Magnetic Particle Testing Course Summary

Training hours minimum		
	Level I	**Level II**
Degree, Diploma or equivalent, in science, engineering or metallurgy:	12	8
Others:	12	8

Note:

- *When qualified to Level II with no time at Level I, the required training time shall be the sum of the time required for Level I and II.*
- *Training Hours maybe adjusted as described in the employer's written practice depending on the candidate's actual education level*

Minimum Experience (Hours)			
Level I		**Level II**	
In Method	Total in NDT	In Method	Total in NDT
70	130	210	400

Note: *While fulfilling total NDT experience requirement, experience may be gained in more than one(1) method, however the minimum hours must be met for each method*

Number of examination questions/Practical Samples		
	Level I	**Level II**
General	40	40
Specific	20	20
Practical	1	1

Notes: *Ten (10) different check point requiring an understanding of test variables and the employer's procedural requirement should be included in this practical examination*

As per SNT-TC-1A - 2016 Recommended Practice for Personal Qualification and Certification in NDT

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Training Course Outlined

(Notes: Training should be outlined in the employer's written practice)

Level 1

A. Principles of Magnets and Magnetic Fields

- Theory of magnetic fields
  - Earth's magnetic field
  - Magnetic fields around magnetized materials
- Theory of magnetism
  - Magnetic poles
  - Law of magnetism
  - Materials influenced by magnetic fields (Ferromagnetic and Paramagnetic)
  - Magnetic characteristics of non ferrous materials
- Terminology associated with magnetic particle testing

B. Characteristics of Magnetic Fields

- Bar magnet
- Ring magnet

C. Effect of Discontinuities of Materials

- Surface cracks
- Scratches
- Subsurface defects

D. Magnetization by Means of Electric Current

Circular field

- Field around a straight conductor
- Right hand rule
- Field in parts through which current flows
  - Long, solid, cylindrical, regular parts
  - Irregularly shaped parts
  - Tubular parts
  - Parts containing machined holes, slots, etc.
- Methods of inducing current flow in parts
  - Contact plates
  - Prods
- Discontinuities commonly discovered by circular fields.

Longitudinal field

- Field produced by current flow in a coil
- Field direction in a current-carrying coil
- Field strength in a current carrying coil

- Discontinuities commonly discovered by longitudinal fields
- Advantages of longitudinal magnetization
- Disadvantages of longitudinal magnetization

E. Selecting the Proper Method of Magnetization
- Alloy, shape and condition of part
- Type of magnetizing current
- Direction of magnetic field
- Sequence of operations
- Value of flux density

. Inspection Materials
- Wet particles
- Dry particles

G. Principles of Demagnetization
- Residual magnetism
- Reasons for requiring demagnetization
- Longitudinal and circular residual fields
- Basic principles of demagnetization
- Retentivity and coercive force
- Methods of demagnetization

H. Magnetic Particle Testing Equipment
- Equipment selection Consideration
    - Type of magnetizing current
    - Location and nature of test
    - Test materials used
    - Purpose of test
    - Area inspected

- Manual inspection equipment
- Medium – and heavy-duty equipment
- Stationary equipment
- Mechanized inspection equipment
    - Semi automatic inspection equipment
    - Single-purpose semi automatic equipment
    - Multipurpose semi automatic equipment
    - Fully automatic equipment

I. Types of Discontinuities Detected by Magnetic Particle Testing
- Inclusions
- Blowholes
- Porosity
- Flakes
- Cracks

- Pipes
- Laminations
- Laps
- Forging bursts
- Voids

J. Magnetic Particle Test Indications and Interpretations
- Indications of non-metallic inclusions
- Indications of surface seams
- Indications of cracks
- Indications of laminations
- Indications of laps
- Indications of bursts and flakes
- Indications of porosity
- Non relevant indication

Level 2

A. Principles
Theory
- Flux patterns
- Frequency and voltage factors
- Current calculations
- Surface flux strength
- Subsurface effects

Magnet and magnetism
- Distance factors versus strength of flux
- Internal and external flux patterns
- Phenomenon action at the discontinuity
- Heat effects on magnetism
- Material hardness versus magnetic retention

B. Flux Fields
Direct current
- Depth of penetration factors
- Source of current

Direct pulsating current
- Similarity to direct current
- Advantages
- Typical fields

Alternating current
- Cyclic effects
- Surface strength characteristics

- Safety precautions
- Voltage and current factors
- Source of current

C. Effect of Discontinuities of Materials
- Design factors
    - Mechanical properties
    - Part use
- Relationship to load-carrying ability

D. Magnetization by Means of Electric Current

Circular techniques
- Current calculations
- Depth-factor considerations
- Precautions-safety and overheating
- Contact prods and yokes
    - Requirements for prods and yokes
    - Current-carrying capabilities
- Discontinuities commonly detected

Longitudinal technique
- Principles of induced flux fields
- Geometry of part to be inspected
- Shapes and sizes of coils
- Use of coils and cables
    - Strength of field
    - Current directional flow versus flux field
    - Shapes, sizes, and current capacities
- Current calculations
    - Formulas
    - Types of current required
    - Current demand
- Discontinuities commonly detected

E. Selecting the Proper Method of Magnetization
- Alloy, shape and condition of part
- Type of magnetizing current
- Direction of magnetic field
- Sequence of operations
- Value of flux density

F. Demagnetization Procedures
- Need for demagnetization of parts
- Current, frequency and field orientation
- Heat factors and precautions

- Need for collapsing flux fields

G. Equipment

Portable type
- Reason for portable equipment
- Capabilities of portable equipment
- Similarity to stationary equipment

Stationary types
- Capability of handling large and heavy parts
- Flexibility in use
- Need for stationary equipment
- Use of accessories and attachments

Automatic type
- Requirements for automation
- Sequential operations
- Control and operation factors
- Alarm and rejection mechanisms

Liquids and powders
- Liquid requirements as a particle vehicle
- Safety precautions
- Temperature needs
- Powder and paste contents
- Mixing procedures
- Need for accurate proportions

Black light type
- Black light and fluorescence
- Visible and black light comparisons
- Requirements in the testing cycle
- Techniques in use

Light sensitive instruments
- Need for instrumentation
- Light characteristics

H. Types of Discontinuities
- In castings
- In ingots
- In wrought sections and parts
- In welds

I. Evaluation Techniques

- Use of standards – e.g. ASTM E 1444, E 709
    - Need for standards and references
    - Comparison of known with unknown
    - Specifications and certifications
    - Comparison techniques

Defect appraisal

- History of part
- Manufacturing process
- Possible causes of defect
- Use of part
- Acceptance and rejection criteria
- Use of tolerances

J. Quality Control of Equipment and Processes

- Malfunctioning of equipment
- Proper magnetic particles and bath liquid
- Bath concentration
    - Settling test
    - Other bath strength tests
- Test for black light intensity