1.1 Duration of training and experience prior to authorization

Each candidate for qualification should receive a minimum of 80 hours training and not less than 3 Months verifiable UT experience using phased arrays. Candidates shall maintain records of the number of hours the individual has been trained and supervised experience.

Candidate shall hold current AS3998 Level 2 Ultrasonic Welds Certification as a minimum.

1.2 Purpose of the Module

To qualify personnel in detection, measurement and recording of discontinuities in Welds using Ultrasonic Phased Arrays.

(Based on the method code AS2207)

This document prescribes the requirements and procedures by which personnel may be examined and, if successful, certified competent for Ultrasonic Testing using Phased Array.

This certification does not apply to any specific proprietary equipment.

However due to the variances in equipment available, two competencies are available:

1) Manual Phased Array Inspection
   Real time inspection and interpretation (for systems not containing data collection or encoded scans).

2) Encoded Phased Array Collection
   Encoded data collection and interpretation.

Note: Satisfactory completion of Encoded Phased Array encompasses Manual Phased Array Inspection.

1.3 Vision Requirements

Vision requirements shall comply with AS 3998/ISO9712
1.4 Content

**Principals of Phased Array**
- Principles of phased array probes
- Array of piezo-electric elements
- Delays
- Control of beam shape and angle
- Laws
- Fundamental principles of probe performance and design
- Principles of inspection sensitivity
- Reference reflectors
- Sensitivity to mis-aligned defects

**Phased Array Instrument**
- Control panel including input and output sockets
- Fundamentals of equipment design and use.

**Scanning with phased array probes**
- Swept beams
- Linear scans
- Fixed beam scans
- Line scans – raster scans

**Calibration and checks**
- Checking probe elements
- Beam angles and offsets/index point
- Beam shape
- Basic interface options or panes
- Setup parameters

**Inspection**
- Inspection sequence
- Groupings
- UT settings

**Data acquisition controls and protocol**
- Data analysis view types
- Analysis tools
- Principles of data analysis
- Displays and display types – options available to customise these including echo-dynamic patterns B, C, D scan formats.
- Soft gain and thresholds including gating and DAC & TVG Curves
- Cursors and gates

**Reporting**
- Reporting and data file conversions available
- Saving files
- Procedures for verification of flaw existence and position
- Reporting
1.5 Learning outcome details

On completion of this module, the candidate will be able to:

Learning outcome 1

- Describe the principles of Phased Array Ultrasonics

Assessment criteria

a) Explain the physics of pulse echo Ultrasonics
b) Explain the process of beam steering.
c) Explain the process of beam focusing.

Learning outcome 2

- Describe the principles of Phased Array Inspections.

Assessment criteria

a) Explain Sector Scanning
b) Explain Linear Scanning
c) Explain suitable applications of each scan type.

Learning Outcome 3

- Describe inspection limitations.

Assessment criteria

a) Explain effect array dimensions on inspections.
b) Explain effect of probe frequency on inspections.
c) Explain method for ensuring adequate coverage.

Learning Outcome 4

- Demonstrate the principles and set-up, calibrate and use of PAUT equipment.

Assessment criteria

a) Set up and calibrate equipment to detect a specific component.
b) Use PAUT equipment to assess component defects.
c) Report results.

Learning outcome 5

- Describe methods for increasing accuracy of inspections.
Assessment criteria

a) Describe how component features and defects can affect UT results.  
   (Geometry, Orientation, Size, Backing Material)

b) Describe back-up methods for confirmation of results.

c) Describe how probe selection may affect accuracy.

Learning outcome 6

- Record results

Assessment criteria

a) Prepare a report on UT test results.

b) Record essential variables obtained during the UT test.

1.6 Delivery of the module

This module is practical in nature and may be taught by active participation, illustration, demonstration and description. The practical skills should be reinforced by instruction covering the relevant theory.

1.7 Examination requirements

Candidates will be tested by written and practical examinations.

Specific Exam

The specific exam shall be Phased Array Ultrasonic Inspection (Multi Sector). The written examination shall contain a mixture of multi choice questions and those requiring short written answers. Minimum number of questions shall be 20 multiple choice and 10 requiring short written answers. Pass mark 70%.
Practical Exam

Exam Samples:
1 off corrosion sample
2 off welds

Manual Phased Array Inspection

(i) Assembly and calibration of Ultrasonic Phased Array equipment.
(4 hours)

NOTE. The student will be required to carry out a full calibration without the use of previously saved setup files. If this part of the examination is satisfactory the candidate may proceed to the remainder, if not the examination will be discontinued.

(ii) Inspection of three off samples as selected by the examiner, comprising a combination of Plate, Pipe or Tee. The student will analyse the data on the instrument, and provide a report displaying the results in an indicated format, and showing the location and size of discontinuities present in the sample. The report shall contain information such as defect no, characterization, size and position from known datum’s. (1 hours 30 minutes each specimen.)

The minimum pass mark for the practical part is 70% overall, and 70% for each sample tested.

(Failure to detect and report a reportable discontinuity in any one sample will result in failure of this examination part).

Encoded Phased Array Collection

(i) Assembly and calibration of Ultrasonic Phased Array equipment.
(4 hours)

NOTE. The student will be required to carry out a full calibration without the use of previously saved setup files. If this part of the examination is satisfactory the candidate may proceed to the remainder, if not the examination will be discontinued.

(ii) Inspection of two off samples as selected by the examiner, comprising a combination of Plate, Pipe or Tee. The student will analyse the data on the instrument or on external device (laptop), and provide a report displaying the results in an indicated format, and showing the location and size of discontinuities present in the sample. The report shall contain information such as defect no, characterization, size and position from known datum’s. The report shall also contain, phased array images of all data collected and each discontinuity.
(1 hour each specimen.)

The minimum pass mark for the practical part is 70% overall, and 70% for each sample tested.
( Failure to detect and report a reportable discontinuity in any one sample will result in failure of this examination part).
1.8 Renewal

Upon completion of the first 5-year period of validity, PAUT testing qualifications may be renewed for a further five years, provided the certificate holder supplies, in a form acceptable to the certification board, documentary evidence of:

a) satisfactorily meeting the vision requirements of AS 3998 during the preceding 12 months;

b) continued satisfactory work activity relevant to the certificate of qualification without significant interruption.

1.8.1 If the criteria for renewal are not met, the individual shall follow the same rules as for initial certification.

1.9 Re-certification

Upon completion of each second period of validity (every ten years), or following a significant interruption, a new certificate of qualification shall be issued by the certification board for a period of five years on the basis of the following requirements:

a) the candidate provides evidence of meeting the vision requirements of AS 4635 during the preceding 12 months.

b) the candidate is successful in a practical examination, which includes the competences covered by this document.

1.9.1 If the Technician fails to achieve a grade of at least 70 % for each re-qualification test attempted, two retests of the whole re-qualification examination shall be allowed within 6 months. In the event of failure in the two permissible retests, the certificate of qualification shall not be issued and in order to regain certification, the individual shall follow the same rules as for initial certification.