PISTON INSPECTION SOFTWARE FOR AL-FIN INSERT DIESEL PISTONS

The Al-Fin bond is a bond between an aluminium alloy and a ferrous metal. The actual bond area is an alloy of iron and aluminium that has an intermediate chemical composition, of approximately $FeAl_3$; it is this area that is to be inspected. In diesel engine piston, this Al-fin process is used to bond an iron insert in the position where the top piston ring groove will be machined. This is necessary because of the high compression ratio of a diesel engine, compared to that of a gasoline engine and therefore the stress on the top ring groove is that much greater. This piston inspection software provides the capability of inspecting the Al-Fin bond using ultrasonic instrumentation. See the reverse of this brochure.

Inspection of top, bottom bonds using pulse echo of through transmission.

Inspection of back bonds and crater cracks.

Measurement of oil cooling gallery position.

Cummins approved automatic threshold algorithm.

Has operator and supervisor modes of operation.

Applies an automatic gage R&R procedure to ensure system calibration traceability.

Supports up to 8 ultrasonic channels.

Insight NDT

Telephone
+44 (0)1981 541122

Fax
+44 (0)1981 541133

Email
Sales@InsightNDT.com

Web Site
www.InsightNDT.com

Insight NDT Equipment Ltd
The Old Cider Mill
Kings Thorn
Herefordshire
HR2 8AW

Directors
Mark Willcox BSc (Hons)
Jiang Li BSc (Hons)

VAT Registration No.
771 3060 50

Registration No.
4198815 England

Registered Office
21 St Owen Street, Hereford,
Herefordshire HR1 2JB

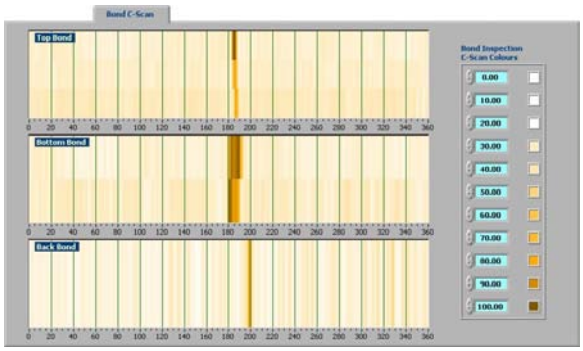
The piston inspection software, allows the use of up to 8 Ultrasonic channels, to test different features associated with diesel engine pistons, which have an Al-Fin bonded iron insert or oil cooling gallery.

The main screen has a number of tab pages, which allow viewing of the data for the desired feature and the setting of the user defined acceptance parameters for that feature. The system has a nominal resolution of 0.05% of the piston circumference, but displays the results to 0.1%.

Bond Inspection

This software allows for the inspection of the Top, Bottom and Back bonds simultaneously. Also more than one channel may be inspecting the same bond to ensure that as much of the bond area is covered as possible.

The result of an inspection is displayed as a strip chart with the defect length calculated as a percentage of the piston circumference, as shown on the front of this brochure and in the form of a C-Scan.

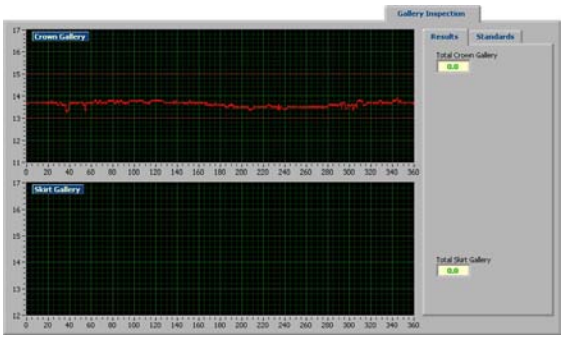


Each line in the C-Scan image is a different channel; therefore in the above case there are 3 channels assigned to the Top bond inspection, 2 channels for the Bottom bond inspection and a single channel for the Back bond inspection.

Gallery Inspection

In addition to the bond inspection the software allows for the measurement of the gallery position. The results of these measurements are shown on a strip chart for channels that have been assigned to the Crown or Skirt Gallery measurements and in the form of a C-Scan.

The gallery position measurement is compared to the user defined tolerance, also shown on the strip chart; the area outside this tolerance band is calculated as a percentage of the piston circumference and also displayed.



Automatic Threshold

The automatic threshold algorithm calculates the threshold to be applied to data from each of the channels not assigned to the gallery position measurement.

It is entirely possible that different threshold levels will result for different channels, since the threshold itself is based on the data set for its respective channel. This has obvious advantages over the traditional fixed threshold approach. In that the sensitivity on each channel is constant and independent of the ultrasonic Instrument gain for that channel. Therefore, it essentially eliminates errors due to incorrect setting of the Ultrasonic Instrument by an operator.

In piston inspection systems it is possible to get different effects on the raw data captured from the Ultrasonic Instrument, it is made up of two frequency components.

A low frequency component normally associated with the tilt of the iron insert. The chart below shows this low frequency effect, where the raw data signal is cyclic in nature for 360° rotation of the piston. And a high frequency component, which results in the signal randomly, fluctuating. The chart below illustrates this high frequency fluctuation, on a typical piston. The chart below shows the result of applying the algorithm to the first chart above. It shows both the low and high frequency components being removed and a threshold of 52.4% calculated.