



Australian Government

MEM24018 Perform advanced ultrasonic testing

Release: 1

MEM24018 Perform advanced ultrasonic testing

Modification History

Release 1. New unit.

Application

This unit of competency defines the skills and knowledge required by non-destructive testing (NDT) technicians to perform advanced ultrasonic testing to the level described in relevant Australian and international standards and codes. The unit applies to ultrasonic time of flight diffraction (TOFD) and phased array ultrasonic (PAUT) testing performed either separately or in combination in a range of industrial applications including testing on welds, fabrications, structures and components. The unit covers testing on both metallic and non-metallic materials. Advanced ultrasonic testing may be performed by NDT technicians in a wide range of industries and sectors including mechanical or mechatronics engineering, maintenance, manufacturing, construction, mining, oil/gas, and associated industry sectors.

The unit covers calibrating, setting up, and using TOFD and PAUT equipment, selection of the most appropriate testing techniques, interpreting results including classifying defects, and reporting of test results.

Where interpretation of technical drawings is required, unit MEM09002 Interpret technical drawing should also be selected.

Where the selection and use of engineering measurement is required, unit MEM12023 Perform engineering measurements should also be selected.

Where the selection and use of power tools are required, unit MEM18002 Use power tools/hand held operations should also be selected.

No licensing or legislative requirements apply to this unit at the time of publication. Certification against Australian standards may be achieved where assessment in this unit of competency is carried out in conjunction with an examining authority as described in ISO 9712 Non-destructive testing — Qualification and certification of personnel.

Band: B

Unit Weight: 6

Pre-requisite Unit

MEM11011 Undertake manual handling

MEM13015 Work safely and effectively in manufacturing and engineering

MEM16006 Organise and communicate information

MEM18001 Use hand tools

MEM24008 Perform ultrasonic testing

MEM24020 Apply materials technology principles to non-destructive testing

Competency Field

Non-destructive testing

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 job requirements	1.1 Follow standard operating procedures (SOPs) 1.2 Comply with work health and safety requirements (WHS) 1.3 Use appropriate personal protective equipment (PPE) in accordance with SOPs 1.4 Identify job requirements from specifications, job sheets or work instructions 1.5 Determine relevant regulatory requirements, standards and codes of practice
2. Prepare for TOFD and PAUT testing	2.1 Liaise with client to explain testing requirements and schedule tests to minimise disruption, 2.2 Arrange safe access to testing site(s) and identify inspection areas 2.3 Clean and prepare for testing using appropriate procedures and materials 2.4 Assess inspection areas visually and identify obvious discontinuities
3. Conduct TOFD tests	3.1 Select appropriate TOFD test technique and equipment 3.2 Set up and prepare TOFD equipment in accordance with manufacturer specifications and job specification 3.3 Select appropriate probe for TOFD test 3.4 Use calibration and reference blocks to calibrate and optimise TOFD equipment for specified tests 3.5 Set TOFD test parameters in accordance with manufacturer specifications and job specification 3.6 Couple probe to surface and undertake testing in accordance with manufacturer specifications and job specification
4. Conduct PAUT tests	4.1 Select appropriate PAUT test technique and equipment 4.2 Set up and prepare PAUT test equipment in accordance with manufacturer specifications and job specification 4.3 Select appropriate probe for PAUT task

Elements	Performance Criteria
Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element.
	4.4 Use calibration and reference blocks to calibrate and optimise PAUT equipment for specified tests 4.5 Set PAUT test parameters in accordance with manufacturer specifications and job specification 4.6 Couple probe to surface and undertake testing in accordance with manufacturer specifications and job specification
5. Interpret and report PAUT and TOFD results	5.1 Monitor scans and assess indications for discontinuities, defects and other data required in test report 5.2 Apply acceptance criteria to discontinuities to detect defects 5.3 Classify defects in accordance with test specification and relevant standards 5.4 Report test results and complete all job records in accordance with relevant standards, test specifications and workplace 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

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.

Standards and codes include Australian or international Standards and codes and include one or more of:

- standards for non-destructive testing of welds
- standards for non-destructive testing of materials
- standards for materials used in manufacturing and engineering
- standards for calibration and operation of test equipment

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| TOFD and PAUT test equipment includes one or more of the following: | <ul style="list-style-type: none">• module• scanners• transducers• probes• couplant.• calibration and reference blocks |
| TOFD and PAUT beam parameters includes one or more of: | <ul style="list-style-type: none">• beam angle• focal distance• wave type and mode• frequency• channels• phase delay• elements• sample rate. |
| Defects include one or more of the following: | <ul style="list-style-type: none">• weld discontinuities and cracks• corrosion• deformation in nonferrous and/or ferrous alloys steels• fatigue cracks• stress corrosion cracking• heat damage• metal properties sorting• manufacturing defects• coating thickness measurement. |

Unit Mapping Information

No equivalent unit

Links

Companion Volume Implementation Guides are found in VETNet - <https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b7050d37-5fd0-4740-8f7d-3b7a49c10bb2>

Assessment Requirements for MEM24018 Perform advanced ultrasonic testing

Modification History

Release 1. New unit.

Performance Evidence

There must be evidence the candidate has demonstrated the ability to:

- apply WHS requirements for a test site and area to TOFD and PAUT testing
- assess geometry and condition of test area surfaces for TOFD testing and determine implications for testing on at least two occasions
- assess geometry and condition of test area surfaces for PAUT testing and determine implications for testing on at least two occasions
- select appropriate TOFD technique for a test specification on at least two occasions
- select appropriate PAUT technique for a test specification on at least two occasions
- apply relevant standards and codes to TOFD and PAUT tests
- correctly use TOFD calibration and PAUT reference blocks
- optimise TOFD and PAUT instruments for expected defects and discontinuities
- correctly place transmitting and receiving probes for TOFD testing
- perform TOFD testing on plate and tube to identify weld discontinuities and defects, and:
 - assess quality of TOFD images
 - interpret images and accept and classify defects and discontinuities according to specified acceptance criteria
- prepare TOFD test reports according to specifications and relevant standards and codes
- perform phased array ultrasonic testing to identify:
 - weld discontinuities and defects including:
 - thickness of plate and pipe
 - corrosion
 - shape defects
- select correct TOFD and PAUT evaluation method for a test specification
- interpret PAUT images and accept and classify defects and discontinuities according to specified acceptance criteria

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

Knowledge Evidence

There must be evidence the candidate has knowledge of:

- standards and codes relevant to ultrasonic time of flight diffraction and phased array testing

- general principles and behaviour of ultrasound including:
 - frequency, velocity, wavelength, amplitude
 - generation and detection of ultrasound
 - characteristics of ultrasound in materials
 - attenuation, reflection, transmission and refraction at interfaces
- principles of ultrasonic time of flight diffraction (TOFD) testing including:
 - transmitting and receiving probes
 - diffraction of waves from crack tips
 - calculation of crack depth
 - dead zone cause and calculation
 - influence of surface conditions of test area
- components of TOFD test equipment and their function including:
 - probes
 - encoders
 - guides
 - reference blocks
 - coupling materials
- TOFD techniques including:
 - single group TOFD
 - multiple TOFD
 - TOFD with pulse echo
 - TOFD with phased array testing
- visualisation of TOFD images
- principles of phased array ultrasonic testing (PAUT) including:
 - difference between conventional and phased array ultrasonic testing
 - transducer array pulsing and timing
 - active and elementary apertures
 - primary axis
 - secondary axis
 - beam steering and focusing
 - reference reflectors
 - transmitting and receiving delays
 - range and sensitivity setting
- types of PAUT probes and their purpose
- evaluation of PAUT indications including:
 - distance gain size (DGS) method
 - distance amplitude curve (DAC) method
 - time corrected gain (TAC) method.
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Assessment Conditions

- Assessors must:
 - have vocational competency in performing advanced ultrasonic testing 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.
- Where possible, assessment must occur in operational workplace situations. Where this is not possible or where personal safety or environmental damage are limiting factors, assessment must occur in a sufficiently rigorous simulated environment that reflects realistic operational workplace conditions that cover all aspects of workplace performance, including environment, task skills, task management skills, contingency management skills and job role environment skills.
- There must be 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.

Links

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