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22538VIC

Course in Precision Metal Castings

Version 2.1 September 2023

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

Accredited for the period: 01/01/2020 to 31/12/2024

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Version History		Date
Version 2.1	Department of Education and Training (DET) details and contact information updated with Department of Jobs, Skills Industries and Regions (DJSIR) details in Section A	September 2023
Version 2	Unit code VU22712 removed and replaced with VU22679 for unit Use mixed or blended reality technologies	October 2020
Version 1	Initial accreditation	September 2019

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Section A: Copyright and course classification information

1. Copyright owner of the course	<p>Copyright of this material is reserved to the Crown in the right of the State of Victoria on behalf of the Department of Jobs, Skills, Industries and Regions (DJSIR) Victoria.</p> <p>© State of Victoria (DJSIR) 2019</p>
2. Address	<p>Executive Director Higher Education and Workforce Skills and Employment Department of Jobs, Skills, Industries and Regions (DJSIR) GPO Box 4509 MELBOURNE VIC 3001</p> <p>Organisational contact Manager, Training and Learning Products Unit Higher Education and Workforce Skills and Employment Telephone: 131 823 Email: course.enquiry@djsir.vic.gov.au</p> <p>Day-to-day contact Curriculum Maintenance Manager (CMM), Engineering Industries Box Hill Institute Private Bag 2014 Box Hill Vic. 3128 Telephone: (03) 9286 9934 Email: steven.bryant@boxhill.edu.au</p>
3. Type of submission	Accreditation
4. Copyright acknowledgement	<p>Copyright of the following units of competency from nationally endorsed training packages is administered by the Commonwealth of Australia and can be accessed from Training.gov (see website here).</p> <p>© Commonwealth of Australia</p> <p>Metal and Engineering Training Package</p> <ul style="list-style-type: none"> – MEM24012C Apply metallurgy principles <p>Business Services Training Package</p> <ul style="list-style-type: none"> – BSBWRT301 Write simple documents <p>22502VIC Diploma of Project Management for Prefabricated Building Systems (Timber)</p> <ul style="list-style-type: none"> – VU22679 Use mixed or blended reality technologies

	<p>22470VIC Certificate II in Engineering Studies</p> <ul style="list-style-type: none"> – VU22340 Use 3D printing to create products <p>Copyright of this material is reserved to the Crown in the right of the State of Victoria.</p> <p>© State of Victoria (DJSIR) 2019.</p> <p>This work is licensed under a Creative Commons Attribution-No Derivatives 4.0 International licence (see Creative Commons for more information).</p> 	
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<p>6. Course accrediting body</p>	<p>Victorian Registration and Qualifications Authority (VRQA)</p>	
<p>7. AVETMISS information</p>	<p>ANZSCO (Australian and New Zealand Standard Classification of Occupations)</p>	<p>322114 Metal Casting Trades Worker</p>

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	ASCED Code – 4 digit (Field of Education)	0307 Mechanical and Industrial Engineering and Technology
	National course code	22538VIC
8. Period of accreditation	1 January 2020 – 31 December 2024	

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Section B: Course information

1. Nomenclature		<i>Standard 1 AQTF Standards for Accredited Courses</i>
1.1. Name of the qualification	Course in Precision Metal Castings	
1.2. Nominal duration of the course	300-330 hours	
2. Vocational or educational outcomes		<i>Standard 1 AQTF Standards for Accredited Courses</i>
2.1. Purpose of the course	<p>The Course in Precision Metal Castings provides an accredited training program and vocational outcomes for individuals and paraprofessionals working or aspiring to work in the specialist industry of metal investment castings. The course is also available to school leavers wishing to pursue a career in metal castings.</p> <p>The course provides graduates with the skills and knowledge to:</p> <ul style="list-style-type: none"> perform precision metal investment castings perform de-waxing and melting of metals develop and manage slurries create shells perform toolmaking use mixed or blended reality technologies 	

3. Development of the course	<i>Standards 1 and 2 AQTF Standards for Accredited Courses</i>
<p>3.1. Industry / enterprise/ community needs</p>	<p>The skills and knowledge in metal castings in the foundry industry have grown with advances in manufacturing and investment casting techniques and practices. This is largely due to demands made of the industry to produce innovative products using environmentally sustainable processes. Growth for precision metal castings has also increased due to demands to support advances in new technologies in industries such as Defence, aerospace, biomedical and automotive supply chains.</p> <p>Industry stakeholders have identified the need to build on existing non accredited training programs delivered in investment casting within the Engineering Industry. The proposed new course will develop specialist skills and expertise through a newly accredited program for Investment Metal Castings.</p> <p>The accredited program will provide specialist training to existing workforce employees working in foundries and to prospective students wishing to work in the specialist industry of Investment Metal Castings. The Course in Precision Metal Castings will also provide valued upskilling of foundry employees working in advanced manufacturing and investment castings.</p> <p>It is anticipated that in the first year 15-20 enrolments will occur in this specialist area once accredited. This number is expected to grow in subsequent years as the specialist course becomes more widely promoted in delivering advanced skill level in support of the increased skill demand.</p> <p>The course development is supported through consultation with the following industry groups and organisations, namely:</p> <ul style="list-style-type: none"> • Keenan Pattern and Engineering • AusChi Furnace supplies • CSIRO • Engineers Australia • Meridian Sculpture • Department of Defence <p>The Course in Precision Metal Castings will provide the fundamental and specialist knowledge and skills to facilitate the upskilling of the workforce working in foundries and applying advanced manufacturing and investment casting techniques. The accredited training program is within the Engineering Industry sector and the training program is in accordance with SAE-ARP-1962 for training of heat treatment personnel, which includes blended learning and hands on learning programs.</p> <p>The proposed course is supported by the Office of the Victorian Skills Commissioner (OSCV) who has approved funding for this initiative as the course will benefit and stimulate growth in the manufacturing and engineering industries. The development and accreditation of the Course in Precision Metal Castings fulfills the Victorian Government's commitment to invest in innovative education and training programs that equips students and the workforce with the relevant skills to function in industries where rapidly changing technologies are the norm.</p>

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	<p>A Project Steering Committee was established to advise on the industry need and development of the course and to confirm its alignment to industry current and future needs.</p> <p>The membership of the committee is:</p> <table border="0"> <tr> <td>Andrew Meek (Chairperson)</td> <td>SGO Consulting</td> </tr> <tr> <td>Dr Roger Lumley</td> <td>Dr Roger Lumley Metallurgical Services</td> </tr> <tr> <td>Geoff Bell</td> <td>A W Bell</td> </tr> <tr> <td>Matthew Harvey</td> <td>A W Bell</td> </tr> <tr> <td>Gary Savage</td> <td>CSIRO</td> </tr> <tr> <td>Gareth Morley</td> <td>Meridian Sculpture</td> </tr> <tr> <td>Sheldon Irving</td> <td>Chisholm TAFE</td> </tr> <tr> <td>Dennis Keenan</td> <td>Keenan Pattern and Engineering</td> </tr> <tr> <td>Merv Atcheson</td> <td>AusChi Furnace supplies</td> </tr> </table> <p>In Attendance:</p> <table border="0"> <tr> <td>George Adda</td> <td>Box Hill Institute</td> </tr> <tr> <td>Vince Rio</td> <td>Box Hill Institute</td> </tr> </table> <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. 	Andrew Meek (Chairperson)	SGO Consulting	Dr Roger Lumley	Dr Roger Lumley Metallurgical Services	Geoff Bell	A W Bell	Matthew Harvey	A W Bell	Gary Savage	CSIRO	Gareth Morley	Meridian Sculpture	Sheldon Irving	Chisholm TAFE	Dennis Keenan	Keenan Pattern and Engineering	Merv Atcheson	AusChi Furnace supplies	George Adda	Box Hill Institute	Vince Rio	Box Hill Institute
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Merv Atcheson	AusChi Furnace supplies																						
George Adda	Box Hill Institute																						
Vince Rio	Box Hill Institute																						
<p>3.2. Review for re-accreditation</p>	<p>Not Applicable</p>																						
<p>4. Course outcomes <i>Standards 1, 2, 3 and 4 AQTF Standards for Accredited Courses</i></p>																							
<p>4.1. Qualification level</p>	<p>The Course in Precision Metal Castings will meet an identified industry need, but does not have the breadth, depth or volume of learning of a qualification.</p>																						
<p>4.2. Employability skills</p>	<p>NA</p>																						
<p>4.3. Recognition given to the course</p>	<p><i>Standard 5 AQTF Standards for Accredited Courses</i> Not Applicable</p>																						
<p>4.4. Licensing/regulatory requirements</p>	<p><i>Standard 5 AQTF Standards for Accredited Courses</i> No licensing, legislative, regulatory or certification requirements apply to these courses at the time of publication.</p>																						

5. Course rules**Standards 2, 6,7 and 9 AQTF Standards for Accredited Courses****5.1 Course structure**

To be awarded the Course in Precision Metal Castings participants must successfully complete 7 units:

- 5 core
- 2 electives

Participants, who exit the course without completing all the required units for the course will receive a Statement of Attainment listing those units that were successfully completed.

Course in Precision Metal Castings – Core

Unit Code	Field of Education code	Unit Title	Pre-requisite	Nominal hours
VU22860	030713	Work safely in a foundry environment	Nil	30
VU22861	030713	Perform tool assembly and disassembly	VU22860	40
VU22862	030713	Produce shells and perform de-waxing processes	VU22860	80
VU22863	030713	Perform casting production and melting using metal	VU22860	60
VU22679	020115	Use mixed or blended reality technologies	Nil	20
Sub Total nominal hours of core units				230

Electives:

Unit Code	Field of Education code	Unit Title	Pre-requisite	Nominal hours
VU22340	030199	Use 3D printing to create products	Nil	40
VU22864	030713	Perform heat treatment processes	VU22860	60
BSBWRT301	080901	Write simple documents	Nil	30
MEM24012C	030305	Apply metallurgy principles	Nil	40
Total nominal hours of core and elective units				300-330

<p>5.2. Entry requirements</p>	<p><i>Standard 9 for Accredited Courses</i></p> <p>The Course in Precision Metal Castings provides an accredited training program and vocational outcomes for individuals and paraprofessionals working or aspiring to work in the specialist industry of precision metal castings.</p> <p>Although not an entry requirement, individuals who have pacemaker implants or associated electronic devices are advised to consult their medical practitioner about the health implications of undertaking this course. This is due to induction furnaces emitting electromagnetic radiation.</p> <p>Learners are best equipped to achieve the outcomes of the Course in Precision Metal Castings if they have minimum language, literacy and numeracy skills that are equivalent to level 3 of the Australian Core Skills Framework (ACSF).</p>
<p>6. Assessment <i>Standards 10 and 12 AQTF Standards for Accredited Courses</i></p>	
<p>6.1. Assessment strategy</p>	<p>All assessment, including Recognition of Prior Learning (RPL) must be compliant with the requirements of:</p> <ul style="list-style-type: none"> • Standard 1 of the Australian Quality Training Framework (AQTF): Essential Conditions and Standards for Initial/Continuing Registration and Guidelines 4.1 and 4.2 of the VRQA Guidelines for VET Providers, <p>or;</p> <ul style="list-style-type: none"> • the Standards for Registered Training Organisations 2015 (SRTOs), • or; • the relevant standards and guidelines for Registered Training Organisations at the time of assessment. <p>Assessment strategies must therefore ensure that:</p> <ul style="list-style-type: none"> • all assessments are valid, reliable, flexible and fair • learners are informed of the context and purpose of the assessment and the assessment process • feedback is provided to learners about the outcomes of the assessment process and guidance given for future options • time allowance to complete a task is reasonable and specified to reflect the industry context in which the task takes place <p>Assessment strategies should be designed to:</p> <ul style="list-style-type: none"> • cover a range of skills and knowledge required to demonstrate achievement of the course aim • collect evidence on a number of occasions to suit a variety of contexts and situations

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	<ul style="list-style-type: none"> • be appropriate to the knowledge, skills, methods of delivery and • needs and characteristics of learners • 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 outcomes • portfolio of documented on-site work evidence • practical demonstration of required physical tasks • investigative research and case study analysis <p>While the Evidence Guide in each unit provides information specific to the unit outcomes 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>Units must be assessed on-the-job in an operational foundry environment.</p> <p>Assessment of the imported units must reflect the Assessment Requirements for the relevant training package or accredited course.</p>
<p>6.2. Assessor competencies</p>	<p><i>Standard 12 AQTF Standards for Accredited Courses</i></p> <p>Assessment must be undertaken by a person or persons in accordance with:</p> <ul style="list-style-type: none"> • Standard 1.4 of the Australian Quality Training Framework (AQTF): Essential Conditions and Standards for Initial/Continuing Registration and Guideline 3 of the VRQA Guidelines for VET Providers, <p>or;</p> <ul style="list-style-type: none"> • Standards for Registered Training Organisations 2015 (SRTOs), <p>or;</p> <ul style="list-style-type: none"> • the relevant standards and guidelines for RTOs at the time of assessment. <p>Assessors of the imported units of competence must meet the requirements for assessors specified in the relevant training package or accredited course.</p>
<p>7. Delivery <i>Standards 11 and 12 AQTF Standards for Accredited Courses</i></p>	
<p>7.1. Delivery modes</p>	<p><i>Standard 11 AQTF Standards for Accredited Courses</i></p> <p>Delivery strategies should be selected to reflect the nature of the industry specific competencies and the need of the learner.</p> <p>It is recommended that the courses be conducted using delivery and assessment methods involving the clustering of units, to maximise opportunities for learners to have learning experiences which are as close as possible to a real-work environment.</p> <p>Delivery methods may include, but are not limited to:</p>

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	<ul style="list-style-type: none"> • classroom presentation for theoretical components • work-based projects • case study analyses • practical work • project-based learning encompassing the clustering of units <p>Delivery of the imported units of competency must be consistent with the requirements in the relevant training package or accredited course.</p>
<p>7.2 Resource</p>	<p><i>Standard 12 AQTF Standards for Accredited Courses</i></p> <p>Successful delivery of this course requires access to a fully operational foundry environment. For this to occur, providers and industry enterprises may form partnerships to deliver realistic and authentic training and assessment.</p> <p>The resources that should be available for these courses relate to normal work practice using procedures, information and resources typical of a workplace. This must include:</p> <ul style="list-style-type: none"> • WHS/OHS policy and work procedures and instructions • personal protective equipment (PPE) • access to foundry workplace environment • tool assembly systems and equipment • slurry mixing ingredients • access to relevant component design plans and specifications, drawings • robotic and automated machinery and equipment • manufacturers' specifications/manuals • operational furnace & foundry equipment • measuring and testing equipment <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 Australian Quality Training Framework (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 Organization's 2015 (SRTOs), <p>or;</p> <ul style="list-style-type: none"> • the relevant standards and guidelines for RTOs at the time of assessment. <p>Units of competency imported from training packages or accredited courses must reflect the requirements for resources/trainers specified in that training package or accredited course.</p>

<p>8. Pathways and articulation</p>	<p>Completion of imported units of competency provides credit into a range of vocational qualifications from nationally endorsed training packages. There are no formal articulations arrangements negotiated and established for the Course in Precision Metal Castings with higher education courses.</p> <p>Providers intending to arrange articulation with other VET or higher education course should refer to the:</p> <p><u>AQF Second Edition 2013 Pathways Policy</u></p>
<p>9. Ongoing monitoring and evaluation</p>	<p><i>Standard 13 AQTF Standards for Accredited Courses</i></p> <p>The Curriculum Maintenance Manager - Engineering Industries is responsible for the ongoing monitoring and maintenance of the course during the accreditation period.</p> <p>The Curriculum Maintenance Manager - Engineering Industries will undertake a formal review of the course at the mid - point of the accreditation period. The review will involve consultation with:</p> <ul style="list-style-type: none"> • course participants and graduates • foundry workers, engineers, component designers and tool assembly makers • teaching/assessing staff <p>Any significant changes to the course resulting from the review will be reported to the VRQA through a formal amendment process.</p> <p>The review of the course may also indicate that the course should be expired if a suitable qualification becomes available through the continuous improvement of a relevant Training Package.</p>

Section C: Units of competency

Current units from other Victorian accredited courses (Refer Section A Item 4 for course details)

VU22679	Use mixed or blended reality technologies
VU22340	Use 3D printing to create products

Imported units of competency from the relevant Endorsed Training Packages are available from the national register [here](#).

MEM24012C	Apply metallurgy principles
BSBWRT301	Write simple reports

Newly developed units of competency:

VU22860	Work safely in the foundry environment
VU22861	Perform tool assembly and disassembly
VU22862	Produce shells and perform de-waxing processes
VU22863	Perform casting production and melting using metals
VU22864	Perform heat treatment processes

VU22860 Work safely in a foundry environment

Unit Descriptor

This unit describes the skills and knowledge to work safely in a foundry. Specifically, the unit covers the identification of safe workplace requirements, identifying hazards and applying Personal Protective Equipment (PPE) when working in a foundry environment.

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

Pre-requisite

Nil

Application of the Unit

This unit is applicable to individuals working in a foundry environment where they are exposed to a range of hazards such as: extreme heat, chemicals, gases and foundry fume and manufacturing equipment.

ELEMENT

PERFORMANCE CRITERIA

- | | |
|---|--|
| 1. Prepare to work in the foundry environment | <p>1.1 Confirm Occupational Health and Safety (OHS)/Workplace Health and Safety (WHS) and environmental protection requirements are in place prior to the commencement of work</p> <p>1.2 Identify personal protective equipment (PPE) and follow workplace safety requirements throughout the work cycle</p> <p>1.3 Identify and apply workplace procedures for the requirements of castings</p> |
| 2. Apply foundry safe work requirements | <p>2.1 Identify relevant workplace hazards and hazardous materials</p> <p>2.2 Inspect foundry environment, worksite layout, serviceability of equipment and confirm operational safety of self and others in work area, including for exposure to magnetic radiation</p> <p>2.3 Check foundry environment for non approved personnel in the work area, in accordance with workplace safety procedures</p> <p>2.4 Check for the existence of gases, vapours and fumes prior to commencing work in accordance with workplace safety procedures</p> <p>2.5 Identify and confirm sequencing and casting process for component manufacture to ensure process is performed within a safe work environment</p> <p>2.6 Apply communication procedures and buddy system requirements during the casting process in accordance with workplace safety procedures</p> |

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- 2.7 Check materials, tools and equipment are safely placed in their proper location in accordance with workplace safety procedures
 - 2.8 Monitor the safe operating performance and temperatures of the furnace in accordance with workplace safety procedures and manufacturer's specifications
 - 2.9 Use relevant manual handling methods for moving components, equipment and materials within foundry work area in accordance with workplace safety procedures
3. Complete foundry clean up tasks
- 3.1 Clean work area and dispose of, reuse or recycle materials according to legislation, regulations, codes of practice and job specifications
 - 3.2 Clean, check and store foundry tools and equipment according to workplace procedures
 - 3.3 Record and report on health and safety issues according to workplace safety procedures

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

Required skills:

- communicating effectively with others when working in a foundry environment
- identifying and assessing hazards and risks
- applying safe working procedures and relevant PPE for work tasks
- performing inspections of foundry working environment
- working with a fully operational furnace and molten metal
- monitoring and identifying safe and unsafe operating performances and temperatures of furnaces
- using and identifying serviceability of foundry tools and equipment
- monitoring and identifying existence of harmful vapours and fumes
- cleaning and storing foundry tools and equipment
- recording and reporting safety risks and issues

Required knowledge:

- relevant legislative and OHS/WHs requirements, codes and practices
- workplace safety procedures, including fire management and evacuation procedures
- use of PPE, including heat resistant clothing
- safe operating performance and temperatures of furnaces
 - non approved personnel in foundry environment, including for exposure to magnetic radiation eg. people with pacemakers

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

- relevant legislation, relevant Acts and National Occupational Health and Safety (NOHS) guidelines
- personal protective equipment
- material safety management systems
- safety data sheets (SDS)
- hazardous substances and dangerous goods codes & control measures
- hand & power tools
- worksite safe operating procedures & risk management
- working in foundries
- working in extreme heat conditions
- first aid
- treatment of burns

Environmental protection requirements may include:

- clean-up protection to existing structures and materials
- ozone protection
- waste management
- noise & dust pollution
- worksite operating hours
- use & storage of hazardous materials
- protection of natural environment
- relevant legislation

Personal protective equipment (PPE) includes but is not limited to:

- protective face mask and helmet
- heat resistant apron
- heat resistant clothing
- ear muffs/plugs
- high visibility retro reflective vests
- safety glasses/goggles
- steel capped boots
- dust masks/respirator

Hazards includes but is not limited to:

- working in extreme heat conditions & temperatures
- heat load/exposure
- radiant heat
- magnetic radiation
- workplace layout
- manufacturing equipment

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- equipment and materials
- hazardous materials
- air pollutant
- manual handling or lifting of tools or equipment
- moisture
- noise
- stationary & moving plant
- working in confined spaces
- protrusions, sharp materials & products

Hazardous materials includes but is not limited to:

- dangerous gases
- foundry fume & vapours
- asbestos containing materials
- hazardous chemicals
- molten metal/glass

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 assess competency in this unit

A person who demonstrates competency in this unit must be able to provide evidence of the ability to:

- apply and work in accordance with Occupational Health and Safety (*OHS*) / Workplace Health and Safety (*WHS*) and environmental protection requirements
- communicate effectively and work safely in a team environment
- apply personal protective equipment

Context of and specific resources for assessment

Skills must be demonstrated in the foundry workplace that reflects real workplace conditions.

Assessment must ensure access to:

- workplace safety procedures
- foundry environment
- operational furnace heating metal to a molten state
- personal protective equipment (PPE)
- relevant foundry tools and equipment

Assessment must be conducted in a safe environment where evidence gathered demonstrates consistent

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performance of typical activities experienced in a real foundry workplace setting.

Method of assessment

A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:

- direct observation should be mandated of candidate working in a real workplace foundry setting;
- oral and/or written questioning on required knowledge;
- review of portfolio of documentary evidence of the candidate;
- review of third-party workplace reports of on-the-job work performance by the candidate.

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VU22861 Perform tool assembly and disassembly

Unit Descriptor

This unit describes the skills and knowledge to assemble and disassemble tools or dies in order to inject or pump hot wax to create casting patterns.

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

Pre-requisite

VU22860 Work safely in a foundry environment

Application of the Unit

This unit is applicable to individuals working in a foundry environment who work with a range of hand and automated tools to assemble dies that house hot wax to create patterns for a variety of component castings.

ELEMENT

PERFORMANCE CRITERIA

1. Prepare for pattern making

- 1.1 Identify tools and die to make a pattern
- 1.2 Set up **tools** in accordance with pattern design specifications and in accordance workplace safety procedures
- 1.3 Identify assembly and disassembly procedures for die to be used
- 1.4 Inspect all **components** of the tooling process to ensure correct assembly
- 1.5 Inspect die cavity for obstructions, damage, distortion, scratches or fingerprints
- 1.6 Apply **personal protective equipment (PPE)** and follow workplace safety procedures in accordance with workplace requirements

2. Apply pattern making procedures

- 2.1 Identify and clean die to be used
- 2.2 Assemble die to ensure correct alignment of wax injection holes and injection nozzle
- 2.3 Apply cavities with lubricant prior to wax injection in accordance with die requirements and with workplace procedures
- 2.4 Position and secure die on work area and/or press for wax injection process
- 2.5 Determine and adjust wax injection controls to regulate pressure, quantity, temperature and timing for the required casting process
- 2.6 Allow wax models or components to solidify in accordance with workplace quality procedures
- 2.7 Pry apart the die in proper sequence removing the draw pins to expose pattern
- 2.8 Inspect pattern for **defects** and confirm conformance of wax pattern with design specifications and in accordance with quality workplace procedures

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3. Assemble trees
 - 3.1 Use wax support bars to strengthen patterns in shell making process where required
 - 3.2 Use tools to join wax models or components together to create the tree
 - 3.3 Select, attach and seal ceramic pouring cup to sprue to receive the molten metal
 - 3.4 Perform final sealing process to create uniform and smooth surfaces prior to progressing to next stage
 - 3.5 Attach gates uniformly and securely to wax sprue or post according to workplace quality procedures
 - 3.6 Confirm alignment, positioning or spacing of gates to corresponding patterns prior to the dipping process and rectify prior to completion of tree assembly
 - 3.7 Inspect and examine total tree for defects and rectify prior to completion of tree assembly in accordance with workplace quality procedures

4. Apply workplace quality procedures
 - 4.1 Confirm compliance with workplace quality procedures during the pattern making process
 - 4.2 Record and report non conformances to design, set up requirements and pattern making processes in accordance with workplace quality procedures and component specifications

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• REQUIRED SKILLS AND KNOWLEDGE

- This section describes the skills and knowledge required for this unit.

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• *Required skills:*

- communicating effectively with others when working in a foundry environment
- applying safe working procedures and relevant PPE for work tasks
- using foundry tools and equipment to assemble and disassemble tools
- identifying tool damage and pattern defects
- applying techniques to prevent tool damage
- producing dimensionally accurate wax models
- working with wax injecting equipment and calibrations

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• *Required knowledge:*

- workplace safety procedures
- non approved personnel in foundry environment
- reasons for maintaining clean worksite, tools and equipment
- tools to be used in assembly and disassembly process
- component examination processes

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- recording and reporting processes

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

Tools include but are not limited to:

- lever bars
- hand held tools
- manual equipment
- semi automatic equipment
- automatic equipment
- hot wax knife (electric)
- artist brush
- spatula
- gas torch

Components include but are not limited to:

- die
- wax
- wax injection tools & equipment
- tree

Personal protective equipment (PPE) includes but not limited to:

- protective face mask and helmet
- heat resistant apron
- heat resistant clothing
- ear muffs/plugs
- high visibility retro reflective vests
- safety glasses/goggles
- steel capped boots
- dust masks/respirator

Defects include but are not limited to:

- distortion of runner
- pattern flash
- non fill of wax pattern
- excess wax
- poor finished surface

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 assess competency in this unit

A person who demonstrates competency in this unit must be able to provide evidence of the ability to:

- apply workplace safety procedures and apply personal protection equipment (PPE) requirements
- assemble and disassemble tools
- conduct inspections and examinations of tools
- identify defects in wax models and component
- assess and perform rectification procedures of wax models or components where required

Context of and specific resources for assessment

Skills must be demonstrated in the foundry workplace that reflects real workplace conditions.

Assessment must ensure access to:

- operational foundry environment
- personal protective equipment (PPE)
- relevant manual or automated foundry tools and equipment
- workplace safety procedures
- relevant lever bars, hand and power tools

Assessment must be conducted in a safe environment where evidence gathered demonstrates consistent performance of typical activities experienced in a real foundry workplace setting.

Method of assessment

A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:

- direct observation should be mandated of candidate in a real foundry workplace setting;
- oral and/or written questioning on required knowledge;
- review of portfolio of documentary evidence of the candidate;
- review of third-party workplace reports of on-the-job work performance by the candidate.

VU22862 Produce shells and perform de-waxing processes

Unit Descriptor This unit describes the skills and knowledge to use foundry equipment and tools to create casting shells. Tools are used to construct moulds to form models of the casting component using hot wax. The unit also covers the creation of hardened shells through repeated dipping into a slurry mixtures and the removal of wax (de-waxing). Shells are broken once used to house molten metal during the casting process.

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

Pre-requisite VU22860 Work safely in a foundry environment

Application of the Unit This unit is applicable to individuals working in a foundry environment where they are involved in the casting process using waxes, foundry machinery and tools to create shells to contain hot wax and metal/alloys.

ELEMENT

PERFORMANCE CRITERIA

- | | |
|-------------------------------|--|
| 1. Prepare slurry application | <p>1.1 Identify and accurately measure ingredients to mix and make a slurry</p> <p>1.2 Develop and mix ceramic slurry material to achieve correct viscosity for shell creation</p> <p>1.3 Apply relevant personal protective equipment (PPE) and follow workplace safety requirements</p> |
| 2. Produce a shell | <p>2.1 Confirm tree(s) for shell development and design specifications and requirements</p> <p>2.2 Dip, clean and drain solution from tree(s) in preparation for shell development</p> <p>2.3 Confirm casting material to be used to achieve the finished product</p> <p>2.4 Confirm correct tolerances of investment castings to be achieved allowing for shrinkage</p> <p>2.5 Wet tree and dip in prepared slurry mixture in accordance with workplace procedures</p> <p>2.6 Cover wet assembly with true ceramic, silicate or sand and repeat process in accordance with design specifications and workplace procedures</p> <p>2.7 Perform drying of pattern assembly between coats, in accordance with design specifications, cooling and drying times</p> |

- | | |
|--|---|
| 3. Perform wax re-claiming, shell breaking and pattern removal | 3.1 Place ceramic shell in an auto-clave for wax removal from shell in accordance with workplace procedures |
| | 3.2 Dry, harden and break out spent shell mould after use in accordance with workplace procedures |
| | 3.2 Cut and/or grind pattern assemblies from tree in accordance with workplace procedures |
| | 3.3 Grind individual patterns containing cutting protrusions and surface blemishes to ensure finishes are in accordance with design specifications and workplace quality procedures |

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

Required skills:

- communicating effectively with others when working in a foundry environment
- applying safe working procedures and relevant PPE for work tasks
- identifying and assessing hazards and risks
- working with hot wax
- numeracy skills to:
 - use measuring equipment to add ingredients
 - test temperature, PH levels and viscosity
 - interpret viscosity range specifications and tolerance levels
- mixing and developing slurries
- identifying component defects
- shell building and wax removal processes
- shell breaking and pattern removal
- using hand and power tools and equipment

Required knowledge:

- relevant legislative and OHS requirements, codes and practices
- workplace safety procedures
- ingredient mixing ratios and adhesion properties
- viscosity range specifications and tolerance levels
- shell building and wax removal procedures
- properties of sand and silica
- component drying times between coats

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

Personal protective equipment (PPE) includes but is not limited to:

- protective face mask and helmet
- heat resistant apron
- heat resistant clothing
- ear muffs/plugs
- high visibility retro reflective vests
- safety glasses/goggles
- steel capped boots
- dust masks/respirator

Break out spent shell mould includes but is not limited to:

- manual or automated use of high pressure water
- manual or automated use of shock and vibration impact

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 assess competency in this unit

A person who demonstrates competency in this unit must be able to provide evidence of the ability to:

- apply workplace safety procedures and apply personal protection equipment (PPE) requirements
- measure and mix slurry ingredients
- develop and produce shell moulds
- work safely with hot waxes
- finish patterns to workplace quality standards.

Context of and specific resources for assessment

Skills must be demonstrated in the foundry workplace that reflects real workplace conditions.

Assessment must ensure access to:

- foundry environment
- personal protective equipment (PPE)
- relevant hand and power tools
- workplace safety procedures
- automated and robotic equipment

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- automated shell breaking machinery and equipment

Assessment must be conducted in a safe environment where evidence gathered demonstrates consistent performance of typical activities experienced in a real foundry workplace setting.

Method of assessment

A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:

- direct observation should be mandated of candidate working in a real foundry workplace setting;
- oral and/or written questioning on required knowledge;
- review of portfolio of documentary evidence of the candidate;
- review of third-party workplace reports of on-the-job work performance by the candidate.

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VU22863 Perform casting production and melting using metals

Unit Descriptor

This unit describes the skills and knowledge to safely heat metals and alloys until molten in a foundry environment. The unit also covers analysing the chemistry of the molten metal to determine additional ingredients to be mixed into molten metal to achieve component specifications.

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

Pre-requisite

VU22860 Work safely in a foundry environment

Application of the Unit

This unit is applicable to individuals working in a foundry environment who test and analyse the molten metal for required chemistry before pouring into casting mould.

ELEMENT

PERFORMANCE CRITERIA

- | | |
|--|--|
| 1. Heat and test metal to specifications | <ul style="list-style-type: none"> 1.1 Apply personal protective equipment (PPE) follow safety procedures in accordance with organisational workplace requirements 1.2 Follow Occupational Health and Safety (OHS)/Workplace Health and Safety (WHS) and environmental protection requirements. 1.3 Confirm that foundry heating equipment is operational 1.4 Confirm metal suitability for heating and casting from metallurgist specifications 1.5 Set temperature to heat metal to molten state in accordance with workplace safety procedures 1.6 Load metal ingots and heat to melting temperature 1.7 Test and analyse molten metal chemistry using spectrometer and add ingredients to achieve required state for casting in accordance with specifications |
| 2. Pour molten metal | <ul style="list-style-type: none"> 2.1 Check molten metal temperature complies with specifications set by metallurgist 2.2 Manage removal of slag during melting and pouring process 2.3 Remove and position heated shells from oven ready for molten metal pour 2.4 Apply relevant filters used in pour in accordance casting requirements 2.5 Fill mould with molten metal using crucibles in accordance workplace safety procedures and casting requirements |
| 3. Perform quality inspections | <ul style="list-style-type: none"> 3.1 Allow mould to cool down and metal to solidify in accordance with workplace procedures |

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- 3.2 Check castings for conformance and finish
- 3.3 Break out shells in accordance with workplace procedures
- 3.4 Carry out **inspections and tests** of finished products in accordance with workplace quality procedures and casting design requirements
- 3.5 Perform inspections for casting **defects using** visual or **other means**
- 3.6 Record and report non conformances to design requirements and specifications in accordance with workplace quality procedures

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

Required skills:

- communicating effectively with others when working in a foundry environment
- applying safe working procedures and relevant PPE for work tasks
- reading and interpreting metallurgist specifications
- using foundry tools and test equipment
- identifying casting defects
- handling techniques in using crucibles and pouring molten metal
- producing molten metal to specifications

Required knowledge:

- workplace safety procedures
- properties of metals and alloys
- safe method for loading metal ingots
- recording and reporting non conformances

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

Personal protective equipment (PPE) include but is not limited to:

- protective face mask and helmet
- heat resistant apron
- heat resistant clothing
- ear muffs/plugs
- high visibility retro reflective vests
- safety glasses/goggles
- steel capped boots
- dust masks/respirator

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

- relevant legislation, relevant Acts and National Occupational Health and Safety (NOHS) guidelines
- personal protective equipment
- material safety management systems
- safety data sheets (SDS)
- hazardous substances and dangerous goods codes & control measures
- hand & power tools
- worksite safe operating procedures & risk management
- working in foundries
- working in extreme heat conditions

Inspections and tests include but are not limited:

- spectrographic
- dimensional
- pyrometric
- materials handling
- reduced pressure test / gas content

Defects include but are not limited:

- pattern broken wax
- handling casting
- non fill
- excess metal
- cut off damage
- shrinkage
- gas
- hot tear

Other means includes but are not limited:

- testing and measuring equipment
- spectrometer
- gauges
- optical comparator
- dedicated gauge
- optical imaging
- laser measuring
- white light inspections

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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 assess competency in this unit

A person who demonstrates competency in this unit must be able to provide evidence of the ability to:

- apply workplace safety procedures and apply personal protection equipment (PPE) requirements
- safely operate and monitor furnace temperatures
- apply risk mitigation strategies to manage furnace operation and temperatures
- use test equipment and determine correct chemistry of molten metal
- handle crucibles and manage and pour molten metals in accordance with workplace quality standards

Context of and specific resources for assessment

Skills must be demonstrated in an operational foundry workplace.

Assessment must ensure access to:

- operational foundry environment
- workplace safety procedures
- personal protective equipment (PPE)
- foundry equipment
- molten metal specifications set by metallurgist
- relevant materials, workplace tools and equipment

Assessment must be conducted in a safe environment where evidence gathered demonstrates consistent performance of typical activities experienced working a real foundry workplace.

Method of assessment

A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:

- direct observation should be mandated of candidate handling crucibles and molten metal, removing slag and pouring it into moulds;
- testing chemistry of molten metal and adding ingredients to achieve the correct molten state for casting
- oral and/or written questioning on required knowledge;

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- review of portfolio of documentary evidence of the candidate;
- review of third-party workplace reports of on-the-job work performance by the candidate.

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VU22864 Perform heat treatment processes

Unit Descriptor

This unit describes the skills and knowledge to work with and apply metallurgical knowledge to a range of metals and alloys and perform heat treatment and associated operations. These heat treatments are designed to ensure the metals and alloys meet required tensile rating and application specifications.

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

Pre-requisite

VU22860 Work safely in a foundry environment

Application of the Unit

This unit is applicable to individuals working in a foundry environment where they are required to apply specific heat treatment to the various metals and alloys during and/or after the casting processes are completed.

ELEMENT

PERFORMANCE CRITERIA

1. Prepare for heat treatment

- 1.1 Follow instructions of the job, specification or relevant Australian Standards for heat treatment.
- 1.2 Prepare for heating processes in accordance with **workplace procedures**
- 1.3 Identify specific equipment to be used in heating process
- 1.4 Confirm component cleanliness prior to application of heat treatment
- 1.5 Verify load size and determine temperature and soak times to be set
- 1.6 Verify atmosphere or vacuum settings if applicable
- 1.7 Prepare equipment and materials for retempering or reheating in accordance with specific part, specification or standard requirements
- 1.8 Identify number and type of test samples required prior to application

2. Apply heat treatment

- 2.1 Apply workplace **personal protective equipment (PPE)** and clothing in accordance with workplace safety requirements
- 2.2 Inspect foundry environment and worksite layout, equipment requirements and potential hazards
- 2.3 Adjust heating and cooling rates in accordance with specific part requirements, workplace quality procedures and relevant Australian Standards
- 2.4 Load work into and out of furnace
- 2.5 Insert and position specific part(s) and equipment for heat treatment and adjust furnace controls in accordance with workplace quality processes

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- 2.6 Monitor and maintain safe operating performance of furnace
 - 2.7 Identify the existence of gases, vapours and fumes to maintain safe working environment
 - 2.8 Verify and apply quenching medium according to workplace quality procedures and component specification
3. Perform testing and inspections
- 3.1 Perform visual *inspections* of parts(s)
 - 3.2 Prepare part(s) for hardness testing or other verification of temper condition
 - 3.3 Inspect and record testing outcomes in accordance with specification requirements
 - 3.4 Verify accuracy of heat treatment on product in accordance with part specifications
 - 3.5 Prepare and conduct metallographic tests on samples
 - 3.6 Analyse data in accordance with workplace procedures and component specifications
 - 3.7 Record and report on data findings in accordance with workplace procedures and component specifications

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

Required skills:

- communicating effectively with others when working in a foundry environment
- applying safe working procedures and relevant PPE for work tasks
- identifying and assessing hazards and risks
- reading and interpreting drawing and specifications
- using foundry tools and equipment
- verifying component cleanliness, load size, temperature settings, soak times and cooling rates
- loading, spacing and unloading baskets into furnaces
- monitoring of furnace safe operation and identifying potentially dangerous conditions
- conducting sample testing and analysing results
- verifying successful heat treatments on metals and alloys
- interpreting and analysing data

Required knowledge:

- workplace safety procedures
- relevant Australian Standards relating to heat treatment of metals and alloys
- furnace operation and setting temperatures

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- heat treatment processes
- properties of metals and alloys
- process for loading, spacing and unloading baskets into furnaces

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

Workplace procedures may include:

- setting up new job in plant
- monitoring nonapproved personnel
- loading, controlling, indicating thermocouples
- approved racking procedures
- soaking commencement times
- preparing shop travellers/job cards
- cleaning procedures
- heat treatment instructions
- preparing personnel approvals

Personal protective equipment (PPE) includes but is not limited:

- protective face mask and helmet
- heat resistant apron
- heat resistant clothing
- ear muffs/plugs
- high visibility retro reflective vests
- safety glasses/goggles
- steel capped boots
- dust masks/respirator

Inspections include but are not limited to:

- cleanliness
- scale
- discolouration
- blistering
- protective coating effectiveness
- evidence of improper heating

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.

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

A person who demonstrates competency in this unit must be able to provide evidence of the ability to:

- apply workplace safety procedures and apply personal protection equipment (PPE) requirements
- set and monitor safe furnace operating temperatures
- safely load and unload components into furnace
- perform component hardness testing according to design specifications
- perform sample testing and analyse test results in accordance with workplace procedures.

Context of and specific resources for assessment

Skills must be demonstrated in the foundry workplace that reflects real workplace conditions.

Assessment must ensure access to:

- foundry environment, relevant metals and materials
- operational furnace
- metal components for heat treatment
- personal protective equipment (PPE)
- relevant foundry tools and testing equipment
- workplace safety procedures

Assessment must be conducted in a safe environment where evidence gathered demonstrates consistent performance of typical activities experienced in a real foundry workplace setting.

Method of assessment

A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:

- direct observation should be mandated of candidate working in a real foundry workplace setting;
- oral and/or written questioning on required knowledge;
- review of portfolio of documentary evidence of the candidate;
- review of third-party workplace reports of on-the-job work performance by the candidate.

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