



Asset Care Counts

December 2015

Understanding the Condition of Your Critical Bolts

Bolts and fasteners are typically one of the lowest cost items in any structure, and are often neglected as part of an integrity management or maintenance strategy, partly because there has not been available an effective quantitative inspection method, and partly because of the "out of sight out of mind" syndrome.

Failures of bolts have occurred in the past and as a result have become a significant cause for concern in operating structures.

One of the main concerns is failure due to corrosion since it often occurs in areas where visual assessment cannot be made.

Since the most common form of corrosion damage is gradual necking of the bolt, traditional zero degree probe ultrasonic scanning from the bolt end fails due to the lack of reliable reflectors from which to assess thickness or diameter loss.

ALS Industrial has developed and optimised the use of phased array technology for the inspection of bolts, providing a highly efficient screening tool for assessing corrosion in bolts as well as other defects.

The problem - Failure of Bolts Embedded in Cement / Concrete

The inspection of anchor fasteners, embedded in concrete or grout, has been the focus of the ALS approach. Typically hold down bolts for Vessels, Towers, and Columns etc...as found in most process plant

Two corrosion damage mechanisms typically operate simultaneously in these circumstances, these being:

- **Crevice corrosion** (from fluid entering crevices in the bolted joint); and
- **Galvanic corrosion** (from the cell created between the embedded and exposed steel).

Other mechanisms i.e. cracking in the thread area can in most cases be found using normal zero degree pulse echo ultrasonic techniques, however corrosion related failures mostly occur at the concrete/air interface as well as in areas where the concrete has degraded, and area up to 300mm in depth from the bolt end. (see Figure 1 below). These areas require a totally different inspection approach.

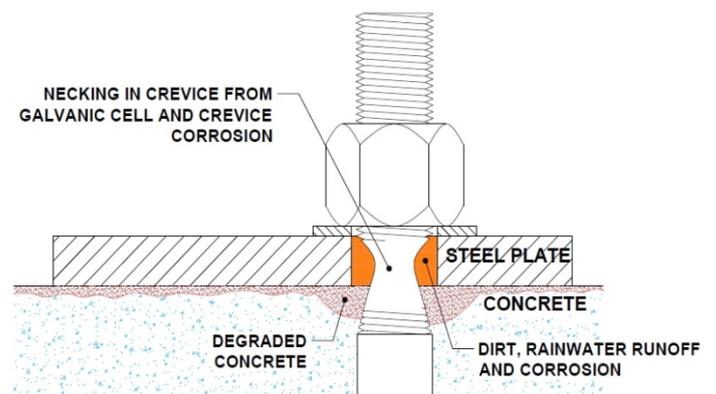


Figure 1 - Typical corrosion necking of an embedded steel bolt

The Solution – Cost Effective Phased Array Ultrasonic Testing

Phased array UT provides an improved solution over traditional ultrasonic scanning. The probe array provides a multitude of signals which are decoded to create a representation of wall thickness loss in the bolts where manual ultrasonics fails.

The method also provides an efficient technique with more bolts inspected more reliably per working hour than can be achieved with traditional techniques.



Figure 2 – Corroded Bolt Inspection by PAUT

By using phased array ultrasonic technology, a significant step forward is made in the provision of accurate and reliable inspections of bolts while in-situ, and has shown to be an excellent screening

method for detection of corrosion in the common areas of interest as indicated above.

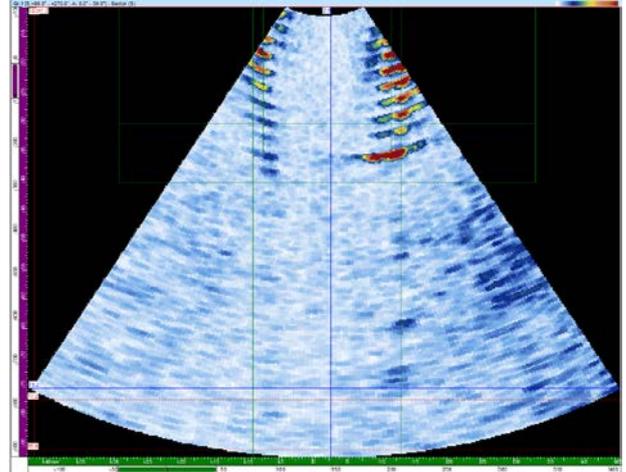


Figure 3 – PAUT image showing the location of threads and artificial defects for the purpose of this test. The technique represents an excellent screen

Our Advanced Inspection Team

ALS Industrial has a dedicated advanced inspection team utilising techniques such as phased array to progress the quality of inspection delivered. Through our level III staff, we have the ability to develop specific inspection techniques, we use purpose built jigs where required, as well as encoded scanning to solve the most challenging inspection tasks.

As always our specialist staff are supported by our extensive group of Inspection technicians, condition monitoring technicians, materials and mechanical engineers.

For your in-situ bolt inspection, please contact: assetcarecontactus@alsglobal.com

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