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# MODERN NON-DESTRUCTIVE TESTING TRENDS IN THE SHIPPING INDUSTRIES

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The Shipping Industry require new trends and techniques in Non-Destructive Testing as compared with the present trends in Ultrasonic Thickness Gauging Surveys, and Wire Rope Testing of Cranes, Derricks, Container Vessels and much more. This article covers the latest trends in Non-Destructive Testing which can be used in the Shipping Industry for better reliability and integrity.

## A. ULTRASONIC THICKNESS GAUGING SURVEYS :

Ultrasonic Thickness Surveys on Ships were once carried out by drilling holes at random places wherever Plates were found to be thin down on Shell Plating, Main Deck Plating, Bulkheads etc. They were then tapped, plugged and welded. In this way the dangers were when the holes were forgotten to be welded the Ship had to go back into the dry dock for the hole to be plugged.

As time passed Ultrasonic Flaw Detectors and Digital Meters replaced the conventional old methods of drill test and the Plates of the Ship were Ultrasonically Thickness Gauged as per the classification surveyor attending. Finally Ultrasonic Thickness Gauging Survey became mandatory with respect to IACS requirements and has been practiced till today.

The Ultrasonic Thickness Gauging Survey has to be reported on TM1.. .. .. .. .. .. TM7 forms in a procedure prescribed by IACS. Drawings of Shell Expansion Plan, Main Deck and other structural members made on AutoCad or Manual drawings of A4 size includes TM forms which show average diminutions and Minimum Allowable Diminution (M.A.D) in a format. The complete general and close up surveys includes Thickness Measurement taken by Digital Thickness Metre at random places on a ship structure and recorded in black and white format. The spreadsheet forms TM1.. .. .. .. .. .. TM7 includes Ultrasonic Thickness readings percentage, Corrosion Loss, Average Diminutions, Minimum Allowable

Diminution etc.

The Ultrasonic Thickness Gaugings taken on structural members on a ship by means of a Ultrasonic Flaw Detector or Digital Meter or Ultrasonic coating Thickness meter are random thickness readings taken manually and physically feed into the computer TM1.. .. .. .. .. .. TM7 forms accordingly. The TM forms which are spreadsheet format are programmed by the software automatically and present the corrosion average diminution of a structural member with respect to the original thickness of a member and the Minimum Allowable Diminution (M.A.D) given by the classification society.

The Ultrasonic Thickness readings taken by any Ultrasonic Thickness Gauge are physically randomly taken for example forward middle aft of a plate with respect to physical corrosion noted by hammer tapping. Hence the complete plate information is not available. Only random information about the plate. There is also a possibility of serious pitting on the other side of the plate being totally missed out.

The new Ultrasonic Technique / Magnetic Flux Leakage System Scans the complete plate in bands which includes all thickness readings and 'C' Scan view giving information to the surveyor in colour and in digital thickness printout of a plate, be it heavy pitting or gradual wall loss. The complete Shell Plating is Scanned from outside, Plate by Plate and without removal of any coating nor any Ultrasonic couplant. The reports are all in colour and percentage corrosion loss or thickness slices are colour coded. Thus the chances of missing out any corroded plate or pits can be narrowed in for cut outs, inserts and repairs marked. The inner structural members can be physically gauged from inside by spot checks only of the vessel but the thickness readings are data logged in the Ultrasonic Digital meters with respect to the structural identification members and IACS format. All thickness readings are presented in colour only. This system is tamper proof and thicknesses readings cannot be modified. A large amount of thickness data can be stored in a spreadsheet thickness format in colour as per IACS format. Hence being very easy to detect Corrosion, Erosion, Pits, Low Percentage Corrosion Loss in colour which in common black and white spreadsheet format would be very difficult and time consuming , eye strenuous to identify and corrosion can be missed out. Localized pits or gradual wall loss after wards to find that the area was highly, corroded, pitted and holed.

The specialized Ultrasonic software can store large amount of ships Ultrasonic Thickness data in IACS format of the complete ship for more than 5 years and ships repairs can be safely planned in a timely manner. This new technique can be put into practical application in two different ways mentioned below :

i)Magnetic Flux Leakage (MFL) for complete Shell Plating from outside, Main Deck Plating Inspection at high speed per each Plate backed by MFL / Ultrasonic 'C' Scan technique.

ii)Conventional Ultrasonics for inner structural members with Data Logging System reporting as per IACS requirements in colour and Mass Data Storage maintained per each ship for 5 years.

The above two NDT Techniques can be selected once the approvals from the various classification society's are acceptable to make the new trends in Non-Destructive Testing economically, viable and affordable by various NDT companies

## B. FERROUS WIRE ROPE TESTING :

Ferrous Wire Rope Testing on Ships, Cranes, Container Vessels, Derricks have always been a major problem of Inspection. The practice still followed till today is 1 ? times load test which includes the Crane hooks the Pins, Wire Ropes and all Associated machinery.

To check for any physical external Wire Breakage on the Wire Rope the conventional Jute and glove technique has only been successful till today. The Wire Rope is passed through the Jute been encircled by the hand glove and the Wire Rope is made to move slowly or the hand is moved over the Wire Rope. If a wire strand is broken externally the Jute sticks to the strands and visually the Inspector evaluates the number of wires broken. Based on this decision and after finding out the cross section of the wire rope physically, the wire rope is accepted or retired accordingly. The method is extremely slow very laborious time consuming and totally dependent only on load test. However if the core or internal strands due to load test corrosion or erosion is internally broken. It is not possible to identify the integrity of the rope. Sometimes the wire rope is also based on number of hours of operation and the load used until a major disaster occurs or the rope is retired. Usually a good wire rope is discarded due to safety reason or operation hours, as till today no method of wire

rope inspection other than visual or load testing exist.
New ropes while being uncoiled on to the crane drum can be permanently damaged by kinks if proper safety measures are not taken and inspected properly. A tight kink unnoticed would have damaged the complete length of the rope permanently with broken core or strands.

The various configuration of Ferrous Wire Rope are enormous and they vary with respect to diameter, load, number of strands, lay of rope, right lay, left lay, diameter of core, diameter of each strand, cross sectional area, loading factor etc. As time passed the material load strength, diameter, cross section started varying enormously yet the techniques of Inspection Jute glove and load testing still remained.

The new computerized ferrous wire rope testing has outdated the conventional old methods and uses the state of the art instrument which Non-Destructively simultaneously measures Loss of metallic cross sectional area (LMA) of the rope and detects Localized Faults (LF) such as Broken Wires, Pitting, Corrosion, Splicing etc. Thus it is possible to conclude whether to remove the rope and if it meets the retirement criteria or avoid extra expenses when the rope is in good condition.

The new ropes, service ropes on Cranes, Derricks can be Inspected from 6 mm to 64 mm dia meter of various Ferrous Wire Rope configuration and sizes using various magnetic heads and wire rope speed of up to 1 to 2 metres per second.

The wire rope testing unit consists of a permanent magnetic head with Hall Sensors and the wire rope is made to pass through the magnetic head at a constant speed up to 1 metre per second. The magnetic head with the encoder is connected to hand held unit which is battery operated and stores large amount of data of the complete length of the wire rope. The hand held unit is then brought from the field and data transferred on to a Laptop computer for complete automatic analysis of cross sectional area LMA and localized faults (LF) of broken wires giving accurate information of defects present in terms of distance in metres.

The state of the art instrument is portable and battery operated and can be used in very difficult environmental, hazardous, dangerous conditions and is intrinsically safe.

At present the system is the best in Ferrous Wire Rope Testing and is suitable for inspection of various diameter, length, cranes, derricks, oilrigs, Gantry cranes and` numerous inspection wherever Ferrous Wire Rope and slings are used. The unit is available is India for demonstration.

**CONCLUSION :**

Shipping is so global and the technical application so varied that almost every as pect of NDT is applicable. More and more challenges are thrown up as diverse avenues as deep Sea mining, cable laying, gas pipelines, optical fibre cabling etc., requiring very stringent measures in NDT. Dangerous and highly corrosive cargoes, nuclear waste carriage etc. are other dimensions where NDT has become indispensable. As newer areas open up, NDT applications require both men and technology and hence it would remain as an ever demanding area in shipping for times to come.