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22462VIC

Course in Fusion Welding to ISO 9606 for Experienced Welders

22461VIC

Course in Fusion Welding to ISO 9606 for Transition Workers

Version 4
December 2022

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

Accredited for the period: 1 January 2018 to 30 June 2024

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Version history:										
Version 4	6/12/2023	<p>Accreditation period extended by VRQA from 31 December 2023 to 30 Jun 2024</p> <p>Copyright owner details updated</p>								
Version 3	12/8/2020	<p>Core unit VU22307 in course 2262VIC and elective unit VU22302 in course 22461VIC have been amended to include <i>virtual reality (VR) simulated welding technology</i>. As a consequence, new unit codes have been allocated and unit titles have been amended. Details are:</p> <p><u>Superseded units:</u></p> <table border="1"> <tr> <td>VU22307</td> <td>Simulate fusion welding processes using augmented reality (AR) equipment</td> </tr> <tr> <td>VU22302</td> <td>Use augmented reality (AR) technology to practice fusion welding processes to ISO 9606</td> </tr> </table> <p><u>New units:</u></p> <table border="1"> <tr> <td>VU23026</td> <td>Simulate fusion welding processes using augmented reality (AR) or virtual reality (VR) equipment</td> </tr> <tr> <td>VU23027</td> <td>Use augmented reality or virtuality reality technology to practice fusion welding processes to ISO 9606</td> </tr> </table> <p><i>There are to be no new enrolments into the superseded units after the 31st January 2021.</i></p>	VU22307	Simulate fusion welding processes using augmented reality (AR) equipment	VU22302	Use augmented reality (AR) technology to practice fusion welding processes to ISO 9606	VU23026	Simulate fusion welding processes using augmented reality (AR) or virtual reality (VR) equipment	VU23027	Use augmented reality or virtuality reality technology to practice fusion welding processes to ISO 9606
VU22307	Simulate fusion welding processes using augmented reality (AR) equipment									
VU22302	Use augmented reality (AR) technology to practice fusion welding processes to ISO 9606									
VU23026	Simulate fusion welding processes using augmented reality (AR) or virtual reality (VR) equipment									
VU23027	Use augmented reality or virtuality reality technology to practice fusion welding processes to ISO 9606									
Version 1	01/01/2018	Initial accreditation								
Version 2	07/04/2020	<p>Addition of two new elective units:</p> <table border="1"> <tr> <td>VU22925</td> <td>Work safety with robotic welding equipment</td> </tr> <tr> <td>VU22926</td> <td>Program robotic welding equipment</td> </tr> </table>	VU22925	Work safety with robotic welding equipment	VU22926	Program robotic welding equipment				
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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) 2017</p>
2. Address	<p>Executive Director Higher Education and Workforce Skills and Employment Department of Jobs, Skills, Industry and Regions (DJSIR) GPO Box 4509 Melbourne Vic 3001</p> <p><u>Organisational Contact:</u> 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><u>Day-to-Day Contact:</u> Curriculum Maintenance Manager-Engineering Industries Box Hill Institute of TAFE Private Bag 2014 Box Hill, Victoria 3128 Telephone: +61 3 9286 9934 Email: cmmei@boxhill.edu.au</p>
3. Type of submission	<p>Accreditation</p>
4. Copyright acknowledgement	<p>The following units of competency:</p> <ul style="list-style-type: none"> ○ MEM05012C Perform routine manual metal arc welding ○ MEM05050B Perform routine gas metal arc welding ○ MEM05007C Perform manual heating and thermal cutting <p>are from the MEM05 Metal and Engineering Training Package.</p> <p>© Commonwealth of Australia</p> <p>These units are available from the National Register of VET at: http://training.gov.au.</p>
5. Licensing and franchise	<p>Copyright of this material is reserved to the Crown in the right of the State of Victoria. © State of Victoria (Department of Jobs, Skills, Industry and Regions) 2023.</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 code – 322311 Metal Fabricator ASCED code – 0307 Mechanical and Industrial Engineering and Technology National course codes – 222461VIC / 222462VIC</p>
<p>8. Period of accreditation</p>	<p>1 January 2018 to 30 June 2024</p>



Section B: Course information

1. Nomenclature		Standard 1 AQTF Standards for Accredited Courses
1.1 Name of the qualifications	Course in Fusion Welding to ISO 9606 for Experienced Welders Course in Fusion Welding to ISO 9606 for Transition Workers	
1.2 Nominal duration of the courses	Course in Fusion Welding to ISO 9606 for Experienced Welders = 80 – 130 Hours Course in Fusion Welding to ISO 9606 for Transition Workers = 190 – 260 Hours	
2. Vocational or educational outcomes		Standard 1 AQTF Standards for Accredited Courses
2.1 Purpose of the courses	<p><i>Course in Fusion Welding to ISO 9606 for Experienced Welders</i></p> <p>The purpose of this course is to provide the training required to upskill experienced welders to meet the requirements of the International Standard: ISO 9606.</p> <p><i>Course in Fusion Welding to ISO 9606 for Transition Workers</i></p> <p>The purpose of this course is to provide the training required for transition workers (persons from a diverse range of working backgrounds), to firstly gain fusion (arc) welding skills and then to upskill to meet the requirements of the international standard: ISO 9606.</p>	
3. Development of the course		Standards 1 and 2 AQTF Standards for Accredited Courses
3.1 Industry / enterprise/ community needs	<p>The Welding Technology Institute of Australia (WTIA) has highlighted an urgent need to build up the number of welders in this country who are certified to meet the international welding standard ISO 9606. Increasingly, this standard is being specified for major manufacturing and engineering projects such as rail, light rail and tram production as well as for shipbuilding, aircraft manufacturing and defence force contracts. ISO 9606 certified welders are also required for other major works projects such as rail tunnelling, bridge and building construction.</p> <p>The Victorian Government has committed to a significant number of rail expansion projects which include a new rail tunnel, rail line extensions, rural rail upgrades and the removal of a significant number of level crossings. Each of these projects requires the skills of welders and increasingly, the welding specifications for these projects is ISO 9606.</p> <p>In addition, Victoria has a significant ship building and public and defence transport manufacturing industry which is required to tender at the national and international level for ongoing project work. It is imperative that Victorian manufacturers are able to demonstrate they have the workforce capability to meet the requirements of the projects for which they are competing for. Welders with ISO 9606 certification contribute to this capability.</p>	

	<p>With the closure of the three vehicle manufacturing plants in Victoria by the end of 2017, many redundant vehicle production workers will be seeking other employment. It is a high priority for the Victorian Government to facilitate retraining opportunities, so many of these workers can be re-engaged in employment in other key manufacturing and engineering areas that will benefit the State's economy. This course contributes to this priority by also providing training for transition workers (workers from other industry areas), to firstly become proficiency welders and then upskill to meet the requirements of ISO 9606.</p> <p>The need for these courses was initiated by the WTIA with the support of the Office of the Victorian Skills Commissioner (OVSC) and their development was managed by the Curriculum Maintenance Manager - Engineering Industries. The content of the courses is based on a skills and knowledge profile (see Appendix 1) validated by the Project Steering Committee (PSC) which also guided the content development. The PSC consisted of the following members:</p> <ul style="list-style-type: none"> • Geoff Crittenden – CEO, WTIA • Paul James - Training manager, WTIA • Victor Blain – Lead welding engineer, Bombardier Transportation Australia • Robert Vernon – Welding consultant & WTIA examiner • Craig Brittle – Head, Industry and Trades, Box Hill Institute • Phill Stubbington - National welding engineer, Lincoln Electric Company (Australia) Pty Ltd • Malcolm Rigby – Technical director, Open Welding • Robert Wiseman – Welding engineer, Specialised Welding Products. <p>In attendance:</p> <ul style="list-style-type: none"> • George Adda - Supervising executive officer, CMM- Engineering Industries • Dennis Crowley – Executive officer, CMM- Engineering Industries • Trevor Lange – Project officer, CMM-Engineering Industries. <p>Initial enrolment numbers is expected to be 80 - 100 students annually including both experienced welders and transition workers.</p> <p>The units in these courses do not duplicate by title or outcomes any endorsed training package or accredited course units.</p>
<p>3.2 Review for re-accreditation</p>	<p>Not applicable</p>
<p>4. Course outcomes</p>	<p>Standards 1, 2, 3 and 4 AQTF Standards for Accredited Courses</p>
<p>4.1 Qualification level</p>	<p><i>Standards 1, 2 and 3 AQTF Standards for Accredited Courses</i></p>



	This course meets an identified industry need, but does not align with any specific Australian Qualifications Framework (AQF) qualification level.			
4.2 Employability skills	Standard 4 AQTF Standards for Accredited Courses Not applicable			
4.3 Recognition given to the course (if applicable)	Standard 5 AQTF Standards for Accredited Courses Successful attainment of this course will enable a graduate to apply to the WTIA for welding certification for ISO 9606 procedures.			
4.4 Licensing/ regulatory requirements (if applicable)	Standard 5 AQTF Standards for Accredited Courses Not applicable			
5. Course rules	Standards 2, 6,7 and 9 AQTF Standards for Accredited Courses			
5.1 Course Structure				
a. Experienced welders:				
To be awarded a Statement of Attainment for the <i>Course in Fusion Welding to ISO 9606 for Experienced Welders</i> , participants must successfully complete three (3) units of competency consisting of the following:				
<ul style="list-style-type: none"> - one (1) core unit plus - two (2) elective units. 				
Participants who do not complete the full <i>Course in</i> requirements will be awarded a Statement of Attainment listing the unit/s successfully attained.				
Unit of competency/ module code	Field of Education code (six- digit)	Unit of competency/module title	Pre-requisite	Nominal hours
Core unit:				
VU22301	030711	Interpret and apply ISO 9606 for fusion welding processes		10
Elective units:				
VU23027	030711	Use augmented reality or virtual reality technology to practice fusion welding processes to ISO 9606	VU22301	20
VU22303	030711	Perform fusion welding procedures to meet the requirements of ISO 9606-1 (Steels - carbon steels)	VU22301	50
VU22304	030711	Perform fusion welding procedures to meet the requirements of ISO 9606-1 (Steels - stainless steel)	VU22301	50
VU22305	030711	Perform fusion welding procedures to meet the requirements of ISO 9606-2(Aluminium/aluminium alloys)	VU22301	60

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VU22306	030711	Perform fusion welding procedures to meet the requirements of ISO 9606-3, 4 or 5 (Exotic metals)	VU22301	60
VU22925	030711	Work safely with robotic welding equipment		20
VU22926	030711	Program robotic welding equipment	VU22925	60
Total nominal hours range (Experienced welders) =				80 - 130

b. Transition workers:

To be awarded a Statement of Attainment for the *Course in Fusion Welding to ISO 9606 for Transition Workers*, participants must successfully complete seven (7) units of competency consisting of the following:

- four (4) core units **plus**
- three (3) elective units.

Participants who do not complete the full *Course in* requirements will be awarded a Statement of Attainment listing the unit/s successfully attained.

Unit of competency/ module code	Field of Education code (six- digit)	Unit of competency/module title	Pre-requisite	Nominal hours
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Core units:

VU23026	030711	Simulate fusion welding processes using augmented reality (AR) or virtual reality (VR) equipment		40
VU22308	030711	Identify welding processes, safe welding practices and use of hand/power tools		30
VU22301	030711	Interpret and apply ISO 9606 for fusion welding processes		10
VU22303	030711	Perform fusion welding procedures to meet the procedures of ISO 9606-1 (Steels - carbon steels)	VU22301	50

Elective units:

VU22304	030711	Perform fusion welding procedures to meet the procedures of ISO 9606-1 (Steels - stainless steel)	VU22301	50
VU22305	030711	Perform fusion welding procedures to meet the requirements of ISO 9606-2(Aluminium/aluminium alloys)	VU22301	60
MEM05012C	030711	Perform routine manual metal arc welding		20



MEM05050B	030711	Perform routine gas metal arc welding	20
MEM05007C	030711	Perform manual heating and thermal cutting	20
VU22309	030711	Read and interpret technical drawings and make measurements for a welding procedure	20
VU22925	030711	Work safely with robotic welding equipment	20
Total nominal hours range (Transition workers) =			190 - 260

5.2 Entry requirements

Standard 9 AQTF Standards for Accredited Courses

Experienced welder:

To enter this course as an experienced welder the applicant is required to have evidence of:

- Certificate III level welding qualification (such as MEM30305 Certificate III in Engineering – Fabrication Trade)
or
- minimum of 3 years fusion welding experience.

Transition workers:

It is envisaged transition workers will have a diverse range of working backgrounds with little or no welding experience. It is recommended each applicant is interviewed to assess their suitability for the course and a career as a welder. As a guide to the interviewer it is suggested evidence of the following should be sought:

- interest in repairing and making things (handyperson)
- use of hand tools and hand held power tools
- manual dexterity/good hand-eye coordination
- safety consciousness/awareness.

In addition to an interview, applicants' suitability for the course could also be assessed with a trial run on an AR simulator.

To assess their own interest and suitability as a welder, applicants could be advised of the WTIA Online Course – Welding Fundamentals – Basic (approximately 14 hours).

<http://net.wtia.com.au/onlinecourses/details/1019>.

It is recommended all applicants for both courses have language, literacy and numeracy skills equivalent to Level 3 of the Australian Core Skills Framework (ACSF).

Information about the ACSF can be found on the website

<https://www.education.gov.au/australian-core-skills-framework>.

Learners who have lower levels of language and literacy may require additional support to undertake the course.

6. Assessment	Standards 10 and 12 AQTF Standards for Accredited Courses
<p>6.1 Assessment strategy</p>	<p><i>Standard 10 AQTF Standards for Accredited Courses</i></p> <ul style="list-style-type: none"> • All assessments, including Recognition of Prior Learning (RPL) must be consistent with: <ul style="list-style-type: none"> • Standard 1.2/1.5 of the Australian Quality Training Framework(AQTF): <i>Essential Conditions and Standards for Initial/Continuing Registration</i> or • Standard 1, Clauses 1.1 and 1.8 of the <i>Standards for Registered Training Organisation (RTOs) 2015,</i> or • the relevant Standards for Registered Training Organisations in effect at the time of assessment.

- Assessment strategies must therefore ensure that:
 - 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 context in which the task takes place.
- Assessment strategies should be designed to:
 - cover a range of skills and knowledge required to demonstrate achievement of the course aims
 - 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
 - recognise existing skills
 - be equitable to all learners.
- Assessment methods are included in each unit of competency and may include:
 - direct observation of processes and procedures
 - oral and/or written questioning
 - testimony from a competent person e.g. welding engineer/supervisor
 - inspection of final process outcomes
 - documented work-based evidence
 - demonstration of practical skills.

A holistic approach to assessment, by combining the assessment of more than one unit of competency, is encouraged to better replicate working practice and to reduce the potential for over assessment.

Units of competency maybe assessed on-the-job, off-the-job or a combination of both. Where assessment occurs off-the-job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.

Imported MEM units in the *Course in Fusion Welding to ISO 9606 for Transition Workers* must reflect the requirements of assessors specified in the MEM05 Metals and Engineering Training Package.

<p>6.2 Assessor competencies</p>	<p><i>Standard 12 AQTF Standards for Accredited Courses</i> Assessment must be undertaken by a person with competencies compliant with:</p> <ul style="list-style-type: none"> • Standard 1.4 of the AQTF: <i>Essential Conditions and Standards for Initial/Continuing Registration</i>, or • Standard1, Clauses 1.13, 1.14, 1.15, 1.16 and 1.17 of the Standards for Registered Training Organisation 2015 (RTOs), or • the relevant Standards for Registered Training Organisations in effect at the time of assessment. <p>Imported MEM units in the <i>Course in Fusion Welding to ISO 9606 for Transition Workers</i> must reflect the requirements of assessors specified in the MEM05 Metals and Engineering Training Package.</p>
<p>7. Delivery</p>	<p>Standards 11 and 12 AQTF Standards for Accredited Courses</p>

<p>7.1 Delivery modes</p>	<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 client group.</p> <p>Units of competency may be delivered on-the-job, off-the-job or a combination of both. Where delivery is to occur off-the-job, conditions must reflect realistic workplace situations.</p> <p>The course aims to develop competent welders who are able to weld to a welding procedure in accordance to the standard prescribed in ISO 9606 for a particular metal material. Practical demonstrations and the opportunity to practice welding skills in a range of positions as laid down by the welding procedures, will provide the most suitable strategy to achieve the objectives of the course.</p> <p>Providers of these courses will be required to implement augmented reality (AR) or virtual reality (VR) welding technology to support delivery. This technology enables participants to repeatedly practice welding skills in a computer generated simulated environment. It provides a realistic welding learning experience without physical risk and zero gas emissions. The technology significantly reduces material costs and may also accommodate a larger number of trainees at any one time, where there is a limited number of welding booths available. An AR/VR unit is included in each course structure - an elective for the experienced welder and core for the transition workers, to incorporate the use of this technology for skill development.</p> <p>Other delivery methods may include:</p> <ul style="list-style-type: none"> • practical demonstrations • classroom presentation and discussion • case study analyses • projects. <p>Program delivery should also allow for self-directed learning and development together with independent judgement and accountability for outputs.</p> <p>Some areas of content may be common to more than one unit of competency, and therefore some integration of delivery may be appropriate.</p>
<p>7.2 Resources</p>	<p><i>Standard 12 AQTF Standards for Accredited Courses</i></p> <p>Facilities equipment and other resources required to deliver this course include:</p> <ul style="list-style-type: none"> • general engineering training facility equipped with hand and power tools required for the welding processes • welding booths and a range of fusion welding equipment • augment reality (AR) or virtual reality (VR) welding technology

	<p>hardware and software</p> <ul style="list-style-type: none"> • thermal cutting machines capable of cutting different types of materials and thicknesses • presses capable of preforming bend and nick break tests • metal materials and welding consumables • personal protective equipment (PPE) • ISO 9606 Parts 1-5 • Fusion welding procedures (WPS) to match ISO 9606 • relevant texts and references • occupational health and safety policy and work procedures/instructions • access to plans, drawings and instructions • manufacturer specifications/equipment manuals. <p>Training must be undertaken by a person or persons compliant with:</p> <ul style="list-style-type: none"> - Standard 1.4 of the <i>AQTF: Essential Conditions and Standards for Initial/Continuing Registration</i> <p>or</p> <ul style="list-style-type: none"> - Standard 1, Clauses 1.13, 1.14, 1.15, 1.16 and 1.17 of the <i>Standards for Registered Training Organisations 2015</i> (SRTOs) <p>or</p> <ul style="list-style-type: none"> - the relevant Standards for Registered Training Organisations in effect at the time of assessment. <p>Imported MEM units for the <i>Course in Fusion Welding to ISO 9606 for Transition Workers</i> must reflect the requirements of trainers specified in the MEM05 Metals and Engineering Training Package.</p>
<p>8. Pathways and articulation Standard 8 AQTF Standards for Accredited Courses</p>	
	<p>There is no formal articulation or credit transfer arrangements from these courses into other VET or higher education qualifications.</p> <p>When arranging articulation providers should refer to the:</p> <p style="text-align: center;"><u><i>AQF Second Edition 2013 Pathways Policy</i></u></p> <p>Providers must negotiate individual pathway arrangements directly.</p> <p>Graduates of the <i>Course in Fusion Welding to ISO 9606 for Transition Workers</i> who have attained any of the imported units of competency from the MEM05 Training Package will gain credit in any future studies that include these units. Likewise, participants who have already attained any of the imported units of competency will be granted a credit for the unit/s.</p>
<p>9. Ongoing monitoring and evaluation Standard 13 AQTF Standards for Accredited Courses</p>	
	<p>Ongoing evaluation and validation of this course is the responsibility of the Curriculum Maintenance Manager,</p>



	<p>Engineering Industries.</p> <p>A course advisory committee will be established for the ongoing monitoring and evaluation of the course.</p>
	<p>It will include:</p> <ul style="list-style-type: none"> • Curriculum Maintenance Manager, Engineering Industries • course providers • WTIA • industry representatives. <p>The committee will:</p> <ul style="list-style-type: none"> • review the implementation of the course • provide advice about changing program requirements • monitor and evaluate course standards, delivery and assessment • assess the continuing need for the course should appropriate units of competency be incorporated into a national endorsed training package qualification. <p>The course advisory committee will meet at least once during the accreditation period for a mid-term review. Additional meetings may be scheduled on an as needs basis.</p> <p>Recommendations for any significant changes will be reported through the Curriculum Maintenance Manager, Engineering Industries to the VRQA.</p>

Appendix 1 - Knowledge and skills outcome of the proposed *Course in Fusion Welding to ISO 9606*

Experience welder:

Knowledge outcomes:

- safety precautions:
 - safe workshop practices
 - control of welding fumes and gases
 - personal protection equipment (PPE)
 - fire hazards
 - electrical safety
- welding equipment
- welding processes
- ISO 9606 Parts 1-5
 - welding procedure specifications (WPS) for fusion welding
 - non-compliance and remedial action
 - macrographic examination of welds
 - mechanical testing
 - visual inspection

Skills outcomes:

- applying WHS/OHS requirements
- carrying out fusion welding procedures (WPS) to meet the requirements of ISO 9606
- undertaking inspection, testing and if necessary remedial action to ensure welds meet the requirements of ISO 9606

Transition worker:

Knowledge outcomes:

- Safety precautions:
 - safe workshop practices
 - control of welding fumes and gases
 - personal protection equipment (PPE)
 - fire hazards
 - welding in a confined space
- hand and hand held power tools
- fusion welding equipment
- fusion welding processes
- types of metals
- joint preparation
- welding procedures specifications (WPS)
- welding in inspection and testing
- welding imperfections and remedial action
- reading and interpreting a technical drawings
- measuring and setting out materials for welding task

Skills outcomes:

- applying WHS/OHS requirements

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- carrying out fusion welding procedures (WPS) to meet the requirements of ISO 9606 Part 1(Steels - carbon steels)
- undertaking inspection, testing and if necessary remedial action to ensure welds meet the requirements of ISO 9606 Part 1 (Steels – carbon steels)



Section C: Units of competency

Victorian Units of Competency

VU22301	Interpret and apply ISO 9606 for fusion welding processes
VU23027	Use augmented reality or virtual reality technology to practice fusion welding processes to ISO 9606
VU22303	Perform fusion welding procedures to meet the requirements of ISO 9606-1 (Steels - carbon steels)
VU22304	Perform fusion welding procedures to meet the requirements of ISO 9606-1 (Steels - stainless steel)
VU22305	Perform fusion welding procedures to meet the requirements of ISO 9606-2(Aluminium/aluminium alloys)
VU22306	Perform fusion welding procedures to meet the requirements of ISO 9606-3, 4 or 5 (Exotic metals)
VU23026	Simulate fusion welding processes using augmented reality (AR) or virtual reality (VR) equipment
VU22308	Identify welding processes, safe welding practices and use of hand/power tools
VU22309	Read and interpret technical drawings and make measurements for a welding procedure
VU22925	Work safely with robotic welding equipment
VU22926	Program robotic welding equipment

Imported Units of Competency: (Copy of these units are available at: <http://training.gov.au>)

MEM05012C	Perform routine manual metal arc welding
MEM05050B	Perform routine gas metal arc welding
MEM05007C	Perform manual heating and thermal cutting

VU22301 - Interpret and apply ISO 9606 for fusion welding processes

Unit Descriptor

This unit describes the skills and knowledge to enable participants to interpret and apply strategies that facilitate compliance with International Standard ISO 9606 for fusion welding processes and welding procedure specifications (WPS).

The Standard includes welding processes, procedures, safety precautions, welding equipment, parent metals, filler metal types, welding sequences/procedures, joint preparation, weld representation and weld imperfections.

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

The unit applies to welders required to interpret and apply fusion welding procedures (WPS) to meet ISO 9606 requirements

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 Interpret ISO 9606 requirements

- 1.1 The **relevant ISO 9606 part** is sourced and examined
- 1.2 **Industry terms** relevant to the job are appropriately applied
- 1.3 Welding procedure specifications (WPS) for difference fusion welding processes, weld types and positions, are identified and interpreted
- 1.4 Implications of non-compliance with relevant components of the Standard are identified
- 1.5 Relevant occupational health and safety/work, health and safety **OHS/WHS requirements** are identified and addressed

2 Apply quality control procedures to welding tasks

- 2.1 The **quality control plan** is reviewed in consultation with relevant personnel
- 2.2 To maintain compliance with the Standard, quality control checks are carried out in accordance to the quality control plan
- 2.3 Compliance records are maintained according to organisational requirements

3 Identify and act on areas of non-compliance in welding procedures

- 3.1 Areas of non-compliance with the Standard are identified and reported to **appropriate personnel**
- 3.2 Corrective action to rectify area/s of non-compliance is carried out
- 3.3 Strategies to ensure ongoing compliance with relevant parts of the

Standard are applied

3.4 Procedures to monitor and maintain compliance with the relevant part of the Standard are followed

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- communicating verbally and in writing using correct industry terminology
- sourcing International Standard ISO9606
- interpreting welding procedure specifications (WPS) and job requirements
- providing feasible solutions to non-compliance issues relating to the relevant part of the standard
- making recommendations based on analysis and evidence
- identifying welding imperfections and recommending remedial action
- maintaining accurate records for compliance with the relevant part of the standard
- working effectively with others in a production/manufacturing environment

Required knowledge:

- ISO 9606 requirements for fusion welding procedures specifications (WPS)
- relevant regulations and code/s of practice specific to fusion welding and related tasks
- industry terminology relevant to fusion welding processes and procedures
- fusion welding processes:
 - manual metal-arc welding with covered electrode
 - classification of electrodes
 - safety precautions
 - gas and self-shielded metal-arc welding
 - type and size of electrodes
 - identification of shielding gas and flow rate
 - type, size and maintenance of nozzles/contact tip
 - selection and limitation of transfer mode
 - protection of the welding arc from draughts
 - safety precautions
- safety precautions for fusion welding:
 - safe assembly, set-up and turn-off procedures
 - safe control of welding fumes and gasses
 - personal protection
 - fire hazards
 - awareness of welding environment
- joint preparation and weld representation for fusion welding
- fusion weld imperfections

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.

Relevant ISO 9606 part
includes:

- Part 1 – steels (carbon steels and stainless steel)
- Part 2 - aluminium and aluminium alloys
- Part 3 - copper and copper alloys

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- Part 4 - nickel and nickel alloys
 - Part 5 – titanium and titanium alloys, zirconium and zirconium alloys
- Industry terms** include but not are limited to:
- material backing
 - gas backing
 - flux backing
 - consumable insert
 - layer
 - root run/root pass
 - filling run
 - capping run
 - deposited thickness
 - back hand welding/fore hand welding
 - branch joint
 - fillet weld
 - butt weld
 - verification
- OHS/WHS requirements** include but are not limited to:
- manual handling technique
 - personal protective equipment
 - material safety management systems
 - hazardous substances and dangerous goods codes
 - workplace safety measures/information
 - awards provisions
- Appropriate personnel** includes but is not limited to:
- welding engineer
 - welding coordinator
 - welding inspector
 - welding supervisor
 - leading hand
 - trainer
 - mentor
 - teacher
- Quality control plan** includes but is not limited to:
- ISO 9606 procedure requirements
 - risk controls
 - distortion prevention measures
 - testing frequencies
 - responsibilities
 - remedial action/s

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 Accredited Course.

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

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the associated performance criteria using the required skills and knowledge.

In particular this shall incorporate evidence that shows a candidate is able to:

- apply quality control procedures to a welding task
- identify and interpret the ISO 9606 WPS requirements for a minimum of four (4) welding procedure specifications (WPS)
- determine areas of non-compliance in welding procedure.

Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job.

Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.

The candidate will have access to all tools, equipment, materials and documentation required such as the Standard, work plan, relevant workplace procedures, product manuals and reference material.

Methods of assessment

Assessment must include the demonstration of practical skills and may also include:

- oral questioning on required knowledge and skills
- written objective tests
- computer testing

Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.

VU23027 - Use augmented reality or virtual reality technology to practice fusion welding processes to ISO 9606

Unit Descriptor

The unit describes the skills and knowledge required to set-up and use augmented reality (AR) or virtual reality (VR) technology to practice and perform a range of welding procedures specifications (WPS) to meet the requirements of International Standard ISO 9606. The unit also includes adjusting and handling the equipment to achieve optimal weld performance, identification and analysis of simulated weld defects as well as safe welding techniques and practices.

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

The unit applies to welders required to carry out fusion welding procedures to meet ISO 9606 requirements using AR welding technology.

ELEMENT

Elements describe the essential outcomes of a unit of competency. Elements describe actions or outcomes that are demonstrable and assessable.

PERFORMANCE CRITERIA

Performance criteria describe the required performance needed to demonstrate achievement of the element – they identify the standard for the element. Where bold/italicised text is used, further information or explanation 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 and set up for AR welding equipment | 1.1 AR/VR welding equipment is investigated and the features are identified |
| | 1.2 Instructions for welding procedure are assembled and confirmed |
| | 1.3 Weld requirements of ISO 9606 are identified |
| | 1.4 AR/VR welding equipment and components are set up for the welding procedure in accordance with job specifications |
| 2. Apply AR technology to complete welding procedure | 2.1 AR/VR head set is fitted and hand held equipment positioned for commencement of the welding procedure |
| | 2.2 Weld deposits are applied in accordance with the ISO 9606 welding procedure specifications (WPS) requirements |
| 3. Examine weld analysis data for non-compliance | 3.1 Weld analysis data is accessed for non-compliance |
| | 3.2 Remedial action is determined and applied |

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills:

22462VIC Course in Fusion Welding to ISO 9606 for Experienced Welders
22461VIC Course in Fusion Welding to ISO 9606 for Transition Workers

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- applying relevant OHS/WHS requirements when using AR/VR welding technology
- reading and interpreting ISO 9606 weld procedure specifications (WPS) for fusion welding processes
- setting up AR/VR welding equipment for a welding procedure
- carrying out various welding procedures in accordance with ISO9606 using augmented reality technology
- analysing and interpreting weld data to assess weld/s quality and compliance

Required Knowledge:

- ISO 9606 WPS requirements for fusion welding processes
- application of AR/VR welding technology
- safety considerations when setting up and using AR/VR welding equipment
- industry terminology relevant to fusion welding processes and procedures
- weld representation images for fusion welding
- welding procedures specifications (WPS) for ISO 9606
- analysis of AR/VR welding data and correction parameters

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.

AR/VR welding equipment includes but is not limited to:

- commercially available augmented reality (AR) or virtual reality (VR) welding technology equipment that provides a simulation that closely resembles live arc welding without using an actual arc or consumables.

Examples are:

- Lincoln Electric Realweld Advanced Trainer
- Lincoln Electric VRTEX VR Training Simulator
- Soldamatic AR Simulator
- GuideWELD® VR welding simulator
- Arc+ NG Welding Simulator Augmented Arc: Welding Simulator
- Pro Spot Welding Simulator

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

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the associated performance criteria using the required skills and knowledge.

In particular, this shall incorporate evidence that shows a candidate is able to:

- carry out a minimum of four (4) fusion welding procedure specifications (WPS) to ISO 9606 requirements using AR welding technology

- analyse AR/VR welding data to assess compliance with the ISO 9606 procedures.

Context of and specific resources for assessment

Assessment will take place in a classroom/training environment where the candidate will have access to AR/VR welding technology equipment, operating information and programming advice and ISO 9606 welding procedure specifications (WPS).

The competencies covered by this unit would either be demonstrated by an individual working alone or as part of class group.

Method(s) of assessment

Assessment must include the demonstration of welding skills using AR/VR welding technology equipment and may also include:

- oral questioning on required knowledge and skills
- written objective tests
- computer testing.

Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.

VU22303**Perform fusion welding procedures to meet the requirements of ISO 9606 -1 (Steels - carbon steels)****Unit Descriptor**

This unit describes the skills and knowledge required to perform fusion welding procedures to meet the requirements of International Standard (ISO) 9606-1 (Steels - carbon steels).

The unit includes welding processes, welding procedure specifications (WPS), safety precautions, welding equipment, parent metals, filler metal types, welding sequences/procedures, joint preparation and weld representation images. It also covers the identification of weld imperfections, their causes, prevention and remedial actions.

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

Employability Skills

This unit contains Employability Skills

Pre-Requisite Unit

VU22301 – Interpret and apply ISO 9606 for fusion welding processes

Application of the Unit

The unit applies to all welders required to carry out fusion welding procedures (WPS) to meet ISO 9606-1 (Steels - carbon steels).

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 prepare for the work

- 1.1 Work requirements including plans and specifications are identified, interpreted and confirmed with appropriate parties or by site inspection
- 1.2 Weld procedure specifications (WPS) for the **welding process** are identified and compliance requirements of **ISO 9606-1** are clarified
- 1.3 Relevant **OHS/WHS requirements**, manufacturers' specifications, environmental requirements and enterprise procedures are identified, applied and monitored throughout the work process
- 1.4 **Resources** required to satisfy the work plan are identified, obtained and inspected for compliance with the job specifications and Standard
- 1.5 Risk assessment of potential hazards is conducted and prevention and/or control measures are selected in accordance with the work plan and site procedures
- 1.6 Work area is prepared in accordance with work requirements and site procedures

2 Weld materials

- 2.1 Materials for welding are prepared and set-up in accordance with the WPS and job specifications
- 2.2 **Distortion prevention measures** are applied in accordance with job requirements
- 2.3 Test runs are undertaken in accordance with the WPS and job

requirements

- 2.4 Materials are welded in accordance with WPS for ISO 9606-1 and job specifications
- 2.5 Welds are cleaned using appropriate tools and techniques in accordance with job specifications
- 3 Check and test welds against specifications
 - 3.1 Weld quality is confirmed by visual inspection and **testing**
 - 3.2 Defects are identified, classified and cause/s determined as required
 - 3.3 Remedial action is undertaken to ensure welding work meets the Standard and job specifications
- 4 Complete the work
 - 4.1 Work is completed and appropriate personnel notified in accordance with site/enterprise requirements
 - 4.2 Work area is cleared of waste, cleaned, restored and secured in accordance with site/enterprise procedures
 - 4.3 Plant, tools and equipment are maintained and stored in accordance with site/enterprise procedures
 - 4.4 **Work completion details** are finalised in accordance with site/enterprise procedures

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- interpreting and applying welding procedure specifications (WPS) for ISO 9606-1 for Steels - carbon steels
- applying relevant OHS/WHS requirements for fusion welding
- reading and interpreting weld representation images on plan, work instructions and specifications
- selecting, assembling and setting up tools, jigs, welding equipment and materials in accordance with work requirements
- carrying out welding procedures in accordance with ISO 9606-1 for Steels - carbon steels
- undertaking inspection, testing and if necessary remedial action of welds in accordance ISO9606-1 for Steels – carbon steels
- maintaining and storing fusion welding equipment and associated materials
- maintaining accurate records of completed welding work

Required knowledge:

- ISO 9606-1 Steels - carbon steels fusion welding procedures specifications (WPS)
- relevant regulations and code/s of practice specific to the fusion welding procedures
- industry terminology relevant to fusion welding processes and procedures
- fusion weld representation images
- fusion welding equipment:
 - construction and maintenance of welding equipment and typical parameters
 - types of welding currents
 - correct connection of the welding return cable
- fusion welding process:
 - arc welding with covered electrode:
 - classification of electrodes

- safety precautions
- gas and self-shielded metal-arc welding
 - type and size of electrodes
 - identification of shielding gas and flow rate
 - type ,size and maintenance of nozzles/contact tip
 - selection and limitation of transfer mode
 - protection of the welding arc from draughts
 - safety precautions
 - definition of metals commonly used for fusion welding:
- parent metals
 - identification of material
 - methods and control of pre-heating
 - control of interpass temperature
- filler metal types
 - identification of filler metals types
 - storage ,handling and conditions of filler metal types
 - selection of correct size
 - cleanliness of electrodes and filler wires
 - control of wire spooling
 - control and monitoring of gas flow rates
- safety precautions for fusion welding:
 - safe assembly, set-up and turn-off procedures
 - safe control of welding fumes and gasses
 - personal protection
 - fire hazards
 - awareness of welding environment
- joint preparation for fusion welding processes;
 - conformity of joint preparation to the welding procedure specification (WPS)
 - cleanliness of fusion faces
- fusion weld imperfection:
 - identification of imperfections
 - causes
 - prevention
 - remedial action

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.

Welding process may include:

- manual metal arc welding (MMAW)
- gas metal arc welding (GMAW)
- flux cored arc welding (FCAW):
 - gas shielded
 - self-shielded
- gas tungsten arc welding (GTAW)

ISO 9606-1 includes:

- International Standard (updated 2012) Part 1 specifying requirements for fusion welding processes for (Steels - carbon

steels and stainless steel). This includes carbon steels and stainless steel. Other ISO 9606 Parts are:

Part 2 - aluminium and aluminium alloys

Part 3 - copper and copper alloys

Part 4 - nickel and nickel alloys

Part 5 – titanium and titanium alloys, zirconium and zirconium alloys

OHS/WHS requirements may include but not limited to:

- manual handling technique
- personal protective equipment
- material safety management systems
- hazardous substances and dangerous goods codes
- workplace safety measures/information
- awards provisions

Resources may include but not limited to:

- work plans/drawings job specifications
- welding equipment
- welding materials
- personal protective equipment
- hand and hand held power tools
- distortion prevention devices

Distortion prevention measures may include but not limited to:

- bracing
- pre setting
- tacking
- bolting
- clamping

Testing may include but not limited to:

- penetrant dye testing
- magnetic particle testing
- macro examination
- bend test
- fillet break test

Work completion details may include but not limited to:

- plant and maintenance records
- job card
- check sheets
- device labelling updates
- reporting and documentation equipment defects
- job completion documentation

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 Accredited Course.

Critical aspects for assessment and evidence required to demonstrate competency in

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the

this unit

associated performance criteria using the required skills and knowledge.

In particular, this shall incorporate evidence that shows a candidate is able to:

- implement and apply relevant OHS/WHS practices and procedures including the use of risk control measures
- carry out a minimum of four (4) fusion welding procedures in compliance with ISO 9606-1 (Steels - carbon steels) specifications (WPS) and job requirements
- take preventive action or where necessary remedial action to address any areas of non-compliance with ISO 9606-1 (Steels - carbon steels) specifications.

Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job.

Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.

The candidate will have access to all tools, equipment, materials and documentation required and will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Methods of assessment

Assessment must include the demonstration of practical skills and may also include:

- oral questioning on required knowledge and skills
- written objective tests
- computer testing.

Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.

VU22304**Perform fusion welding procedures to meet the requirements of ISO 9606 -1 (Steels - stainless steel)****Unit Descriptor**

This unit describes the skills and knowledge required to perform fusion welding procedures to meet the requirements of International Standard (ISO) 9606-1 (Steels - stainless steel).

The unit includes welding processes, welding procedure specifications (WPS), safety precautions, welding equipment, parent metals, filler metal types, welding sequences/procedures, joint preparation and weld representation images. It also covers the identification of weld imperfections, their causes, prevention and remedial actions.

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

Employability Skills

This unit contains Employability Skills

Pre-Requisite Unit

VU22301 – Interpret and apply ISO 9606 for fusion welding processes

Application of the Unit

The unit applies to all welders required to carry out fusion welding procedures (WPS) to meet ISO 9606-1 (Steels - stainless steel).

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 prepare for the work

- 1.3 Work requirements including plans and specifications are identified, interpreted and confirmed with appropriate parties or by site inspection
- 1.4 Weld procedure specifications (WPS) for the **welding process** are identified and compliance requirements of **ISO 9606-1** are clarified
- 1.3 Relevant **OHS/WHS requirements**, manufacturers' specifications, environmental requirements and enterprise procedures are identified, applied and monitored throughout the work process
- 1.4 **Resources** required to satisfy the work plan are identified, obtained and inspected for compliance with the job specifications and Standard
- 1.5 Risk assessment of potential hazards is conducted and prevention and/or control measures are selected in accordance with the work plan and site procedures
- 1.6 Work area is prepared in accordance with work requirements and site procedures

2 Weld materials

- 2.1 Materials for welding are prepared and set-up in accordance with the WPS and job specifications

2.2 **Distortion prevention measures** are applied in accordance with job requirements

2.3 Test runs are undertaken in accordance with the WPS and job requirements

2.4 Materials are welded in accordance with WPS for ISO 9606-1 and job specifications

2.5 Welds are cleaned using appropriate tools and techniques in accordance with job specifications

3 Check and test welds against specifications

3.1 Weld quality is confirmed by visual inspection and **testing**

3.2 Defects are identified, classified and cause/s determined as required

3.3 Remedial action is undertaken to ensure welding work meets the standard and job specifications

4 Complete the work

4.1 Work is completed and appropriate personnel notified in accordance with site/enterprise requirements

4.2 Work area is cleared of waste, cleaned, restored and secured in accordance with site/enterprise procedures

4.3 Plant, tools and equipment are maintained and stored in accordance with site/enterprise procedures

4.4 **Work completion details** are finalised in accordance with site/enterprise procedures

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- interpreting and applying welding procedure specifications (WPS) for ISO 9606-1 for Steels - stainless steel
- applying relevant OHS/WHS requirements for fusion welding
- reading and interpreting weld representation images on plan, work instructions and specifications
- selecting, assembling and setting up tools, jigs, welding equipment and materials in accordance with work requirements
- carrying out welding procedures in accordance with ISO 9606-1 for Steel - stainless steel
- undertaking inspection, testing and if necessary remedial action of welds in accordance ISO9606-1 for stainless steel
- maintaining and storing fusion welding equipment and associated materials
- maintaining accurate records of completed welding work

Required knowledge:

- ISO 9606-1 for Steels - stainless steel welding procedure specifications (WPS)
- relevant regulations and code/s of practice specific to the work
- industry terminology relevant to fusion welding processes and procedures
- fusion weld representation images
- fusion welding equipment:
 - construction and maintenance of welding equipment and typical parameters

- types of welding current
- correct connection of the welding return cable
- fusion welding process:
 - arc welding with covered electrode:
 - classification of electrodes
 - safety precautions
 - gas and self-shielded metal-arc welding
 - type and size of electrodes
 - identification of shielding gas and flow rate
 - type ,size and maintenance of nozzles/contact tip
 - selection and limitation of transfer mode
 - protection of the welding arc from draughts
 - safety precautions
 - definition of metals
 - parent metals
 - identification of material
 - methods and control of pre-heating
 - control of interpass temperature
 - filler metal types
 - identification of filler metals types
 - storage ,handling and conditions of filler metal types
 - selection of correct size
 - cleanliness of electrodes and filler wires
 - control of wire spooling
 - control and monitoring of gas flow rates
- safety precautions for fusion welding:
 - safe assembly, set-up and turn-off procedures
 - safe control of welding fumes and gasses
 - personal protection
 - fire hazards
 - awareness of welding environment
- joint preparation for fusion welding processes:
 - conformity of joint preparation to the welding procedure specification (WPS)
 - cleanliness of fusion faces
- fusion weld imperfection:
 - identification of imperfections
 - causes
 - prevention
 - remedial action

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.

Welding process may include:

- manual metal arc welding (MMAW)
- gas metal arc welding (GMAW)
- flux cored arc welding (FCAW):

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- gas shielded
- self-shielded
- gas tungsten arc welding (GTAW)

ISO 9606-1 includes:

- International Standard (updated 2012) Part 1 specifying requirements for fusion welding processes for (Steels – carbon steels and stainless steel). This includes carbon steels and stainless steel. Other ISO 9606 Parts are:
 - Part 2 - aluminium and aluminium alloys
 - Part 3 - copper and copper alloys
 - Part 4 - nickel and nickel alloys
 - Part 5 – titanium and titanium alloys, zirconium and zirconium alloys

OHS/WHS requirements may include but not limited to:

- manual handling technique
- personal protective equipment
- material safety management systems
- hazardous substances and dangerous goods codes
- workplace safety measures/information
- awards provisions

Resources may include but not limited to:

- work plans/drawings job specifications
- welding equipment
- welding materials
- personal protective equipment
- hand and hand held power tools
- distortion prevention devices

Distortion prevention measures may include but not limited to:

- bracing
- pre setting
- tacking
- bolting
- clamping

Testing may include but not limited to:

- penetrant dye testing
- magnetic particle testing
- macro examination
- bend test
- fillet break test

Work completion details may include but not limited to:

- plant and maintenance records
- job card
- check sheets
- device labelling updates
- reporting and documentation equipment defects
- job completion documentation

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 Accredited Course.

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

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the associated performance criteria using the required skills and knowledge.

In particular, this shall incorporate evidence that shows a candidate is able to:

- implement and apply relevant OHS/WHS practices and procedures including the use of risk control measures
- carry out a minimum of four (4) fusion welding procedures in compliance with ISO 9606-1 (Steels - stainless steel) specifications (WPS) and job requirements
- take preventive action or where necessary remedial action to address any areas of non-compliance with ISO 9606-1 (Steels - stainless steel) specifications.

Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job.

Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.

The candidate will have access to all tools, equipment, materials and documentation required and will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Methods of assessment

Assessment must include the demonstration of practical skills and may also include:

- oral questioning on required knowledge and skills
- written objective tests
- computer testing.

Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.

VU22305**Perform fusion welding procedures to meet the requirements of ISO 9606-2(Aluminium/aluminium alloys)****Unit Descriptor**

This unit describes the skills and knowledge required to perform fusion welding procedures to meet the requirements of International Standard (ISO) 9606-2 (Aluminium/aluminium alloys).

The unit includes welding processes, weld procedures specifications (WPS), safety precautions, welding equipment, parent metals, filler metal types, welding sequences/procedures, joint preparation and weld representation images. It also covers the identification of weld imperfections, their causes, prevention and remedial actions.

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

Employability Skills

This unit contains Employability Skills

Pre-Requisite Unit

VU22301 – Interpret and apply ISO 9606 for fusion welding processes

Application of the Unit

The unit applies to all welders required to interpret and apply fusion welding procedures (WPS) to meet ISO 9606-2 (Aluminium/aluminium alloys) requirements.

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 prepare for the work

1.1 Work requirements including plans and specifications are identified, interpreted and confirmed with appropriate parties or by site inspection

1.2 Weld procedure specifications (WPS) for the **welding process** are identified and compliance requirements of **ISO 9606-2** are clarified

1.3 Relevant **OHS/WHS requirements**, manufacturers' specifications, environmental requirements and enterprise procedures are identified, applied and monitored throughout the work procedure

1.4 **Resources** required to satisfy the work plan are identified, obtained and inspected for compliance with the job specifications and Standard

1.5 Potential hazards are identified and prevention and/or control measures are selected in accordance with the work plan and site procedures

1.6 Work area is prepared in accordance with work requirements and site procedures

2 Weld materials

2.1 Materials for welding are prepared and aligned in accordance with

the WPS and job specifications

2.2 **Distortion prevention measures** are applied in accordance with job requirements

2.3 Test runs are undertaken in accordance with the WPS and job requirements

2.4 Materials are welded in accordance with the WPS for ISO9606-2 and job specifications

2.5 Welds are cleaned using appropriate tools and techniques in accordance with the work plan

3 Check and test welds against specifications

3.1 Welds specifications are confirmed by visual inspection and **testing** in accordance to the standard

3.2 Defects are identified, classified and cause/s determined as required

3.3 Remedial action is undertaken to ensure welding work meets standard and job specifications

4 Complete the work

4.1 Work is completed and appropriate personnel notified in accordance with site/enterprise requirements

4.2 Work area is cleared of waste, cleaned, restored and secured in accordance with site/enterprise procedures

4.3 Plant, tools and equipment are maintained and stored in accordance with site/enterprise procedures

4.4 **Work completion details** are finalised in accordance with site/enterprise procedures

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- interpreting and applying welding procedure specifications (WPS) for ISO 9606-2 for Aluminium/aluminium alloys
- applying relevant OHS/WHS requirements
- reading and interpreting weld representation images on plan, work instructions and specifications
- selecting, assembling and setting up tools, jigs, welding equipment and materials in accordance with work requirements
- carrying out welding procedures in accordance with ISO 9606-2 Aluminium/aluminium alloys
- undertaking inspection, testing and if necessary remedial action of welds in accordance ISO9606-2
- maintaining and storing welding equipment and associated materials
- maintaining accurate records of completed welding work

Required knowledge:

- ISO 9606-2 - Aluminium/aluminium alloys welding procedures specifications (WPS)
- relevant regulations and code/s of practice specific to the work
- industry terminology relevant to fusion welding processes and procedures
- fusion weld representation images

- fusion welding equipment:
 - construction and maintenance of welding equipment and typical parameters
 - types of welding current
 - correct connection of the welding return cable
- fusion welding process:
 - gas metal arc welding
 - gas tungsten arc welding
 - type and size of electrodes
 - identification of shielding gas and flow rate
 - type ,size and maintenance of nozzles/contact tip
 - selection and limitation of transfer mode
 - protection of the welding arc from draughts
 - safety precautions
- safety precautions
 - safe assembly, set-up and turn-off procedures
 - safe control of welding fumes and gasses
 - personal protection
 - fire hazards
 - welding in confined spaces
 - awareness of welding environment
- joint preparation for fusion welding
 - conformity of joint preparation to the welding procedure specification (WPS)
 - cleanliness of fusion faces
- fusion weld imperfection:
 - identification of imperfections
 - causes
 - prevention
 - remedial action

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.

Welding process includes:

- gas metal arc welding (GMAW)
- gas tungsten arc welding (GTAW)

ISO 9606-2 includes:

- International Standard (updated 2012) Part 2 specifying requirements for fusion welding processes for (Aluminium/aluminium alloys). Other ISO 9606 Parts are:
Part 1 – steels
Part 3 - copper and copper alloys
Part 4 - nickel and nickel alloys
Part 5 – titanium and titanium alloys, zirconium and zirconium alloys

OHS/WHS requirements may include but not limited to:

- manual handling technique
- personal protective equipment
- material safety management systems
- hazardous substances and dangerous goods codes

Resources may include but not limited to:

- workplace safety measures/information
- awards provisions
- work plans/drawings job specifications
- welding equipment
- welding materials
- personal protective equipment
- hand and hand held power tools
- distortion prevention devices

Distortion prevention measures may include but not limited to:

- bracing
- pre setting
- tacking
- bolting
- clamping

Testing may include but not limited to:

- penetrant dye testing
- bend test
- macro examination
- fillet break test

Work completion details may include but not limited to:

- plant and maintenance records
- job card
- check sheets
- device labelling updates
- reporting and documentation equipment defects
- job completion documentation

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 Accredited Course.

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

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the associated performance criteria using the required skills and knowledge.

In particular, this shall incorporate evidence that shows a candidate is able to:

- implement and apply relevant OHS/WHS practices and procedures including the use of risk control measures
- carry out a minimum of four (4) fusion welding procedures in compliance with ISO 9606-2 specifications (WPS) and job requirements

- take preventive action or where necessary remedial action to address any areas of non-compliance with ISO 9606-2 specifications.

Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job.

Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.

The candidate will have access to all tools, equipment, materials and documentation required and will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Methods of assessment

Assessment must include the demonstration of practical skills and may also include:

- oral questioning on required knowledge and skills
- written objective tests
- computer testing.

Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.

VU22306**Perform fusion welding procedures to meet the requirements of ISO 9606-3, 4 or 5 (Exotic metals)****Unit Descriptor**

This unit provides the skills and knowledge required to perform fusion welding procedures to meet the requirements of International Standard (ISO) 9606-3, 4 or 5.

The unit includes welding processes, welding procedures specifications (WPS), safety precautions, welding equipment, parent metals, filler metal types, welding sequences/procedures, joint preparation and weld representation images. It also covers the identification of weld imperfections, their causes, prevention and remedial actions.

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

Employability Skills

This unit contains Employability Skills

Pre-Requisite Unit

VU22301 – Interpret and apply ISO 9606 for fusion welding processes

Application of the Unit

The unit applies to all welders required to carry out fusion welding procedures (WPS) to meet ISO 9606-3, 4 or 5 requirements for exotic metals which include copper/copper alloys, nickel/nickel alloys, titanium/titanium alloys, zirconium/zirconium alloys.

ELEMENT

Elements describe the essential outcomes of a unit of competency.

1 Plan and prepare for the work

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 Work requirements including plans and specifications are identified, interpreted and confirmed with appropriate parties or by site inspection
- 1.2 Weld procedure specifications (WPS) for the **welding process** are identified and compliance requirements of **ISO 9606-3, 4 or 5** are clarified
- 1.3 Relevant **OHS/WHS requirements**, manufacturers' specifications, environmental requirements and enterprise procedures are identified, applied and monitored throughout the work procedure
- 1.4 **Resources** required to satisfy the work plan are identified, obtained and inspected for compliance with the job specifications and Standard
- 1.5 Potential hazards are identified and prevention and/or control measures are selected in accordance with the work plan and site procedures
- 1.6 Work area is prepared in accordance with work requirements and site procedures

2 Weld materials

2.1 Materials for welding are prepared and aligned in accordance with

the WPS and job specifications

2.2 **Distortion prevention measures** are applied in accordance with job requirements

2.3 Test runs are undertaken in accordance with the WPS and job requirements

2.4 Materials are welded in accordance with WPS for ISO 9606 3, 4 or 5 and job specifications

2.5 Welds are cleaned using appropriate tools and techniques in accordance with the job specifications

3 Check and test welds against specifications

3.1 Welds specifications are confirmed by visual inspection and **testing** in accordance to the standard

3.2 Defects are identified, classified and cause/s determined as required

3.3 Remedial action is undertaken to ensure welding work meets standard and job specifications

4 Complete the work

4.1 Work is completed and appropriate personnel notified in accordance with site/enterprise requirements

4.2 Work area is cleared of waste, cleaned, restored and secured in accordance with site/enterprise procedures

4.3 Plant, tools and equipment are maintained and stored in accordance with site/enterprise procedures

4.4 **Work completion details** are finalised in accordance with site/enterprise procedures

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- interpreting and applying welding procedure specifications (WPS) for ISO 9606-3, 4 or 5
- applying relevant OHS/WHS requirements for fusion welding
- reading and interpreting weld representation images on plan, work instructions and specifications
- selecting, assembling and setting up tools, jigs, welding equipment and materials in accordance with work requirements
- carrying out welding procedures in accordance with ISO 9606-3, 4 or 5
- undertaking inspection, testing and if necessary remedial action of welds in accordance ISO9606-3,4 and 5
- maintaining and storing welding equipment and associated materials
- maintaining accurate record of completed welding work

Required knowledge:

- ISO 9606-3, 4 or 5 welding procedures specifications (WPS)
- relevant regulations and code/s of practice specific to fusion welding procedure
- industry terminology relevant to fusion welding processes and procedures
- fusion weld representation images
- fusion welding equipment:

- construction and maintenance of welding equipment and typical parameters
- types of welding current
- correct connection of the welding return cable
- fusion welding process:
 - gas metal-arc welding (GMAW)
 - gas tungsten arc welding (GTAW)
 - manual metal arc welding (MMAW)
 - flux cored arc welding (FCAW)
 - type and size of electrodes
 - identification of shielding gas and flow rate
 - type ,size and maintenance of nozzles/contact tip
 - selection and limitation of transfer mode
 - protection of the welding arc from draughts
 - safety precautions
 - definition of exotic metals
 - parent metals
 - identification of material
 - methods and control of pre-heating
 - control of interpass temperature
 - filler metal types
 - identification of filler metals types
 - storage ,handling and conditions of filler metal types
 - selection of correct size
 - cleanliness of electrodes and filler wires
 - control of wire spooling
 - control and monitoring of gas flow rates
- safety precautions for fusion welding
 - safe assembly, set-up and turn-off procedures
 - safe control of welding fumes and gasses
 - personal protection
 - fire hazards
 - awareness of welding environment
- joint preparation for fusion welding:
 - conformity of joint preparation to the welding procedure specification (WPS)
 - cleanliness of fusion faces
- fusion weld imperfection:
 - identification of imperfections
 - causes
 - prevention
 - remedial action

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.

- Welding process*** includes::
- copper/copper alloys:
 - gas metal arc welding (GMAW)
 - gas tungsten arc welding (GTAW)

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- nickel/nickel alloys:
 - manual metal arc welding (MMAW)
 - gas metal arc welding (GMAW)
 - flux cored arc welding (FCAW):
 - gas shielded
 - gas tungsten arc welding (GTAW)
- titanium/titanium alloys and zirconium/zirconium alloys:
 - gas tungsten arc welding (GTAW)

ISO 9606-3, 4 or 5 includes:

- International Standard (updated 2012) specifying requirements for fusion welding processes for:
 - Part 3 - copper and copper alloys
 - Part 4 - nickel and nickel alloys
 - Part 5 – titanium and titanium alloys, zirconium and zirconium alloys

OHS/WHS requirements may include but not limited to:

- manual handling technique
- personal protective equipment
- material safety management systems
- hazardous substances and dangerous goods codes
- workplace safety measures/information
- awards provisions

Resources may include but not limited to:

- work plans/drawings job specifications
- welding equipment
- welding materials
- personal protective equipment
- hand and hand held power tools
- distortion prevention devices

Distortion prevention measures may include but not limited to:

- bracing
- pre setting
- tacking
- bolting
- clamping

Testing may include but not limited to:

- penetrant dye testing
- bend test
- macro examination
- fillet break test

Work completion details may include but not limited to:

- plant and maintenance records
- job card
- check sheets
- device labelling updates

- reporting and documentation equipment defects
- job completion documentation

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 Accredited Course.

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

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the associated performance criteria using the required skills and knowledge.

In particular, this shall incorporate evidence that shows a candidate is able to:

- implement and apply relevant OHS/WHS practices and procedures including the use of risk control measures
- carry out minimum four (4) welding procedures (WPS) in compliance with either ISO 9606-3, 4 or 5 specifications
- take preventive action or where necessary remedial action to address any areas of non-compliance with ISO 9606-3, 4 or 5 specifications.

Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job.

Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.

The candidate will have access to all tools, equipment, materials and documentation required and will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Methods of assessment

Assessment must include the demonstration of practical skills and may also include:

- oral questioning on required knowledge and skills
- written objective tests
- computer testing.

Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.

VU23026– Simulate fusion welding processes using augmented reality (AR) or virtual reality (VR) welding equipment

Unit Descriptor

The unit describes the skills and knowledge required to simulate the fusion welding processes using an augmented reality (AR) or virtual reality (VR) welding technology.

The unit includes making adjustment and handling of the AR/VR equipment and tools to achieve a range of simulated fusion welding tasks in various positions, analysing the weld quality data and identifying defects.

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 is applicable a person such as a transition workers, seeking to develop and practice fusion welding 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. Prepare to use AR/VR welding equipment

1.1 ***AR/VR welding equipment*** is investigated and the features are described

1.2 AR/VR settings pertaining to the ***type of weld*** and ***welding process*** are identified

1.3 The AR/VR headset and welding rod holder are trialed

2. Set up and prepare for virtual welding task

2.1 Location of welds are identified in accordance to job instructions

2.2 ***AR/VR equipment parameters*** are set for the weld process and type of weld required

2.3 AR/VR electrodes are selected and connected

2.4 AR/VR materials for welding task are fixed into the required position

3. Perform and analyse virtual welding tasks

3.1 AR/VR headset is fitted and hand held equipment positioned for commencement of the welding tasks

3.2 Virtual weld deposits are applied in accordance with job specifications

3.3 Weld quality analysis data is examined for non-compliance

3.4 Welding tasks are repeated until compliance parameters are achieved

REQUIRED SKILLS AND KNOWLEDGE

Required skills:

- using computer simulation welding packages
- virtually preparing materials and electrodes
- setting parameters on AR/VR welding equipment
- welding in an AR/VR environment
- reading and interpreting routine welding information such as job instructions, welding procedures specifications (WPS)
- reading and interpreting weld analysis data

Required knowledge:

- AR/VR welding technology hardware and software
- AR/VR fusion welding processes
- AR/VR welding procedure specifications (WPS)
- AR/VR welding parameters such as amperage voltage, type and size of electrode, gas mixture and feed rates
- safe welding practices using AR/VR welding equipment
- industry terminology relevant to fusion welding processes and procedures
- fusion welding compliance parameters

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.

AR/VR welding equipment includes but is not limited to:

- Commercially available augmented reality (AR) or virtual reality (VR) welding technology equipment that provides a simulation that closely resembles live arc welding without using an actual arc or consumables. Examples are:
 - Lincoln Electric Realweld Advanced Trainer
 - Lincoln Electric VRTEX® VR Welding Training
 - Soldamatic AR Simulator
 - GuideWELD® VR welding simulator
 - Arc+ NG Welding Simulator Augmented Arc: Welding Simulator
 - Pro Spot Welding Simulator

Type of weld includes but is not limited to:

- butt weld
- fillet weld
- compound weld
- lap joint weld
- pipe weld

AR/VR weld process includes but is not limited to:

- Metal Inert Gas (MIG) or Gas Metal Arc Welding (GMAW)
- Arc or Shielded Metal Arc Welding (SMAW)
- Flux Cored Arc (FCAW)
- Tungsten Inert Gas (TIG) or Gas Tungsten Arc Welding (GTAW)

AR/VR equipment

parameters include but are not limited to:

- amperage
- voltage
- type and size of electrode and feed rate
- wire feed rate
- gas mixture and flow rates

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

Assessors must be satisfied that the candidate can:

- set up and adjust the parameters of AR/VR welding equipment and materials for a range of weld tasks
- perform a minimum of four (4) AR/VR welding procedures to conform with job requirements
- examine AR/VR weld analysis data and assess weld quality against compliance requirements.

Context of and specific resources for assessment

Assessment will take place in a classroom/training environment where the candidate will have access to augmented reality welding technology, analysis information and programming advice. As well as job specifications drawings and other relevant documentation.

The competencies covered by this unit would either be demonstrated by an individual working alone or as part of class group.

Method of assessment

Assessment must include the demonstration of practical skills using augmented reality welding technology and may also include:

- oral questioning on required knowledge and skills
- computer testing.

Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.

VU22308**Identify welding processes, safe welding practices and use of hand/power tools****Unit Descriptor**

This unit describes the knowledge and skills required to identify the characteristics and properties of common metal used for welding, the various welding processes, steps commonly used to prevent distortion, welding imperfections and safe work practices associated with the welding process.

The unit also includes the identification and safe use of various hand and power tools commonly used in conjunction with the welding process.

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 transition workers preparing to pursue a career as certified welders

Element

Elements describe the essential outcomes of a unit of competency. Elements describe actions or outcomes that are demonstrable and assessable.

Performance Criteria

Performance criteria describe the required performance needed to demonstrate achievement of the element – they identify the standard for the element. Where bold/italicised text is used, further information or explanation 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 characteristics and properties of metals fused by welding

1.1 ***Metals commonly fused by welding*** are identified

1.2 ***Basic metallurgical characteristics and properties*** of the metals are recognised

1.3 Applications of the metals are identified

2 Select appropriate welding processes

2.1 ***Fusion welding processes*** and their applications are identified

2.2 Welding process is selected to achieve a specified outcome with a selected metal

2.3 ***Effects of the welding processes*** on materials are recognised

2.4 Process of cleaning and preparing metals for welding processes are identified

2.5 ***Distortion prevention measures*** are identified

2.6 ***Common welding imperfections*** and their likely cause are recognised

3.1 Relevant WHS/OHS standards, regulations and workplace safety information is accessed and interpreted

- | | | | |
|---|--|-----|--|
| 3 | Minimise risks associated with the welding process | 3.2 | WHS/OHS risk associated with welding processes are identified |
| | | 3.3 | Steps to reduce WHS/OHS risks to self and others are identified and undertaken |
| | | 3.4 | Workplace safety non-compliances are reported in accordance with workplace procedures |
| 4 | Use hand and hand held power tools | 4.1 | Required hand and hand held power tools appropriate for the welding task are identified and selected |
| | | 4.2 | Hand tools are correctly used to achieve required outcome |
| | | 4.3 | Hand held power tools are used in accordance with manufacturer's directions |
| | | 4.4 | Damaged or faulty hand or hand held power tools are identified and marked for repair according to workshop procedure or where necessary disposed |
| | | 4.5 | Hand and hand held power tools are returned and stored in appropriate locations in accordance workshop procedure |
| | | 4.6 | Routine maintenance of hand and hand held power tools is undertaken in accordance with manufacturer's requirements and workshop procedure |

Required Skills and Knowledge

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

Required Skills:

- selecting an appropriate fusion welding process for a given situation
- identifying common metal types used for fusion welding and their various applications
- applying welding practices for fusion welding processes
- selecting and using a hand and/or power tools appropriate to the welding task
- recognising hand and hand held power tool defects
- undertaking basic hand and hand held power tool maintenance

Required Knowledge:

- metals commonly joined by a fusion welding processes
- properties and characteristics of commonly joined metals used for fusion welding
- fusion welding processes
- impact of fusion welding on commonly used metals
- distortion control measures for fusion welding
- fusion welding imperfections and likely cause/s
- safe fusion welding practices and OHS/WHS regulations
- hand and hand held power tools used in conjunction with the welding process and maintenance requirement

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.

Metals commonly fused for welding include but are not limited to:

- low and medium carbon steel
- alloy steels
- stainless steel
- aluminium and aluminium alloys
- copper and copper alloys
- nickel and nickel alloys

Basic metallurgical characteristics and properties include but are not limited to:

- tensile strength
- grade
- heat resistance density
- melting point

Fusion welding processes include but are not limited to:

- manual metal arc welding (MMAW)
- gas metal arc welding (GMAW)
- flux cored arc welding (FCAW)
- gas tungsten arc welding (GTAW)

Effects of the welding processes include but are not limited to:

- thermal expansion
- recrystallise and soften in heat affected zones
- altered density
- distortion

Distortion prevention measures include but are not limited to:

- assembly technique:
 - tack welding
 - back to back assembly
 - stiffening
- welding procedure:
 - welding process
 - welding technique
 - welding sequence

Common welding imperfections include but are not limited to:

- cracks
- distortion
- gas inclusion
- lack of fusion and incomplete penetration
- undercut

Steps to reduce WHS/OHS risks include but are not limited to:

- shielding requirements
- ventilation
- use of personal protective clothing
- checking equipment condition
- correct operation of equipment
- correct voltage and electrical connections
- fire safety, plant and equipment isolation
- communication with other workers
- good posture
- manual handling techniques

Hand tools include but are not limited to:

- open ended and ring spanners
- sockets and ratchet handles and extensions
- adjustable spanners
- screwdrivers
- vice grips/multi grips
- G-clamps
- ball peen and chipping hammer
- centre punches
- scribes
- cold chisels

Hand held power tools include but are not limited to:

- grinders
- drills
- abrasive cut off saw
- nibblers

Routine maintenance includes but is not limited to:

- cleaning
- lubricating
- sharpening
- electrical connection checks

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

Assessment must confirm the ability to:

- identify minimum of six (6) common metal materials joined by welding and describe the basic characteristics and properties of each
- select an appropriate welding process for a specified outcome and selected metal material
- recognise common welding imperfection and explain their likely cause
- identify and apply steps to reduce WHS/OHS risk to self and other when welding
- select and safely use a range of hand and power tools.

Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job.

Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.

The candidate will have access to all tools, equipment, materials and documentation required and will be permitted to refer to any relevant

workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Method(s) of assessment

Assessment must include the demonstration of practical skills and may also include:

- oral questioning on required knowledge and skills
- written objective tests.

Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.

VU22309**Read and interpret technical drawings and make measurements for a welding procedure****Unit Descriptor**

This unit describes the knowledge and skills required to read and interpret a technical drawing for the purpose of determining dimensions, interpreting weld symbols and other relevant information required for a welding procedure.

The unit also includes the knowledge and skills required to select and use measuring devices normally used for setting out and measuring materials for a welding procedure specifications (WPS).

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 transition workers preparing to pursue a career as certified welders.

Element

Elements describe the essential outcomes of a unit of competency. Elements describe actions or outcomes that are demonstrable and assessable.

Performance Criteria

Performance criteria describe the required performance needed to demonstrate achievement of the element – they identify the standard for the element. Where bold/italicised text is used, further information or explanation 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 selected technical drawing to plan for a welding procedure | 1.1 Required <i>technical drawing/s</i> are obtained in accordance with workplace procedures |
| | 1.2 Drawing version is checked and validated against job requirements |
| 2 Read and interpret drawing details for welding procedure | 2.1 Views, projections and assemblies are identified and interpreted |
| | 2.2 Dimensions, weld symbols, specifications and work instructions for weld procedures are identified and interpreted |
| | 2.3 Any drawing details that are unclear or required further information are identified and the additional information is sought |
| | 2.4 Relevant information is gathered and the welding procedure is planned |
| 3 Select appropriate measurement device | 3.1 Required measurements are determined from the drawing/s |
| | 3.2 Appropriate <i>measuring device/s</i> for the task are selected |
| 4 Obtain measurements from drawing/s and set | 4.1 Appropriate handling technique for the selected measuring device is applied |

out materials to be welded

- 4.2 Required dimensions from the drawing/s are obtained and applied to the material/s for the welding procedure using the appropriate measuring device/s
- 4.3 Measurements are checked and verified using basic calculations where required
- 4.4 Selected measuring device/s are checked for wear and tear and returned to place of storage when measuring tasks are completed

Required Knowledge and Skills

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

Required Skills:

- reading and interpreting dimensions and other information on a scaled two dimensional technical drawing
- recognising weld symbols and weld representations on a scaled two dimensional technical drawing
- selecting the appropriate measuring device for a welding task
- reading and interpreting measurement devices accurately
- transferring measurements from a two dimensional technical drawing to metal materials for a welding procedure

Required Knowledge:

- types and the function of technical drawings used for welding procedures
- technical drawing standards and conventions relevant to welding procedures
- general technical drawing terms and symbols
- fusion welding symbols and weld representations
- measuring devices used in conjunction with fusion welding task

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.

Technical drawing/s include but are not limited to:

- two dimensional drawings (with scaled elevations and sectional views)
- scaled isometric or three dimensional drawings

Measuring devices include but are not limited to:

- rules
- tapes
- set squares
- protractors
- combination squares
- dividers and trammels

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

Assessment must confirm the ability to:

- read and interpret information from a technical drawing to set out materials for a welding procedure
- select and use appropriate measuring devices to set out specified dimensions on materials for a welding procedure.

Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job.

Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.

The candidate will have access to all tools, equipment, materials and documentation required and will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Method(s) of assessment

Assessment must include the demonstration of practical skills and may also include:

- oral questioning on required knowledge and skills
- written objective tests.

Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.

VU22925 – Work safely with robotic welding equipment

Unit Descriptor This unit describes the knowledge and skills required to operate a robotic welding arm and apply the relevant Occupational Health and Safety/Workplace Health and Safety (OHS/WHS) procedures during its operations.

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 automated welding workshops or manufacturing organisations where robotic arms and equipment are used to weld parts and manufacture components to design specifications and timeframes.

ELEMENT	PERFORMANCE CRITERIA
1. Apply safety procedures in the workplace	1.1 Obtain and clarify Occupational Health and Safety/Workplace Health and Safety (OHS/WHS) requirements when welding with robotics 1.2 Fit relevant personal protective equipment (PPE) in accordance with workplace safety requirements 1.3 Apply robotic safety features during operations 1.4 Apply safety and risk control measures with operational robotic welding technology
2. Operate robotic welding equipment	2.1 Confirm robot type to be used 2.2 Identify operating procedures for robot 2.3 Confirm weld to be performed and job plan and specifications 2.4 Identify and safely operate hand and power tools 2.5 Set up a robotic arm for functional operation in accordance with manufacturer's specifications 2.6 Test and modify operation of robot in accordance with manufacturers' specifications 2.7 Perform weld requirements in accordance with job plan, specifications, relevant welding standards and manufacturers' specifications 2.8 Maintain the equipment according to manufacturers' requirements
3. Evaluate performance	3.1 Review the robotic welding process 3.2 Identify areas for performance improvements for a given context

3.3 Record and report on review findings in accordance with workplace procedures

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- communication to record, report and share workplace information on safety
- identification of hazards and risk mitigation
- interpretation of Occupational Health and Safety/Workplace Health and Safety (OHS/WHS) requirements
- setting up and monitoring of robotic welding and automated equipment
- operation of robotic welding and automated equipment
- operation of hand and power tools
- reading and interpretation of drawings, job requirements and manufacturer's specifications
- evaluation and analysis

Required knowledge:

- relevant legislative and OHS/WHS requirements, codes and practices
- workplace safety procedures
- manual handling procedures
- recording and reporting procedures

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

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

- 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
- work safely with hand & power tools
- worksite safe operating procedures & risk management
- working with robotics and automated equipment

personal protective equipment (PPE) includes but are not limited:

- protective welding face mask
- heat resistant apron
- heat resistant clothing
- ear muffs/plugs
- high visibility retro reflective vests
- safety glasses/goggles
- steel capped boots

Set up includes but is not limited to:

- jog & joint co-ordinate system
- jog/tool frame
- work co-ordinate system

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/Workplace Health and Safety (OHS/WHS) and environmental protection requirements
- set up and safely operate robotic welding arm and automated welding equipment
- perform welding operations to design standards and job specifications
- safely use hand and power tools.

Context of and specific resources for assessment

Skills must have been demonstrated in the workplace or simulated environment that reflects workplace conditions. Where simulation is used, it must reflect real working conditions by modelling industry operating conditions and contingencies, as well as using suitable facilities, equipment and resources.

Assessment must ensure access to:

- Personal protective equipment (PPE)
- Operational welding environment, relevant metals and materials, workplace tools and equipment
- Robotic welding arm and automated welding equipment
- Relevant 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 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 of the candidate working in a real or simulated workplace setting;
- oral and/or written questioning on required knowledge and skills;
- review of portfolio of documentary evidence of the candidate;
- review of third-party workplace reports of on-the-job performance by the candidate.

VU22926 – Program robotic welding equipment

Unit Descriptor

This unit describes the knowledge and skills required to program robotic welding equipment to perform a range of manoeuvres and welding functions for specific job applications to the design specifications.

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

Pre-requisite

VUXX001 - Work Safely with robotic welding equipment

Application of the Unit

This unit is applicable to technicians and engineers required to set up automated welding equipment to perform specific welding tasks for a range of job applications.

ELEMENT

PERFORMANCE CRITERIA

- | | |
|--|--|
| 1. Apply safety procedures in the workplace | 1.1 Confirm and apply Occupational Health and Safety/Workplace Health and Safety (OHS/WHS) requirements when welding with robotics
1.2 Fit relevant personal protective equipment (PPE) in accordance with workplace safety requirements
1.3 Apply robotic safety features during operations
1.4 Apply safety and risk control measures with operational robotic welding technology
1.5 Identify and safely operate hand and power tools |
| 2. Create welding program for robot welding technology | 2.1 Plan robot welding program
2.2 Identify robotic technology to be used in welding applications
2.3 Confirm types of weld to be performed for given task
2.4 Identify suitable program code for robotic technology and welding applications
2.5 Create unique names for each program developed
2.6 Program for calibration of robot arm for weld application
2.7 Program weld procedure for the robot using short, interrupted and continuous welds
2.8 Program for application of required elements
2.9 Create command instructions for welding instructions |
| 3. Trial created robotic welding program | 3.1 Test program for weld accuracy, compatibility and efficiency requirements
3.2 Test program for ease of editorial application and subsequent performance |

- | | |
|-------------------------------------|--|
| 4. Evaluate applied robotic program | <p>3.3 Record and report non-compliance operations and discrepancies in accordance with manufacturer's and customer requirements</p> <p>4.1 Verify welding compliance standards and specifications to be achieved</p> <p>4.2 Review robotic moves for accuracy and efficiency in accordance with job plan and specifications</p> <p>4.3 Design revised programming for implementation</p> <p>4.4 Record and report on review findings to ensure improvement processes and edits are applied on future welding projects</p> |
|-------------------------------------|--|

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- communication to record, report and share workplace safety information
- interpretation of drawings, brief, specifications and programming requirements
- operation of robotics and automated equipment
- application of risk mitigation strategies
- program design, application and methodology
- problem solving and fault finding
- simulation techniques
- planning and testing procedures
- analysis and interpretation

Required knowledge:

- relevant legislative and OHS/WHS requirements, codes and practices
- programming processes and applications
- robotic arms and automotive equipment
- types of welds and applications
- recording and reporting procedures

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

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

- 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
- work safely with hand & power tools
- worksite safe operating procedures & risk management
- working with robotics and automated equipment

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

- protective welding face mask
- heat resistant apron
- heat resistant clothing
- ear muffs/plugs
- high visibility retro reflective vests
- safety glasses/goggles
- steel capped boots

Types of weld include but not limited to:

- V-bead
- weaving
- circular & circle
- weld on plate

Weld procedure includes but not limited to:

- crater fill
- jog & joint coordinate systems
- pulse welding

Application includes but not limited to:

- write protection
- adding comments
- copying & deleting
- wait & review instructions
- back-up requirements

Elements include but not limited to:

- line
- motion type
- position data
- travel speed
- termination

Command instructions include but not limited to:

- comment
- edit
- undo

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/Workplace Health and Safety (OHS/WHS)
- design and apply an operational program for the robotic welding arm and automated equipment
- operate a robotic welding arm to weld to specified requirements
- perform testing operations and re-programming functions for compliance.

Context of and specific resources for assessment

Skills must have been demonstrated in the workplace or simulated environment that reflects workplace conditions. Where simulation is used, it must reflect real working conditions by modelling industry operating conditions and contingencies, as well as using suitable facilities, equipment and resources.

Assessment must ensure access to:

- Personal protective equipment (PPE)
- Operational welding environment, relevant metals and materials, workplace tools and equipment
- Robotic welding arms and automated welding equipment
- Relevant hand and power tools.
- Relevant robotic simulation software for on-line programming

Assessment must be conducted in a safe environment where evidence gathered demonstrates consistent performance of typical activities experienced in a real 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 of candidate working in a real or simulated workplace setting;
- oral and/or written questioning on required knowledge and skills;
- review of portfolio of documentary evidence of the candidate;
- review of third-party workplace reports of on-the-job performance by the candidate.