DEFECT EVALUATION OF COMPOSITE BARRELS USING IMMERSION ULTRASONIC SYSTEM

DHVANI RESEARCH
Making Technology Work

Composites are well known for their excellent strength and stiffness properties. Composites have now replaced many light metal alloy components since they are lighter and have lower maintenance.

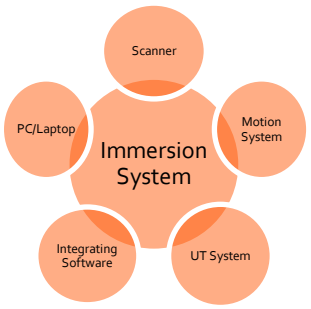
The essential part of a shoulder-fired rocket launcher is its barrel which holds the ammunition. With the recent developments, this barrel has been made several times lighter by using composite windings over the metal base in place of using a whole metal barrel. Astringent inspection of these barrels becomes very important being a handheld high accuracy weapon. The defects are generated either during the production of equipment or in the course of the normal service life of the equipment. During the life cycle of the equipment, it has to experience a working temperature of about 3450 K and the shots will be proceeded at a muzzle velocity of 6000 ft./sec.

Ultrasonic immersion scanning is widely accepted as a technique for finding the dimensions of the damage in the composite samples. The easiness of setting the sample, automatic report generation, speed of inspection, and reliability of results are the key features of the ultrasonic immersion technique.

The system used for the inspection is an indigenously developed customizable, automated, multi-axis scanner that allows the simultaneous collection of Pulse echo (PE) and Through Transmission (TT) data. The machine is capable of operating in a go-no-go mode, which has a minimum user intervention, or in a manual mode which allows an experienced user to experiment with various UT parameters. The system also consists of an advanced data acquisition software and post-processor allowing a layer-by-layer

analysis option to analyze between various composite layers.

The system consists of four axes X, Y, Z, and a Roller. X and roller axes are motorized while the other axes are manual. Manual angulations to the probe are provided for the probe normalization concerning the sample. The probe is connected to a fixture that is fixed on the X-axis. The fixture is made similar to the shape of a tuning fork, so that probe holders can be attached to both legs of the fixture and among the two legs, one will go inside the hollow barrel and the other outside the barrel.



The barrel is placed on the motorized rollers and the transducer is introduced into the sample with the help of the X-axis. The C-scan image is developed by setting X-axis as the index axis and the Roller as the scan axis and the inspection method can be chosen based on the user's interest.

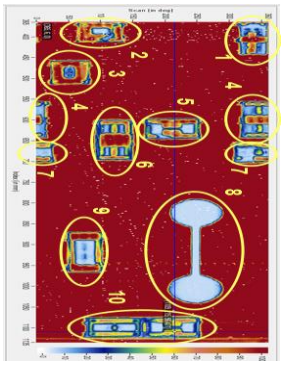
Rocket launcher

Courtesy: Gun and Shell Factory, Cossipore

If the Pulse-Echo method is used, then one probe is only required, so the user can use the transducer inside the barrel or the one outside the barrel as required. In the through-transmission technique, two separate probes are used for transmitting and receiving the ultrasonic energy. The probes are placed on the opposite side of the sample at equal distances. The signal from the good region is taken as a reference and gain is adjusted to attain good signals. In the damaged regions, the sound waves get scattered or return and sound energy reaching the receiver transducer will be less compared with the good region

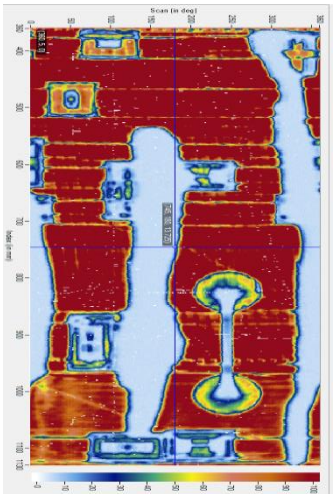
A defect-free standard barrel is used as the calibration standard. The ultrasonic parameters were so set to have 100% through a transmitted signal from the sample (except at regions having fitment brackets and handle; Marked in the picture below). The C-scan result is given below.

C-Scan Image of Standard Sample With Fitments and Brackets Marked



At every point on the sample, except the regions with fitment brackets and handle, the through transmitted signal has stayed at a constant 100%. The system employs automatic defect-finding algorithms to avoid the artifacts and has an automatic reporting feature. The system employs one press operation from a single user interface

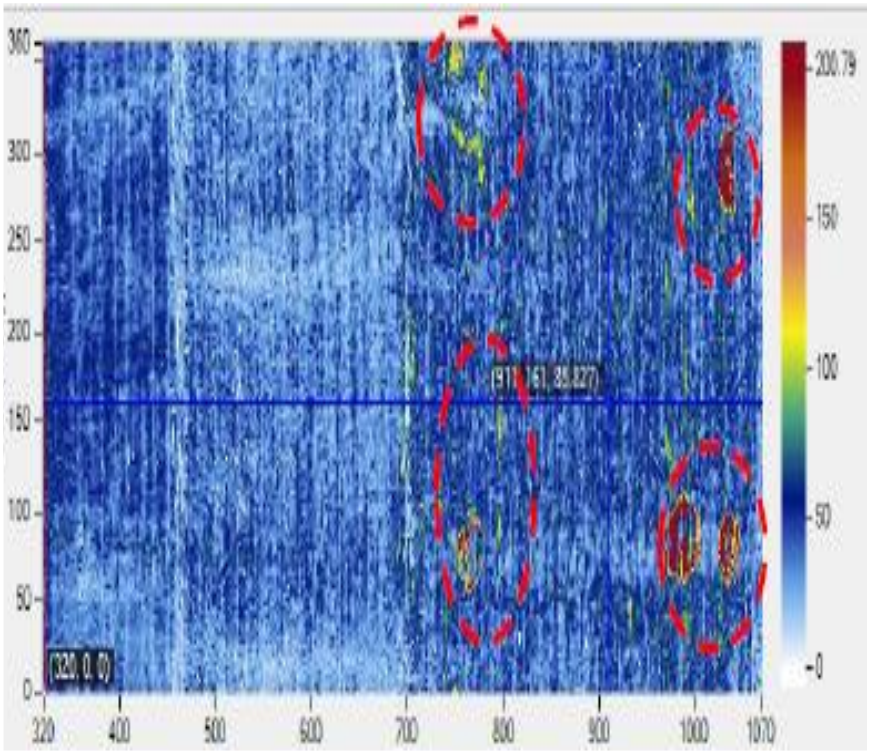
C-Scan Image of a Bad Sample



Defect evaluation of composite barrels using immersion ultrasonic system

A Dhvani Research Application Note

Chennai, INDIA



Inspection C-scan image showing defect on the composite sample by Pulse-Echo method

For more information, please contact:

info@dhvani-research.com

+91-44-6646-9880

No.10 Veeramamunivar street,
C.B.I Colony 2nd main Road,
Kandanchavadi, Chennai 600096 - India.

DHVANI RESEARCH
Making Technology Work