

Training Package	Metal and Engineering (MEM05)			HSC Requirements and Advice
Title	Select welding process			
Unit code	Competency field	Band	Unit weight	HSC Indicative Hours
MEM05051A	Fabrication	A	2	10

Unit descriptor	This unit covers identifying material properties and selecting appropriate welding processes to achieve safe and effective welding outcomes.
Prerequisites	None
Application of the competency	This unit applies to all types of welding. It includes the identification of properties and characteristics of all commonly used metals, and selection of appropriate welding techniques to ensure integrity of materials is maintained during welding processes.
Related units	–

Evidence Guide

The evidence guide specifies the evidence required to demonstrate achievement in the unit of competency as a whole. It must be read in conjunction with the unit descriptor, performance criteria, range statement and the assessment guidelines for the Metal and Engineering Training Package.

Overview of assessment requirements	Context of assessment	Interdependent assessment	Method of assessment
A person who demonstrates competency in this unit must be able to select welding processes.	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, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with selecting welding processes or other units requiring the exercise of the skills and knowledge covered by this unit.	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Evidence Guide cont/d			HSC Requirements and Advice
Consistency of performance	Required skills	Required knowledge	Key Terms and Concepts
Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.	Look for evidence that confirms skills in: <ul style="list-style-type: none"> • reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents • planning and sequencing operations • checking and clarifying task-related information. 	Look for evidence that confirms knowledge of: <ul style="list-style-type: none"> • hazards and control measures associated with welding practices, including housekeeping • safe work practices and procedures • properties and characteristics of commonly used metals and materials • basic metallurgy principles • information resources • chemical content of fumes emitted by welding processes • uses and purposes of various metals • distortion prevention measures for various metals. 	<ul style="list-style-type: none"> • alternative joining methods • characteristics and properties of metals and materials • check and clarify information • cleaning and preparation of metals • contaminants • correct handling, application, transport and storage of hazardous and non-hazardous materials • distortion prevention measures • effects of welding processes • fumes • grades of metals • Material Data Safety Sheet (MSDS) • materials to be welded • metal alloys • metallurgy • occupational health and safety (OHS) • personal protective equipment (PPE) • safe work practices and procedures • safety requirements • sources of information • use and purpose of metals and materials • welding contingencies • welding electrodes • welding flaws • welding processes and techniques • work instructions and procedures • work sequencing.

Elements	Performance criteria	Range Statement	HSC Requirements and Advice
1 Identify properties of <i>commonly used metals</i>	1.1 Materials to be welded are identified.	<p>The range statement provides information about the context in which the unit of competency is carried out. The variables [in bold] and scope [dot points] cater for different work requirements, work practices and knowledge between States, Territories and the Commonwealth, and between organisations and workplaces. The range statement relates to the unit as a whole and provides a focus for assessment. Text in italics in the performance criteria is explained here.</p> <p>The following variables may be present and <i>may include</i>, but are not limited to, the examples listed under the scope. All work is undertaken to relevant legislative requirements, where applicable.</p> <p>Commonly used metals</p> <ul style="list-style-type: none"> stainless steel, aluminium, galvanised metals, carbon steel, copper, manganese, zinc. <p>Characteristics</p> <ul style="list-style-type: none"> tensile strength, grade, heat resistance, density. <p>Properties</p> <ul style="list-style-type: none"> physical properties, flammable limits, melting point. <p>Basic metallurgical characteristics</p> <ul style="list-style-type: none"> alloys and grades of metals and different types of electrodes. 	<p>Learning experiences for the HSC must address:</p> <p>Identification of a range of common materials to be welded.</p>
	1.2 <i>Characteristics and properties</i> of commonly used materials are identified.		<p>Learning experiences for the HSC must address:</p> <p>A definition of:</p> <ul style="list-style-type: none"> metallurgy tensile strength grade heat resistance density physical properties flammability limits melting point. <p>Knowledge and identification of characteristics, properties, use and purpose of commonly used metals and materials.</p>
	1.3 Uses and purposes of commonly used materials are identified.		<p>Learning experiences for the HSC must address:</p> <p>Basic metallurgical principles.</p>
	1.4 <i>Basic metallurgical characteristics</i> are considered.		<p>Learning experiences for the HSC must address:</p> <p>An understanding of basic metallurgical characteristics of:</p> <ul style="list-style-type: none"> metals <ul style="list-style-type: none"> alloys grades welding electrodes.
2 Identify and provide for welding contingencies.	2.1 <i>Information</i> relevant to welding processes is sourced as required.	<p>Information</p> <ul style="list-style-type: none"> steel suppliers handbooks, welding company materials, standard operating procedures, safety documentation. 	<p>Learning experiences for the HSC must address:</p> <p>A range of sources for information on welding, materials, consumables, work instructions and procedures including:</p> <ul style="list-style-type: none"> work schedules job card/sheet/plans/specifications standard operating procedures (SOP) standard operation sheets

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			<ul style="list-style-type: none"> • Material Safety Data Sheets (MSDS) • diagrams/sketches • regulations/legislation • manufacturer/workplace guidelines, policies and procedures • Australian Standards • steel supplier's handbooks/representatives • welding company materials/representatives • seminars, field days and exhibitions. <p>An understanding of how to check and clarify task-related information.</p>
	<p>2.2 Potential contingencies are identified and solutions are considered.</p>		<p>Learning experiences for the HSC must address:</p> <p>Knowledge of the fumes and their chemical content produced by different welding processes.</p> <p>An awareness of the effects that these fumes have on:</p> <ul style="list-style-type: none"> • operators • the environment. <p>Safe work practices and procedures.</p> <p>Hazard identification and risk control.</p> <p>Housekeeping/clean-up procedures with due consideration to OHS and the environment.</p> <p>Work sequencing including:</p> <ul style="list-style-type: none"> • receiving instructions • organising for the task <ul style="list-style-type: none"> - selection of tools and equipment - locate materials and/or parts - personal protective equipment (PPE) • carry out the task <ul style="list-style-type: none"> - in a logical order - within completion time frame - according to quality measures • clean-up after task completion. <p>Solutions to a range of potential problems.</p>

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3 Identify appropriate welding processes	3.1 <i>Welding processes</i> are identified and selected to achieve specified outcomes with selected metals.	Welding processes <ul style="list-style-type: none"> • fusion: <ul style="list-style-type: none"> - electric arc welding - gas (oxy-fuel) welding - thermit welding • pressure welding processes: <ul style="list-style-type: none"> - resistance welding - fire or forge welding - friction welding - explosive welding • low temperature processes: <ul style="list-style-type: none"> - soldering - brazing • other: <ul style="list-style-type: none"> - ultrasonic welding - electron beam welding. 	Learning experiences for the HSC must address: <p>A basic understanding of a range of welding processes, their use and application for joining a range of selected metals.</p> <p>Selection of appropriate welding techniques to ensure:</p> <ul style="list-style-type: none"> • integrity of materials is maintained during welding processes • safe and effective welding outcomes. <p>Safe work practices for using welding tools and equipment including:</p> <ul style="list-style-type: none"> • following SOP and manufacturer’s specifications before, during and after use • risk management (identifying hazards and implementing control measures) • correct manual handling • safe handling, application and storage of hazardous substances • appropriate use of PPE • regular servicing and maintenance of tools and equipment • selection of appropriate tool for use • working with electricity in a safe manner • adequate ventilation • attaching appropriate safety guards where required • awareness of occupational health and safety (OHS) issues in relation to welding. <p>Use and application of a range of PPE including:</p> <ul style="list-style-type: none"> • footwear • head protection • gloves • protective clothing • respirator • face mask/shield • hearing protection • eye protection. <p>Importance of correct fitting PPE.</p>
	3.2 <i>Effects</i> of welding processes on materials are identified.	Effects <ul style="list-style-type: none"> • thermal expansion, heat affected zones, 	Learning experiences for the HSC must address:

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		fume emissions, altered density, distortion.	A definition of: <ul style="list-style-type: none"> • thermal expansion • heat-affected zone • fume emission • density • distortion.
	3.3 <i>Distortion prevention measures</i> are identified.	Distortion prevention measures <ul style="list-style-type: none"> • heat treatments, consolidations. 	Learning experiences for the HSC must address: A basic knowledge of measures that can be used to prevent or minimise the effects of distortion during a range of welding processes.
	3.4 Alternative joining methods for job are identified and assessed for relevancy.		Learning experiences for the HSC must address: An awareness of alternative joining methods including: <ul style="list-style-type: none"> • seaming • riveting • mechanical fastening (such as tek screws, nuts and bolts and screws) • bonding. OHS issues associated with alternative joining methods.
4 Identify cleaning and preparation requirements	4.1 <i>Processes for cleaning and preparing metals</i> are identified.	Processes for cleaning and weld preparation <ul style="list-style-type: none"> • etching, grinding, arc gouging, thermal cutting, chemical additives, anti-corrosion treatments. 	Learning experiences for the HSC must address: Knowledge of a range of processes available for cleaning and preparing metals for a range of welding processes.
	4.2 Role of contaminants in welding flaws is explained.		Learning experiences for the HSC must address: A definition of: <ul style="list-style-type: none"> • welding flaw. A basic understanding of the role of contaminants in welding flaws including: <ul style="list-style-type: none"> • solid non-metallic inclusions

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			<ul style="list-style-type: none"> - flux - slag - oxides • oil • grease • paint • flux residue.
	<p>4.3 <i>Safety requirements</i> for chemicals and other materials are identified and utilised in accordance with manufacturers' specifications and legislative requirements.</p>	<p>Safety requirements</p> <ul style="list-style-type: none"> • dry and ventilated areas • in accordance with workplace procedures • location away from heat risks • location away from incompatible substances • requirements for hazardous substances • adequate signage and labelling • appropriate sealing • routine inspections • emergency procedures • regulatory notification requirements. 	<p>Learning experiences for the HSC must address:</p> <p>Correct handling, application, transport and storage of hazardous and non-hazardous materials.</p> <p>An understanding of the differences between chemical labels and associated MSDS.</p> <p>How and where to obtain required MSDS.</p> <p>An awareness of information provided in MSDS:</p> <ul style="list-style-type: none"> • manufacturer's/supplier's details • identification of substance • use • ingredients • health hazard information • first aid • precautions for use • safe handling information • control point. <p>Interpretation of the safety information on chemical labels and MSDS.</p> <p>An awareness of the legislative requirements for the disposal of chemicals and empty chemical containers.</p>