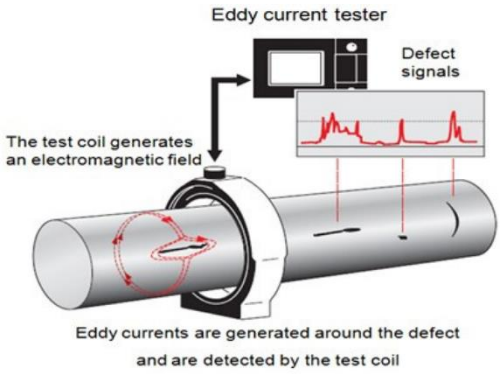
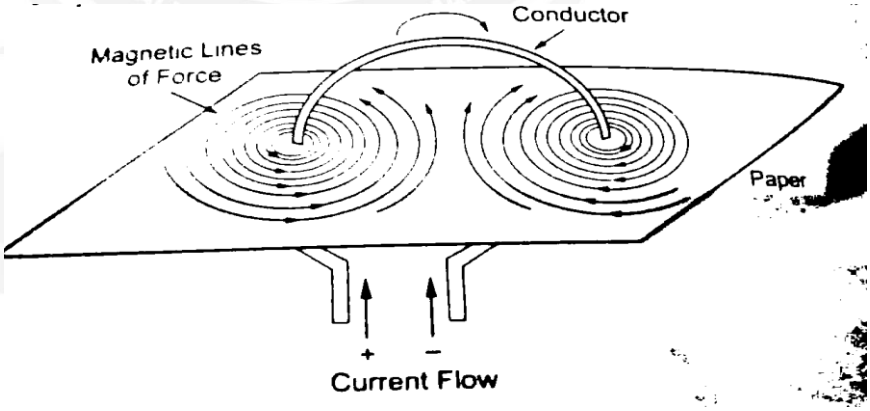
3.7 ELECTROMAGNETIC TESTING (ET) OR EDDY CURRENT TESTING

- This testing method uses an electric current or magnetic field which is passed through a conductive part.
- Eddy current testing uses an alternating current coil to induce an electromagnetic field into the test piece, alternating current field measurement and remote field testing both uses a probe to introduce a magnetic field, with RFT generally used to test pipes.



1. PRINCIPLE

- An electromagnetic inductor is used to generate a magnetic field. When this field is introduced in the surface of the test piece, it generates so called “eddy currents” in the material.



2. COMPONENTS OF EDDY CURRENT TESTING

- **Eddy probe (AC source, Electromagnetic coil, Display unit, Receiver coil, Exciting coil) –**AC voltage source for the purpose of the test can generate a primary electromagnetic alternating field. The exciter coil and the receiver coil normally have coil axes parallel to each other, so that the primary alternating magnetic field of the exciter coil induces an AC voltage in the receiver coil.

4. WORKING OF EDDY CURRENT TESTING

- When eddy current probe brought close to the testing material alternating current flows through a wire coil and generates an oscillating magnetic field.
- The electrical currents are called eddy currents because the flow in c at and just below the surface of the material. The Eddy Current gee new superposed magnetic field. This field is detected by a receiver coil.
- Interruptions in the flow of eddy currents, caused by Imperfection dimensional changes, or changes in the materials conductive permeability properties, can be detected with the proper equipment probs.
- Eddy current testing can be used on all electrically conducting material with a reasonably smooth surface. The figure shows the difference flawless and flaw surface with impedance graph.
- The test equipment consists of a generator (AC power supply), a test coil and recording equipment, eg a galvanometer or an oscilloscope
- Used for crack detection, material thickness measurement (corrosion detection), sorting materials, coating thickness measurement, metal detection, etc.

4. THE STRENGTH OF THE EDDY CURRENTS PRODUCED DEPENDS ON

- Electrical conductivity of the specimen
- Magnetic permeability (for a ferromagnetic specimen)

- Stand-off distance between the specimen and coil.
- AC frequency used in the exciting coil dimensions of the coil and specimen.

5.FACTORS THAT AFFECT EDDY CURRENT INSPECTION

- Material conductivity
- Permeability
- Frequency
- Geometry
- Proximity/Lift-Off
- Depth of Penetration
- Eddy Current Testing and Industry

6. ADVANTAGES

- Sensitive to small cracks and other defects
- Detects surface and near surface defects
- Inspection gives immediate results Equipment is very portable
- Method can be used for much more than flaw detection.
- Minimum part preparation is required
- Test probe does not need to contact the part
- Inspects complex shapes and sizes of conductive materials Able to detect surface and near-surface cracks as small as 0.5mm
- Able to detect defects through several layers, including non-conductive surface coatings, without interference from planar defects
- Effective on test objects with physically complex geometries
- Provides immediate feedback

7. LIMITATIONS

- Can only be used on conductive materials
- The depth of penetration is variable
- Very susceptible to magnetic permeability changes.
- Unable to detect defects that are parallel to the test object's surface
- Only conductive materials can be inspected
- Surface must be accessible to the probe
- Skill and training required
- Surface finish and roughness may interfere
- Reference standards needed for setup

- Depth of penetration is limited
- Flaws such as delamination that lie parallel to the probe coil winding probe scan direction are undetectable.

8.APPLICATIONS

- It is often applied for surface crack detection and material sorting. Materia sorting is used to ensure that the proper materials are component materials or assembly features (such as the orientation position of a subcomponent in an assembly).
- **Weld Inspection -** To scan the surface for open surface cracks on well caps and in heat affected zones.
- **Conductivity Testing** - Eddy current testing's ability to measure conductivity can be used to identify and sort ferrous & nonferrous alloy and to verify heat treatment.
- **Surface Inspection-** Surface cracks in machined parts and metal stod can be readily identified with eddy current.
- **Corrosion Detection-** Low frequency probes can be used to locate corrosion on second and third layers of metal that cannot be inspected ultrasonically.
- **Bolt Hole Inspection**- Cracking inside bolt holes can be detected using bolt hole probes, often with automated rotary scanners.
- **Tubing inspection** - Both in-line inspection of tubing at the manufacturing stage and field inspection of tubing like heat exchangers are common eddy current applications. Both cracking and thickness variations can be detected.