

## Conventional UT vs. Phased Array UT

### What You Need to Know About Ultrasonic Testing

Ultrasonic testing (UT) is a non-destructive inspection method used on Oil Country Tubular Goods (OCTG). Both conventional and phased array inspections provide near full-length coverage of tubular goods in accordance with American Petroleum Institute (API) specifications.

The biggest difference between conventional UT and phased array UT is the transducer. Conventional UT's use single-element transducers or paired element transducers, one for transmitting and one for receiving, to generate and receive ultrasonic sound waves. Phased array UT transducers have 16 to 256 individual elements, a substantial increase. With computer controlled firing of element groups, focal depth, incidence angle, and the very physics of the inspection process can differ between these two NDT techniques.

Conventional UT has mechanically fixed inspection parameters, each inspection configuration has a fixed focal point and fixed incidence angle. The focal point in the test material is the depth the inspection is performed, and is determined by the acoustic lens physically on the probe. The incidence angle is the angle the ultrasonic signal is emitted into the test material, and is mechanically determined by the wedge used to create the angle. Because both the focal point and the incidence angle are fixed parameters, determined by physical components, it can be difficult to optimize conventional UT's to detect expected flaws.

Phased array UT's solution to the difficulties inherent with conventional ultrasonic testing is to utilize multiple elements on a single transducer. This provides the inspection system flexibility to electronically control parameters such as focal point, inspection spot size, and incidence angle by pulsing elements in groups to create the desired beam shape (liner, focused, or sectorial). When groups of phased array elements are pulsed, the ultrasonic sound waves combine constructively and destructively to form software configurable wave fronts that provide versatility for phased array UT inspections that reflect off discontinuities.

For phased array units, beam shape configurations, known as focal laws, are how inspection parameters are fine-tuned. A single phased array transducer has multiple elements that can be divided into several transducers. This technology has greatly improved flaw detection and flaw visualization over conventional UT systems yet still preserves all proven means of defect sizing (i.e. amplitude comparison, dB drop, time of flight diffraction, and zone discrimination methods).

Patterson's phased array units have industry leading repeatability (accuracy) of  $\pm 1$  dB, and have proven both reliable and versatile since their inception in 2004. In addition to the inspection services provided by a conventional UT, Patterson's phased array UT units can measure the outer diameter (OD) and ovality of tubular products.

In general, PTS's phased array UT units are compatible with tubulars of the below characteristics. Please contact us regarding tubular goods outside this range.

Outside Diameter Range	2.375 in to 24 in (60.325 mm to 609.6 mm)
Wall Thickness Range	0.190 in to 2 in (4.826 mm to 50.8 mm)
Length Range	8 ft. to 48 ft. (2.4 m to 13.7 m)
Material	Carbon Steel, Chromium Alloys (Cr 13)

### References:

1. <http://www.olympus-ims.com/en/ndt-tutorials/phased-array/>