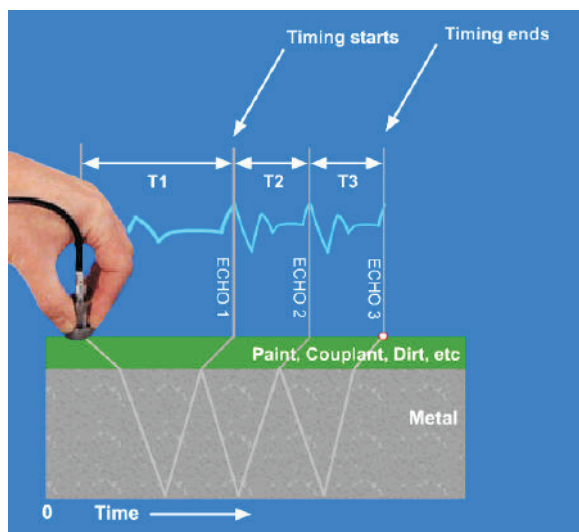


Multiple Echo Technique

HOW IT WORKS

The following is a brief explanation of how the multiple-echo technique works in Cygnus gauges. The instrument is basically a sophisticated timing device that measures the time between echoes of sound. The first pulse of sound is sent into the metal and the instrument then waits for the return of the first echo. When this echo comes back, the clock is turned on. Upon the return of the second echo, the time elapsed is recorded in the memory of the instrument. Simultaneously the gauge begins to time the third echo. The gauge then looks to match the timings between the second and third echoes. If these timings match, exactly, the gauge will display a measurement. By matching the second and third timings, verification is made that the sound is coming from the same back-wall reflector. The measurement displayed is in fact a true and accurate thickness measurement. If the timings do not match, no measurement is displayed thus no false measurement. We would rather give a "non-reading" than a "false" measurement. A "non-reading" is an indication that a problem is present in the steel such as internal corrosion, inclusions, cracks, etc. **Displaying only a true and accurate measurement is one of the many advantages to using the multiple-echo technique.**



The 'multiple echo' beam travel is depicted left, spread out for time, to illustrate the timing method. The beam path is in fact straight, at 90 Degrees to the surface, and the ultrasonic energy reverberates up and down within the metal. Each time the echo is reflected back down, a small portion of the energy comes up through the coating, striking the probe which now acts as a receiver.

The delay between echoes at the probe face is exactly equal to the time taken to pass through the metal twice, therefore coatings such as paint are ignored and the measurement displayed is of the metal thickness only.

ADVANTAGES OF MULTIPLE ECHO

The most **obvious** advantage of using the multiple echo technique is that coatings, such as paint or epoxy, do not have to be removed and the thickness will not be included in the measurement displayed. Cygnus gauges can read through coatings up to approximately 6mm (0.24") thick. Also with deep-coat function, Cygnus gauges can read through up to 20mm(3/4 inch) thick of coatings.

The **major** advantage of using multiple echo is the ability to match the second and third echoes, and verification that the sound is coming from the same backwall reflector and the measurement is truly accurate to +/- 0.1 mm (0.005") or +/- 0.05mm (0.002"). Another advantage is that the Cygnus gauge uses a single transducer probe with a straight up and down beam path. This is extremely useful when attempting to measure a curved surface (ie: pipe). The probe need only be perpendicular to the curved surface and measurements can be taken down to about a 25 mm (1") diameter pipe with the 13mm (1/2") probe. The probe can be in any orientation on the curved surface with no effect on the measurement. 6mm (1/4") probes are available for measuring diameters less than 25mm (1").



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