



## 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



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#### 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