University of Jordan

Non-destructive testing (NDT)

9

Properties of Engineering materials lab

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Safety

Safety is a state in which hazards and conditions leading to physical, psychological, or material harm are controlled to preserve the health and well-being of individuals and the community.

Before starting the experiment in laboratory, we must follow safety rules:

1. Put on protective clothing like lab coat, a pair of safety glasses and a pair of disposable gloves.
2. Do not taste or sniff chemicals.
3. Rings and jewellery must not be worn.
4. Long and loose hair must be contained.
5. Close fitting / protective clothing must be worn.

Objectives

In this experiment, we will use three of the various NDT methods that may be used to test a specimen to check for flaws in a piece of metal (a steel tube): the magnetic particle method (Electro Magnetic Yoke), high frequency eddy current method, and ultrasonic unit (Ultrasound test).

Materials and Apparatus

MATERIALS :

- Steel tube
- Black magnetic ink
- Iron magnetic powder
- Aluminium and steel specimen
- Ferrous and non-ferrous specimens

APPARATUS :

- Electro-magnetic yoke
- Locater UH high frequency eddy current unit probes
- Ten-eleven SG ultrasonic unit and transducer

Experimental procedure

❖ Magnetic particle method (electromagnetic Yoke):

1. Clean inspected area of specimen with steel brush and wipe off with cloth.
2. Place yoke on test piece perpendicular to direction of suspected cracks.
3. Energize yoke magnetic field will form in test piece.
4. Apply magnetic ink or powder while yoke is still energized.
5. Indications will form immediately.

❖ High frequency eddy current method:

1. Connect probe required and set the frequency switch to match.
2. Set type of alarm condition required.
3. Set the metal selector-switch to match the metal to be tested
4. Set alarm level required.
5. Switch to “ON”.
6. Place probe on surface of sound part of the metal
7. Press the release “TRAIN” bottom, Lower L.E.D lights up, Raise probe until upper L.E.D lights. Lower probe to surface, raise probe again until upper L.E.D lights, lower probe to surface. “TRAIN” period is ended when both L.E.D’s are extinguished.

8. Movement upwards during “TRAIN” should be only a fraction of a (mm). Downward movement to the surface of the metal should be gentle.

9. Probes with flat ends should be held accurately perpendicular to the metal surface during the train procedure.

10. Ideally the probe should be raised and lowered about twice/sec during the train period, but this is not critical. After two or three cycles, the probe may be left resting on the metal until the train period is offer.

11. Ensure that left-off is compensated by raising the probe slightly by inserting a plastic spacer (0.1- 0.2) and check that meter deflection is less than 20% when sensitivity is set at 5. Now that GMH2 flat-end shielded probes will compensate only over very short distances, so lift-off is best checked by rocking the probe by say +/- 15 degrees.

12. The unit is now compensated for lift-off and will indicate surface breaking cracks. Sensitivity may be set by training on the calibration block of similar metal and setting the deflection of a given slot depth e.g., 80% deflection for 0.5 mm slot.

13. Move the probe lightly across the work piece surface, maintaining the probe approximately perpendicular to the surface of the sample.

14. A crack will be deflection by a sharp kick on the meter.

15. The meter deflection is at a maximum when the probe head is over the center of the crack. The magnitude of the deflection indicates the severity of the crack.

❖ Ultrasonic testing:

1. Connect transducer as a Tx “transmitter” or Rx “receiver”

2. Set gain required

3. Set range required

4. Turn on the unit

5. Set focus needed

6. Place lubricant “oil, water” on the surface of the workpiece.

7. Place transducer on surface of the metal

8. Move the transducer gently across the workpiece surface.

9. A discontinuity “crack, hole” will be indicated by a pip on the oscilloscope

10. The distance between the blips (pips) is proportional to the depth of the defects

Results and discussion

In this experiment we used three types of tests to detect defects in a piece of metal (steel tube) and ensure that it is free of defects without having to damage it. Therefore, these tests are called (nondestructive testing). This type is classified as follows:

1. The magnetic particle method (electromagnetic yoke).
2. High frequency eddy current method.
3. Ultrasound test.

As a result, we were able to inspect the same steel tube in three different ways without having to destroy it and dispose of or replace it at each test, thus reducing cost

Conclusion

This experiment aimed to assess the characteristics of a material, component, structure, or system for distinctive variations or welding faults and discontinuities without affecting the original part. In this experiment, we used three different sorts of tests to find flaws in a piece of metal (a steel tube) and make sure it is flaw-free without needing to harm it

References

❖References

- YouTube videos
- The manual
- Notes during the lab
- Wikipedia

❖ Technology

- Word