MAGNETIC TESTING

NDT METHOD

COURSE MATERIALS

Department of Mechanical Engineering

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Topical Outline MT – Level- I

1. Principles of Magnets and Magnetic Fields

a. Theory of magnetic fields
- (1) Earth's magnetic fields
- (2) Magnetic fields around magnetized materials

b. Theory of magnetism
- (1) Magnetic poles
- (2) Law of magnetism
- (3) Materials influenced by magnetic fields
  - (a) Ferromagnetic
  - (b) Paramagnetic
- (4) Magnetic characteristics of nonferrous materials

c. Terminology associated with magnetic particle testing

2. Characteristics of Magnetic Fields

a. Bar magnet

b. Ring magnet

3. Effect of Discontinuities of Materials

a. Surface cracks

b. Scratches

c. Subsurface defects

4. Magnetization by Means of Electric Current

a. Circular field
- (1) Field around a straight conductor
- (2) Right hand rule
- (3) Field in parts through which current flows
  - (a) Long, solid, cylindrical, regular parts
  - (b) Irregularly shaped parts
  - (c) Tubular parts
  - (d) Parts containing machined holes, slots, etc
- (4) Methods of inducing current flow in parts
  - (a) Contact plates
  - (b) Prods
- (5) Discontinuities commonly discovered by circular fields

b. Longitudinal field
(1) Field produced by current flow in a coil
(2) Field direction in a current – carrying coil
(3) Field strength in a current – carrying coil
(4) Discontinuities commonly discovered by Longitudinal fields
(5) Advantages of longitudinal magnetization
(6) Disadvantages of longitudinal magnetization

5. Selecting the Proper Method of Magnetization
a. Alloy, shape and condition of part
b. Type of magnetizing current
c. Direction of magnetic field
d. Sequence of operations
e. Value of flux density

6. Inspection Materials
a. Wet particles
b. Dry particles

7. Principles of Demagnetization
a. Residual magnetism
b. Reason for requiring demagnetization
c. Longitudinal and circular residual fields
d. Basic principles of demagnetization
e. Retentivity and coercive force
f. Methods of demagnetization

8. Magnetic Particle Testing Equipment
a. Equipment selection considerations
(1) Type of magnetizing current
(2) Location and nature of test
(3) Test material used
(4) Purpose of test
(5) Area inspected
b. Manual inspection equipment
c. Medium – and heavy- duty equipment
d. Stationary equipment
e. Mechanized inspection equipment
(1) Semiautomatic inspection equipment
(2) Single – purpose semiautomatic equipment
(3) Multipurpose semiautomatic equipment
(4) Fully automatic equipment

9. Types of Discontinuities Detected by Magnetic Particle Testing

a. Inclusions
b. Blowholes
c. Porosity
d. Flakes
e. Cracks
f. Pipes
g. Laminations
h. Laps
i. Forging bursts
j. Voids

10. Magnetic Particle Test Indications and Interpretations

a. Indications of nonmetallic inclusions
b. Indications of surface seams
c. Indications of cracks
d. Indications of laminations
e. Indications of lamps
f. Indications of bursts and flakes
g, Indicators of porosity
h. Nonrelevant indications