

**Eddy Current Level I Course Outline (40hrs)**

**NDT overview and certification requirements**

**Introduction to Electromagnetic Testing  
(Eddy Current/Flux Leakage)**

- a. Brief history of testing
- b. Basic principles of testing

**Electromagnetic Theory**

- a. Eddy current theory
  - (1) Generation of eddy currents by means of an AC field
  - (2) Effect of fields created by eddy currents (impedance changes)
  - (3) Effect of change of impedance on instrumentation
  - (4) Properties of eddy current
    - (a) Travel in circular direction
    - (b) Strongest on surface of test material
    - (c) Zero value at center of solid conductor placed in an alternating magnetic field
    - (d) Strength, time relationship, and orientation as functions of test- system parameters and test-part characteristics
    - (e) Have properties of compressible fluids
    - (f) Small magnitude of current flow
    - (g) Relationship of frequency and plane with current in coil
    - (h) Effective permeability variations when induced in magnetic materials
    - (i) Effect of discontinuity orientation
    - (j) Power losses
- b. Flux leakage theory
  - (1) Terminology and units
  - (2) Principles of magnetization
    - (a) B-H curve
    - (b) Magnetic properties
    - (c) Magnetic field
    - (d) Hysteresis loop
    - (e) Magnetic permeability
    - (f) Factors affecting permeability
  - (3) Magnetization - electromagnetism theory
    - (a) Oersted's law
    - (b) Faraday's law
    - (c) Electromagnetics

**Readout Mechanism**

- a. Meter
- b. Impedance plane
- c. LED bar graph
- d. Alarm, lights, etc.
- e. Numerical
- f. Marking system

g. Strip chart recorder

### **Types of Eddy Current Sensing Elements**

a. Probes

- (1) Types of arrangements
  - (a) Absolute
  - (b) Differential
- (2) Lift-off
- (3) Theory of operation
- (4) Applications
- (5) Advantages
- (6) Limitations

b. Through, encircling, or annular coils

- (1) Types of arrangements
  - (a) Absolute
  - (b) Differential
- (2) Fill factor
- (3) Theory of operation
- (4) Applications
- (5) Advantages
- (6) Limitations

c. Factors affecting choice of sensing elements (1) Type of part to be inspected

- (2) Type of discontinuity to be detected
- (3) Speed of testing required
- (4) Amount of testing required
- (5) Probable location of discontinuity

### **Applications for Eddy Current Testing**

- a. Aerospace
- b. Tubing inspection (power plant)
- c. Rod, wire, tube inspection (Manufacturing)

### **Types of Abnormalities detected by ET**

- a. Conductivity testing
- b. Crack detection (Surface and sub-surface)
- c. Corrosion detection
- d. Overheated structure
- e. Coating thickness
- f. Metal thinning

### **Practical demonstrations and exercises**

### **Eddy Current Level I End of course test and review**

*TEST NDT does not have any pre-requisites for attending any of our courses, it is entirely up to the attendee to determine whether the course is suitable for their needs and whether they are capable of achieving the standards. Please study the applicable course outline and decide if the course is suitable for your needs before enrolling, if in doubt, please contact us to discuss. For employer funded attendees, please discuss the suitability of any of the courses with your employers responsible NDT level 3 before enrolling.*