



**Australian Government**

# **MEM05063 Write and proof robotic welding system programs**

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## Modification History

| Release | Comments                                                                                     |
|---------|----------------------------------------------------------------------------------------------|
| 2       | Unit code updated in Application to reflect status.                                          |
| 1       | This unit of competency was first released in MEM Manufacturing and Engineering Release 3.0. |

## Application

This unit of competency was developed for post trade engineering fabrication training and the recognition of post trade skills in planning and writing programs for robotic welding operations.

It defines the skills and knowledge required to plan and write programs in accordance with the manufacturer's operating procedures, using manufacturer specific language and the functional parameters of the welding robot as defined in the unit in conjunction with its prerequisites.

The unit scope includes writing, proofing and making necessary adjustments to programs using offline programming software and teach pendants.

Where integration of the welding robot with other programmable equipment is required the unit MEM07040 Set multistage integrated processes must also be selected. Where welding to AS 1554 Structural Purpose (SP) level or equivalent is to be programmed, then either the unit MEM05073 Perform advanced welding using gas metal arc welding, or MEM05074 Perform advanced welding using gas tungsten arc welding process, and their prerequisites must be selected.

**Band: B**

**Unit Weight: 6**

## Licensing/Regulatory Information

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

## Pre-requisite unit(s)

MEM05050 Perform routine gas metal arc welding

MEM05052 Apply safe welding practices

MEM05085 Select welding processes

MEM09002 Interpret technical drawing

MEM11011 Undertake manual handling

MEM12023 Perform engineering measurements

MEM12024 Perform computations

MEM13015 Work safely and effectively in manufacturing and engineering

MEM14006 Plan work activities

MEM16006 Organise and communicate information

MEM18001 Use hand tools

MEM18002 Use power tools/hand held operations

Plus either:

MEM05017 Weld using gas metal arc welding process

MEM05050 Perform routine gas metal arc welding

or:

MEM05049 Perform routine gas tungsten arc welding

MEM05092 Weld using gas tungsten arc welding process

## Competency field(s)

Fabrication

## Unit sector(s)

N/A

## Elements and Performance Criteria

| Elements                                  | Performance criteria                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Elements describe the essential outcomes. | Performance criteria describe the performance needed to demonstrate achievement of the element.                                                                                                                                                                                                                                                                                                                                                      |
| 1. Determine welding requirements         | <p>1.1 Identify welding requirements including relevant standards and codes from drawings, specifications and other customer and enterprise documentation</p> <p>1.2 Check material to be welded is to specifications and job requirement</p> <p>1.3 Identify requirements for any test pieces for non-destructive testing (NDT), sample pieces and production plates in accordance with specifications and standard operating procedures (SOPs)</p> |

|                                                           |                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2. Confirm welding robot suitability for job requirements | 2.1 Identify welding robot features and specifications including robot language and welding process and parameter capabilities<br>2.2 Identify welding robot safety features<br>2.3 Establish required torch path geometry and robot operations using drawings and welding robot operating features<br>2.4 Confirm required operations for robot arm and torch using appropriate technical reference sources |
| 3. Prepare for welding robot programming                  | 3.1 Check alignment of selected torch to robot<br>3.2 Create torch centre point and check location and alignment<br>3.3 Review robot file library for correct references to weld size and weld type<br>3.4 Check availability of logical subroutines and other standard instructions for position orientation<br>3.5 Check job for any positions or welds requiring non-standard instructions                |
| 4. Write or record program                                | 4.1 Write joint arm and welding moves using teach pendant or software<br>4.2 Perform any additional programming required including instructions, weld data recording and lower-level programming<br>4.3 Produce operation sheets to specification in accordance with SOPs                                                                                                                                    |
| 5. Trial program                                          | 5.1 Trial program on test material<br>5.2 Verify trial welds and program performance against required specifications<br>5.3 Edit program to adjust welding operations based on trial outcomes<br>5.4 Save final program and complete operation sheets and any required records according to enterprise procedures                                                                                            |

## Foundation Skills

This section describes those language, literacy, numeracy and employment skills that are essential to performance.

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

## Range of conditions

|                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>This field allows for different work environments and conditions that may affect performance. Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included.</b></p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Standards and codes include Australian or international standards and codes covering:                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>• welding processes</li> <li>• welding consumables</li> <li>• materials used in fabrication related projects or products</li> <li>• destructive and non-destructive testing of welds</li> <li>• qualifying of welders, welding inspectors and welding supervisors.</li> </ul>                                                                                                                                                                                                                          |
| Welding robot features and specifications include one or more of the following:                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>• components</li> <li>• capabilities</li> <li>• speed</li> <li>• reach</li> <li>• accuracy/repeatability</li> <li>• classification</li> <li>• home position</li> <li>• polar coordinate</li> <li>• cartesian coordinate</li> <li>• jointed elbow</li> <li>• movements</li> <li>• base</li> <li>• shoulder</li> <li>• elbow</li> <li>• pitch</li> <li>• roll</li> <li>• yaw</li> <li>• applications</li> <li>• required operating conditions</li> <li>• limitations</li> <li>• justification</li> </ul> |

|                                                                            |                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                            | <ul style="list-style-type: none"> <li>• safety features</li> </ul>                                                                                                                                                                                                                                                                                             |
| Welding parameters for welding robot include one or more of the following: | <ul style="list-style-type: none"> <li>• material preparation</li> <li>• joint detail</li> <li>• position</li> <li>• run sequence and pass number</li> <li>• welding process</li> <li>• filler material</li> <li>• flux</li> <li>• current</li> <li>• voltage</li> <li>• polarity</li> <li>• wire feed speed where relevant</li> <li>• travel speed.</li> </ul> |
| Lower level programming:                                                   | <ul style="list-style-type: none"> <li>• lower-level programming is where the programmer creates complex instructions and data types for functions that go beyond those supplied with the standard welding robot software.</li> </ul>                                                                                                                           |

## Unit Mapping Information

| Current Code and Title                                   | Previous Code and Title | Comments                                                                                                                         | Equivalence   |
|----------------------------------------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------|---------------|
| MEM05063 Write and proof robotic welding system programs |                         | This unit has been created to address a skill or task required by industry that is not covered by an existing unit of competency | Newly created |

# Assessment Requirements for MEM05063 Write and proof robotic welding system programs

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## Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy the requirements of the elements and performance criteria and include the ability to:

- identify and interpret customer specifications, weld procedure specifications, engineering drawings and other applicable reference documents on at least two occasions for information relevant to writing programs for welding robots
- identify materials and consumables compliance against job specifications
- identify required welding robot operations to be incorporated in welding robot programming on at least two occasions
- determine coordinates for welding and producing operation sheets for the program and process on at least two occasions
- record weld coordinates and torch movements using teach pendant
- use software including canned cycles and sub-routines for programming welding operations on at least two occasions
- trial the program on at least two occasions ensuring the welding robot operates safely and correctly and produces work that meets specification
- edit a welding robot program to ensure compliance with specifications
- visually check robot welds to specifications.

*Note: Where a volume and/or frequency is not specified, demonstration must be provided at least once.*

## Knowledge Evidence

Evidence required to demonstrate the required knowledge for this unit must be relevant to and satisfy the requirements of the elements and performance criteria and include knowledge of:

- safety features and requirements of welding robots

- welding symbols and abbreviations
- welding parameters as applied to welding robots
- welding robot programming including the use of standard program codes and comments, and input controls for welding robot programs
- procedures for producing test pieces for NDT, sample plates and production plates
- default positions and datum points used by welding robots
- procedures and good practice for writing welding robot programming with teach pendants including:
  - using the same wire stick out length
  - ensuring axis moves of more than 180 degrees are made in two moves to ensure smooth motion
  - robot posture is kept as close as possible to the home position
  - using the wrist axis to position the torch angle
  - avoiding excessive torch motion to create singularity on any axis
  - avoiding multiple weld settings for the same joint type
  - avoid touch ups for one defect on one part
- procedures for trialling and editing welding robot programs.

## Assessment Conditions

- Assessors must:
  - have vocational competency in writing and proofing robotic welding system programs at least to the level being assessed with relevant industry knowledge and experience
  - satisfy the assessor requirements in the *Standards for Registered Training Organisations 2015* or its replacement and comply with the *National Vocational Education and Training Regulator Act 2011*, its replacement or equivalent legislation covering VET regulation in a non-referring state/territory as the case requires.
- Assessment must occur in a functioning workplace. Where assessment in the workplace would be unsafe, impractical or threatens the environment, assessment must occur in a sufficiently rigorous simulated environment that reflects the circumstances that would be experienced in a functioning workplace. Assessment must cover all aspects of workplace performance, including task skills, task management skills, contingency management skills and job role environment skills.
- Knowledge assessment may be either verbal or written but must adequately reflect the knowledge requirements of the unit in a functioning workplace.
- Conditions for assessment must include access to all tools, equipment, materials and documentation required, including relevant workplace procedures, product and manufacturing specifications.

- Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.

## Link

Companion volumes, including implementation guides, are found on the national training register - <https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=45a7f1d5-61a5-447a-9688-7abbd7e1a5c7>.