



Magnetic Particle Testing NAS 410 Revision 3 Level 1 and 2

Course Outline

1. Principles of Magnets and Magnetic Fields

- a. Theory of magnetic fields
 - (1) Earth's magnetic field
 - (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. Reasons 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 materials 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



Plumstead Quality and Training Services

Radiation Safety - Training and Level III Consulting for Nondestructive Testing

10. Magnetic Particle Test Indications and

- a. Interpretations
 - (1) Indications of nonmetallic inclusions
 - (2) Indications of surface seams
 - (3) Indications of cracks
 - (4) Indications of laminations
 - (5) Indications of laps
 - (6) Indications of bursts and flakes
 - (7) Indications of porosity
 - (8) Nonrelevant indications

11. Hands-on workshop

- a. Wet Horizontal Bench
- b. Magnetic Yoke – Wet Method
- c. Magnetic Yoke – Dry Method