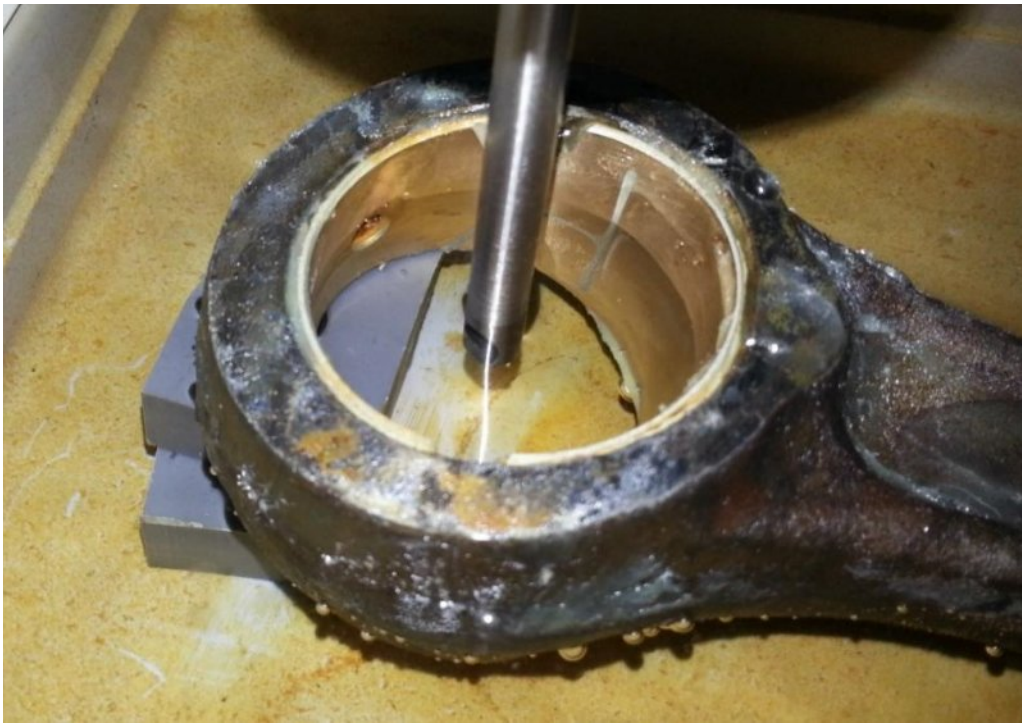


Immersion Ultrasonic imaging of Connecting rod small end bush interface
A Dhvani Research Application Note

DHVANI RESEARCH
Making Technology Work
www.dhvani-research.com

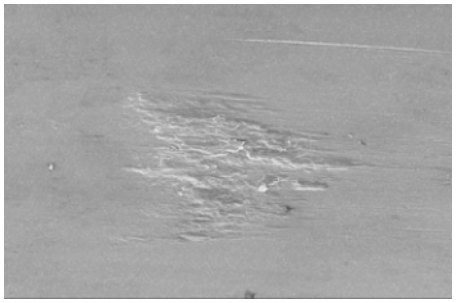
25 September 2013

# NDT OF AUTOMOBILE COMPONENTS

## NON-CONTACT WATER COUPLED ULTRASOUND NDT SOLUTION

The connecting rod has a number of important design features and many of these are associated with the design of the small end. The primary function of the connecting rod is of course to transmit the power of the reciprocating motion of the piston to the rotating crankshaft. The small end must provide sufficient bearing area to transmit the forces due to combustion and also to withstand the forces due to rapid deceleration of the piston assembly at top dead center. The bearing is commonly a bush of a bronze material which is a shrink-fit in the small end of the connecting rod. The bearing needs to be lubricated and the bush therefore often carries oil grooves to facilitate the flow of oil around the piston pin. The fitting of the bush itself may cause problems, especially in special connecting rods a number of surface treatment processes has been used on both the bush and the con rod in an attempt to overcome the problems of galling as the bush is fitted. The stress caused by the interference fit of the bush must be taken into account when calculating the stresses around the small end. Galling is a form of wear caused by adhesion between sliding surfaces. When a material galls, some of it is pulled with the contacting surface, especially if there is a large amount of force compressing the surfaces together. Galling is caused by a combination of friction and adhesion between the surfaces, followed by slipping and tearing of crystal structure beneath the surface. This will generally leave some material stuck or even friction welded to the adjacent surface, while the galled material may appear gouged with balled-up or torn lumps of material stuck to its surface.

## IN THIS ISSUE

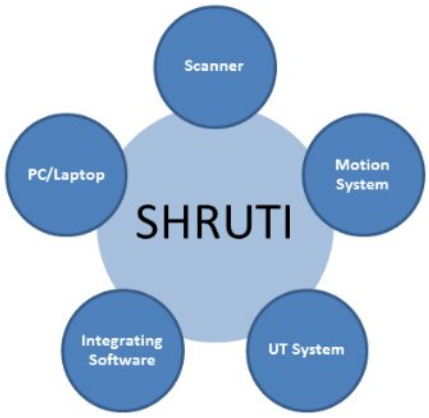


A typical Microscopic image showing Galling

This problem of galling while fitting the small end bush will give rise to non-contact zones or lacking proper contact zone along the circumference of the small end bush leading to localized mechanical and thermal stresses which causes catastrophic problems in the long run of the engine. Our solution for the problem is a high resolution scanning of the connecting rod-bush interface at the small end to give quantitative and detailed report on the percentage of non-contact giving sufficient space for decision making whether to reject or accept the component before releasing it to the final client.

SHRUTI® (Scanning High Resolution Ultrasonic Testing and Imaging) is a DHVANI RESEARCH developed customizable, automated, multi-axis robotic scanner. Along with an advanced ultrasonic inspection instrument, advanced data analysis (*extut*®)) and image analysis package (*imagine*®), SHRUTI provides for the easy inspection of samples and components.

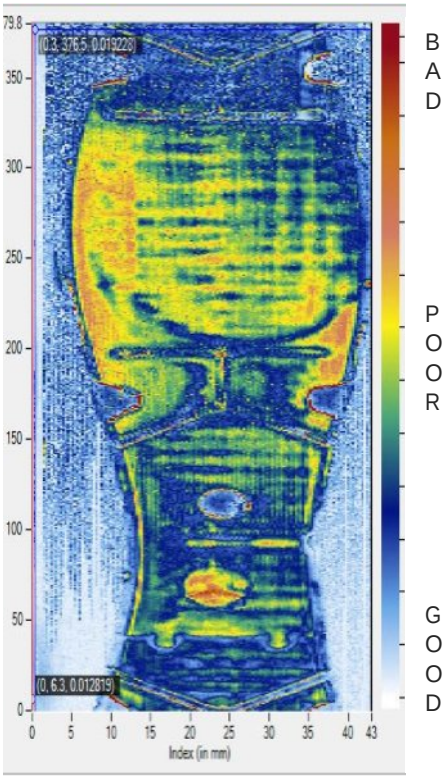
SHRUTI® (Scanning High Resolution Ultrasonic Testing and Imaging) offers very high resolution image of the test coupons with very high scanning speeds. The complete instrument control is through the software. Skeleton of the system is being built from lightweight aluminum extrusions which are upgraded to Stainless Steel for heavy duty applications. All the electrical connections are rugged and properly routed following industrial standards offering very durable and reliable running.




Robust Hardware

## TYPICALCONNECTING ROD INTERFACE SCANNING UT IMAGES

The interface scanning is carried out in the SHRUTI Scanner with a side looking transducer of frequency 10 Mhz in pulse echo mode. The scanning resolution was maintained at a 0.3 deg for rotary scan axis and 0.3 mm for the linear index axis. Red indicates high amount of reflection and blue indicates less amount of reflection. Wherever there is less contact there will be high reflection as less energy will only be coupled to the next medium.




# Advantages Of Immersion Scanning

Immersion scanning has distinctive advantages over other modes of scanning. The first one being the efficiency and the consistency in coupling the energy from the transducer to the test coupons. As constant water column is always maintained between the transducer and the test coupon which always ensures that the same amount of energy is always impinging on the sample surface giving point by point accuracy in the results. Another one is as the impedance mismatch between the components and water is less it enables high transmission coefficients to the sample

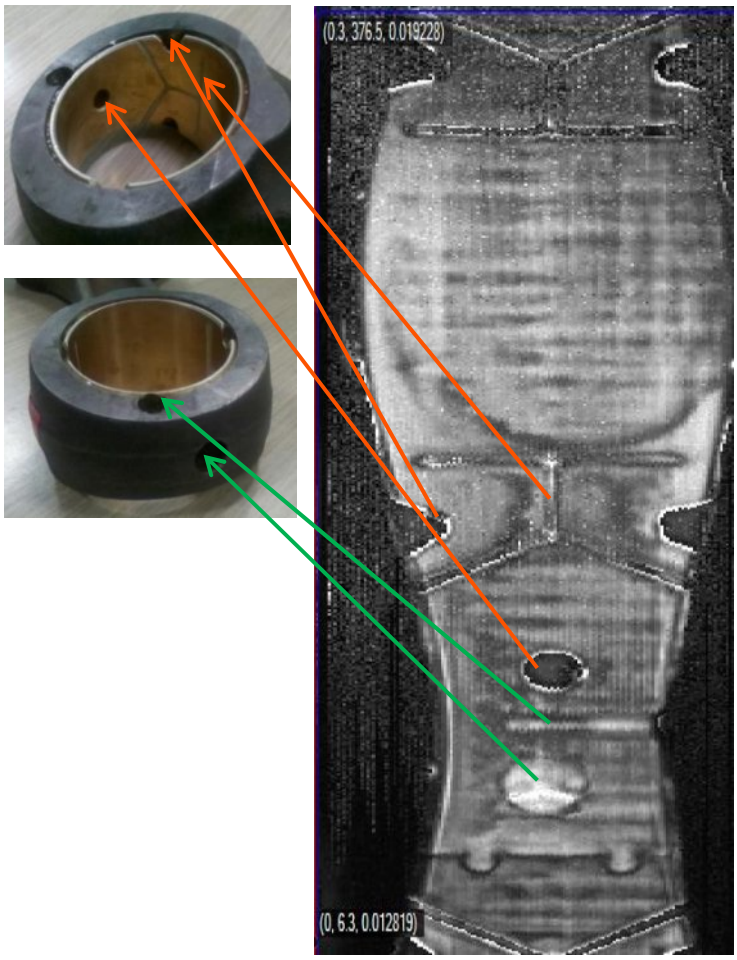
## IMMERSION SCANNING UT IMAGES

The image shown below is of an immersion scanning carried out on a 5 rupee and 10 rupee coin using a 15 Mhz transducer in pulse echo mode. The image plotted is a front wall gated C Scan

# Immersion Ultrasonic imaging of Connecting rod small end bush interface

A Dhvani Research Application Note

Chennai, INDIA




Features which were already present in the sample by design

Artificially induced defects for calibration purposes to introduce non-contact between connecting rod and bush

Typical Immersion Ultrasonic Image obtained on a Connecting Rod small end – bush interface with programmed defects.

For more information please contact:
Ms. Sujatha Chakravarthy
Managing Director
Dhvani Research and Development Solutions Pvt Ltd.
01J, First Floor, IITM Research Park,
Kanagam Road, Taramani, Chennai 600 113 INDIA
Email: sujatha.c@dhvani-research.com
Tel/Fax: +91-44-6646-9880

DHVANI RESEARCH
Making Technology Work
www.dhvani-research.com