



Australian Government

MEM24037 Undertake advanced ultrasonic testing

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Modification History

Release	Comments
1	This unit of competency was first released in MEM Manufacturing and Engineering Release 5.0.

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, aerospace, 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. These employees work under the general supervision of personnel such as engineering associates, NDT technicians aligned to level 3 in technical standards; professional engineers and scientists; engineering technologists; and production, operations and maintenance managers.

Where interpretation of technical drawings is required, unit MEM09229 Read and interpret technical drawings 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 hand tools are required unit MEM18001 Use hand tools 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.

Band: B

Unit Weight: 6

Licensing/Regulatory Information

Assessment as competent against MEM24037 Undertake advanced ultrasonic testing may contribute to certification against Australian NDT standards may be achieved where assessment in this unit of competency is carried out in conjunction with an examining authority as described in AS ISO 9712 NDT – Qualification and certification of personnel, or subsequent Standards.

Pre-requisite unit(s)

MEM13015 Work safely and effectively in manufacturing and engineering

MEM16006 Organise and communicate information

MEM24028 Undertake ultrasonic tests

MEM24039 Apply materials technology principles to non-destructive testing

MEM30007 Select common engineering materials

Competency field(s)

Non-destructive testing

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. Establish job requirements	1.1 Comply with relevant WHS and regulatory requirements, standards, codes of practice and standard operating procedures (SOPs) for advanced ultrasonic testing 1.2 Identify job requirements from specifications, job sheets or work instructions
2. Prepare for TOFD and PAUT testing	2.1 Liaise with client to explain testing requirements and schedule tests 2.2 Use established safe work practices and personal protective equipment (PPE) in accordance with SOPs 2.3 Identify inspection areas and determine if special access requirements appropriate for the NDT test need to be communicated to the client 2.4 Clean and prepare inspection areas for testing using appropriate procedures and materials 2.5 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 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 Review conduct of the tests and confirm test procedures were applied correctly 5.2 Monitor scans and assess indications for discontinuities, defects and other data required in test report 5.3 Apply acceptance criteria to discontinuities to detect defects 5.4 Classify defects in accordance with test specification and relevant standards 5.5 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.	
TOFD and PAUT test equipment includes one (1) or more of the following:	• module • scanners • transducers • probes • couplant • calibration and reference blocks.
TOFD and PAUT beam parameters includes one (1) or more of the following:	• beam angle • focal distance • wave type and mode • frequency • channels • phase delay • elements • sample rate.
Defects include one (1) or more of the following:	• 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

Current Code and Title	Previous Code and Title	Comments	Equivalence

MEM24037 Undertake advanced ultrasonic testing	MEM24018 Perform advanced ultrasonic testing	Superseded	Equivalent
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Assessment Requirements for MEM24037 Undertake advanced ultrasonic testing

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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. Different specimens means different in character, i.e. in product form, material specification, shape, size, or discontinuity type and be representative of products typically tested in the industrial sector.

Evidence required includes:

- 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 different specimens
- select appropriate PAUT technique for a test specification on at least two different specimens
- 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

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:

- 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.

Assessment Conditions

- Assessors must:
 - have vocational competency in undertaking advanced ultrasonic testing at least to the level being assessed with relevant industry knowledge and experience
 - satisfy the assessor requirements in the current vocational education and training legislation, frameworks and/or standards.
- 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.

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>.