assurance considerations relevant to creation of 3D digital printed products

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 this Training Package.

RANGE STATEMENT

This describes the essential skills and knowledge and their level, required for this unit. Bold italicised wording in the Performance Criteria is detailed below.

- Requirements*** may include but not limited to::
- assets for integration
 - collaboration with others
 - creative expectations
 - design specifications
 - output format
 - technical specifications

Purpose may include but not limited to:	<ul style="list-style-type: none"> • architectural models • rapid prototyping • rapid manufacturing • small batch custom manufacturing
Workplace Health and Safety/Occupational Health and Safety (WHS/OHS) may include but not limited to:	<ul style="list-style-type: none"> • legislation • safety management systems • enterprise safe work procedures • protective equipment • hazardous substances and dangerous goods code
Relevant personnel may include but not limited to:	<ul style="list-style-type: none"> • supervisor • trainer/teacher • project Manager
3D printer may include but not limited to:	<ul style="list-style-type: none"> • RepRap • Ultimaker • Airwolf • RoBo • Solidoodle
Reference materials may include but not limited to:	<ul style="list-style-type: none"> • concept drawings and sketches • real object on which the product is to be based • photo images • video images
Integrity may include but not limited to:	<ul style="list-style-type: none"> • double faces • isolated vertices • pivot points • resetting transforms • scale of product relative to other components
Refined may include but not limited to:	<ul style="list-style-type: none"> • required shape • required topology • required functionality
Format may include but not limited to:	<ul style="list-style-type: none"> • Standard Tessellation Language (STL) • Audio Video Interleave (AVI) • Interchange File Format (IFF) • Joint Photographic Experts Group (JPEG) • Tagged Image File Format (TIFF) • Quicktime • Moving Pictures Experts Group (MPEG) • Portable Network Graphics

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 this Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria

Specifically they must be able to:

- use and manipulate 3D digital printing technology to develop and produce at least one (1) simple product to specification
- manage 3D digital printing files and directories by applying standard naming conventions and version control protocols
- apply relevant WHS/OHS procedures and work practices while using 3D digital printing technology.

Context of and specific resources for assessment

Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials

Methods of assessment

Evidence can be gathered through a variety of ways including:

- observation of processes and procedures
- oral and/or written questioning
- testimony from supervisors, colleagues, clients and/or other appropriate persons
- inspection of the final product or outcome
- portfolio of documented evidence.

Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons.

VU22341 - Apply basic computer networking concepts and practices

Unit Descriptor

This unit describes the knowledge and skills required to apply basic computer networking concepts and practices to a new or existing computer network.

The unit includes the knowledge and skills to build a basic Local Area Network (LAN) including wireless access.

No licensing or certification requirements apply to this unit at the time of accreditation.

Employability Skills

This unit contains Employability Skills.

Application of the Unit

This unit would be applied by entry level engineering students required to apply basic computer networking concepts and practices under supervision.

ELEMENT

Elements describe the essential outcomes of a unit of competency

PERFORMANCE CRITERIA

Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.

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| 1. Establish how end-user devices interact with a computer network | 1.1 Role of network devices enabling an end user to access internet services are indentified. |
| | 1.2 Configuring Internet Protocol (IP) addresses on an end device are confirmed. |
| | 1.3 Basic network components are identified. |
| 2. Investigate the basic operation of key network services | 2.1 Feature of an IP address is indentified. |
| | 2.2 Different types of IPv4 addresses are compared. |
| | 2.3 IPv6 address structures is indentified. |
| | 2.4 Function and role of a Dynamic Host Control Protocol (DHCP) server are confirmed. |
| | 2.5 Function and role of the four layers of the TCP/IP stack are identified. |
| | 2.6 Function and operation of static Network Address Translation (NAT) is indentified. |
| 3. Build and configure a basic computer network and test for connectivity | 3.1 Basic function and operation of a network switch and business router are determined. |
| | 3.2 Network is cabled according to a provided network diagram. |
| | 3.3 Structure of an Internetworking Operating System (IOS) for a switch and router is clarified. |
| | 3.4 Common IOS show and test commands are utilised. |
| | 3.5 Network switches and routers are configured and tested for connectivity. |
| | 3.6 Configure IP addresses on a workstation or laptop. |
| | 3.7 Troubleshooting methodologies and tools are used as required. |

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|---|---|
| 4. Configure wireless clients for a network | 4.1 <i>Different types of wireless network connections</i> are determined. |
| | 4.2 Current Wi-Fi standards and functionality are explained. |
| | 4.3 Functionality of a Wireless LAN router is described. |
| | 4.4 Wireless clients are added to the network. |
| | 4.5 Wireless security vulnerabilities and Wireless LAN router security features are recognised and implemented. |
| | 4.6 Mobile devices for the Wireless LAN network are configured. |

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- articulating issues arising from the operation of a network
- base level problem solving to implement provided scripts for a switch and a router
- reading and accurately interpreting documents and reports
- operating a personal computer
- cabling network at a basic level
- identifying and using networking devices
- configuring IP addresses on a workstation or laptop
- building and testing a network
- configuring Wireless LAN routers
- adding users to a wireless network

Required knowledge:

- function and operation of transport layer protocols
- IPV4 addressing structure
- IPV6 addressing fundamentals
- DHCP concepts
- basic operation of static NAT
- routers, switches, firewall fundamentals
- IOS commands
- end to end network test commands eg Ping, Traceroute
- Wireless LANs operation and vulnerabilities
- basic firewall operation
- malware attacks mechanisms and detection tools
- basic network security concepts and practices
- configuring Wireless LAN routers

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 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 of the candidate, accessibility of the item, and local industry and regional contexts.

Basic network may include but not limited to:

- workstations
- switch
- hub

Different types of IPv4 addresses may include but not limited to:

- Class A Addresses
- Class B Addresses
- Class C Addresses
- Class D Addresses

Network devices may include but not limited to:

- workstation
- laptop
- switch
- tablet
- hub
- router

Common IOS show and test commands may include but not limited to:

- show running-configuration (or equivalent)
- show interface (or equivalent)

Troubleshooting methodologies and tools may include but not limited to:

- top down bottom up testing
- ping
- traceroute

Different types of wireless network connections may include but not limited to:

- ad hoc
- multihop

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 this Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria

Specifically they must be able to:

- explain the function and operation of networking devices and how they interact with the internet
- explain the structure and operation of IP addresses and key protocols of the Transmit Control Protocol/Internet Protocol (TCP/IP) suite
- build a small network using an integrated router including security considerations
- configure an integrated wireless router and wireless clients including security considerations.
- add users to a wireless network.

Context of and specific resources for assessment

Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Methods of assessment

Evidence can be gathered through a variety of ways including:

- observation of processes and procedures
- oral and/or written questioning
- testimony from supervisors, colleagues, clients and/or other appropriate persons
- inspection of the final product or outcome
- portfolio of documented evidence.

Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons.

Appendix 1 - Summary of Knowledge and Skills

Required knowledge:

- Knowledge of production processes e.g. forming, fabricating, shaping, extrusion
- Knowledge of materials e.g. ferrous, nonferrous, non-metallic
- Identify and clarify task requirements
- Major sectors of the engineering industry
- Structure of the engineering industry
- Interpret work instructions and procedures
- Technical drawing standards, conventions and specifications
- Computer operating systems and peripheral devices
- Computer applications
- Types and functions of technical drawings
- Types of robotic devices including mobile robots
- Functions and features of CAD software system
- 3D digital printing techniques

Required skills:

- Safe work practices
- Use of personal protective clothing
- Use of safety equipment and devices
- Emergency procedures
- Create a career plan
- Hazard identification and control
- Reporting of workplace hazards and incidents
- Identification of dangerous goods labels
- Identification of safety signs and symbols
- Work in a team
- Follow oral and written instructions
- Prepare a written work plan
- Follow a determined sequence of operations
- Manual handling techniques
- Use of mechanical aids and lifting devices
- Selection and use of hand tools
- Mark out materials
- Operate cut off machines
- Undertake off-hand grinding
- Undertake drilling
- Operate a lathe
- Operate a milling machine
- Use of joining methods
- Operate fabrication machinery
- Fabrication techniques
- Geometric construction methods and applications
- Freehand sketching
- Interpret sketches and drawings
- Programming of a basic robotics system
- Construct basic shapes using 2D and 3D CAD
- Use of industry-current 3D printing software applications
- Build a small network using an integrated router