

Abstract

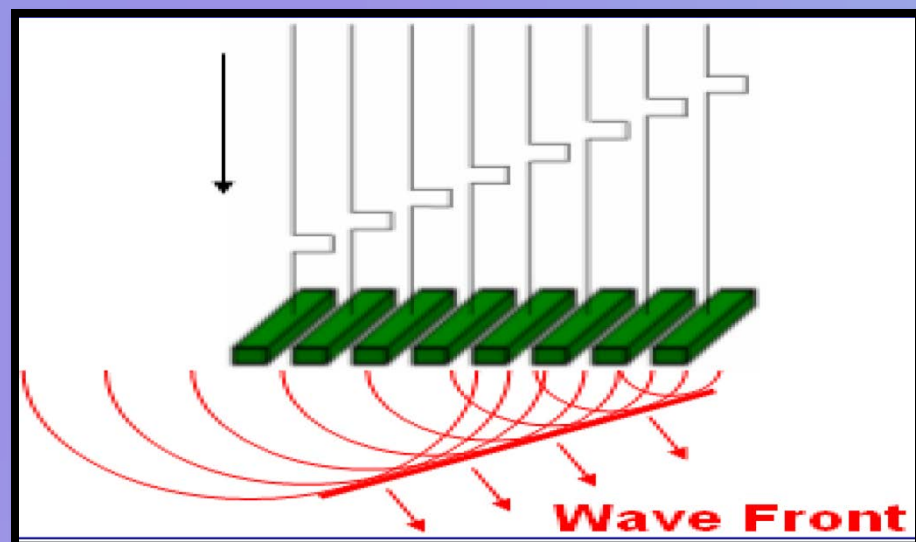
Ultrasonic testing is a proven reliable method which is able to detect and measure the size of defects in butt welds with acceptable tolerance. Recent advancement of technology has introduced a computerized technique which is phased array. Phased array employs focal law that enable focusing and steering of beam at the active aperture axis. This enables one line scanning but covering the whole weld volume as compared to conventional technique which employs aster scan and multiple probes to completely cover the whole weld volume. Phased array also gives multiple data view which assist the interpreter. This paper is about the study of these two techniques and technical analysis of comparison between the two. The conventional technique is performed using GE USM GO with 4 MHz 45 degrees shear wave probe. The phased array technique uses OLYMPUS OMNISCAN MX2 with 5L64 linear array probe with 16 elements aperture and 55 degrees wedge emitting shear wave into the specimen. Sensitivity of both techniques are based on 1.5 mm Side Drilled Hole. The results are compared and analysis such as defect sizing and defect type determination are performed.

Objective

1. To perform measurement of defect size in carbon steel butt welds using conventional UT technique
2. To perform measurement of defect size in carbon steel butt welds using phased array UT technique
3. To perform comparison of defect size between the two techniques

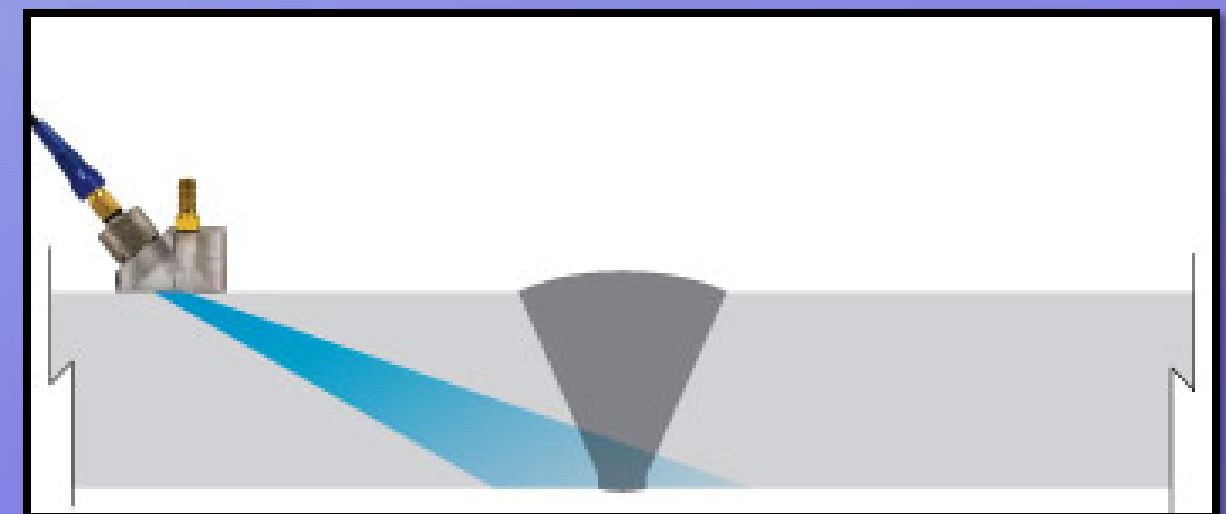
Phased Array Ultrasonic Testing

- Based on Huygen's – Fresnel principle
- Triggering of each individual piezo elements shall produce wavelets.
- These wavelets will form a wavefront.
- The elements are triggered at certain delay
- The direction of wavefront propagation depends on the delay law applied.



Conventional Ultrasonic Testing

- Widely used in industry
- Single element
- No beam steering capability and scan to be performed using multiple angle probes
- Takes longer time during inspection
- No permanent record



Methodology

Specimen configuration

Specimen	Weld configuration	Plate thickness
Plate 1	Single v butt weld	12 mm
Plate 2	Single v butt weld	15 mm
Plate 3	Double v butt weld	25 mm

Phased Array Ultrasonic defect size measurement

- Equipment : Olympus MX2
- Probe : 5L64-A12
- Array type : Linear
- Pitch size : 0.6 mm
- Active element : 16
- Active aperture : 10 mm
- TCG : 80% FSH
- Sensitivity reference : 1.5 mm SDH
- Sectorial angle : 45° to 70°
- Sizing method : 6dB drop

Conventional Ultrasonic defect size measurement

- Equipment : USM Go
- Probe : 45°, 60° and 70°
- Crystal layout : Single
- Probe size : 4 mm x 8 mm
- Sensitivity level : DAC at 80% FSH
- Sensitivity reference : 1.5 mm SDH
- Type of scanning : Lateral and horizontal
- Sizing method : 6dB drop

Results

Specimen	Type of defect	Length Conventional UT (mm)	Length PAUT (mm)
Plate 1	Lack of root penetration	15	18
Plate 2	Slag Inclusion	22	28
	Toe crack	14	8
Plate 3	Toe crack	14	17
	Toe crack	16	18

Conclusion

No significant difference in defect length between phased array ultrasonic and conventional ultrasonic. However, further study with more number of specimens is needed to allow statistical analysis to be performed



Inspection using Phased Array Ultrasonic



Inspection using Conventional Ultrasonic