



**AFRICAN NDT CENTRE**  
**COURSE CURRICULUM**  
**MAGNETIC PARTICLE TESTING LEVEL 1, 2 and 3**

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 Issue : 1  
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2.0 Physical principles and associated knowledge	2.0 Basic physical phenomena in terms of general description  Electric circuits, typical values, units Magnetic circuits, typical values, units Magnetic field created by electric circuits Passage of the flux from a magnetic medium to a non magnetic media Magnetic flux of a magnetic discontinuity Influence of depth and orientation of a magnetic discontinuity on its detection Magnetic properties of materials Nonmagnetic materials Magnetic materials. Curie point	2.0 Basic physical phenomena  Electric circuits, typical value, units Magnetic circuits, typical value, units  Magnetic field created by electric circuits Indefinite rectilinear conductor Long magnetic coil Short or flat magnetizing coil Passage of the flow of a magnetic in a non magnetic media Continuity of HT Continuity of BN Magnetic flux of a magnetic discontinuity	2.0 Basics  Diamagnetism – Paramagnetism Ferromagnetism – Ferrimagnetism Magnetic fields characterization and Measurements  Magnetic field H - magnetic Induction B Hysteresis cycle and remarkable points Influence of the temperature on the magnetic properties  Principle of magnetic particle testing Influence of the interface between a magnetic medium and a nonmagnetic medium Continuity of HT Continuity of BN



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		<p>Influence of the geometry (depth, thickness) and of the orientation of a magnetic discontinuity on its detection</p> <p>Magnetic properties          Designation of alloys          Non magnetic materials          Magnetic materials          Field of application          Curie Point          Curve of the first magnetization          Hysteresis cycle and remarkable points          Magnetic properties of steels</p>	<p>Influence of the orientation of the discontinuity on magnetic flux          Behaviour of a magnetic particle in the vicinity of a magnetic flux          Influence of geometry (depth, thickness and orientation) on detectability          Magnetic properties of principal ferromagnetic alloys          Magnetic field H, magnetic induction B, relative magnetic permeability <math>\mu R</math>, coercitive force Hc, electrical resistance          Influence of composition, heat treatments and work hardening of the steel.          Influence of work hardening.          Influence of heat treatment          Particular alloys: e.g. Permalloys, Invar, Inconel</p>
3.0  Product knowledge and capabilities of method and its derivate techniques	3.0  Typical discontinuities according to the production process (welds, forgings, castings and roller products	3.0  Typical discontinuities in welds, forgings, castings and roller products and there indications	3.0  Typical discontinuities in welds, forgings, castings and roller products and there indications
	3.1 Testing parameters:  Magnetization, detection media and test of detection media indication.	3.1 Testing parameters:  Magnetization, detection media and test of detection media indication.	3.1 Testing parameters:  Magnetization, detection media and test of detection media indication.



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<p>4.0 Equipment</p>	<p>4.0 Equipment</p> <p>Magnetizing equipment Viewing condition Measurement and calibration Demagnetization</p>	<p>4.0 Equipment</p> <p>Various types Portable electromagnet Mobile Magnetic benches Automatic and robotized with automatic detection (magnetic leakage field) Sources of light and conditions of illumination Accessories Flux indicators and products indicators Field strength measuring devices Photometers and radiometers Considerations on the choice of the equipment Elements to be taken into account materials and components to be controlled zones to be controlled, goal of the test place and environment Choice of the technique type of current Magnetic flow technique (open and closed circuit) Current flow technique – Induced current flow combined system Multidirectional magnetization and rotating field</p>	<p>4.0 Equipment</p> <p>Mobile or fixed equipment using magnetic flow technique or current flow technique Automatic and robotized with automatic detection (magnetic leakage field)</p>
	<p>4.1 Relevant standards: EN ISO 9934-2 and EN ISO 9934-3</p>	<p>4.1 Relevant standards: EN ISO 9934-2 and EN ISO 9934-3</p>	<p>4.1 Relevant standards: EN ISO 9934-2 and EN ISO 9934-3</p>



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<p>5.0 Information prior to testing</p>	<p>5.0 Application of a written instruction</p>	<p>5.0 Identification or designation material.</p> <ul style="list-style-type: none"> <li>-Kind of manufacture.</li> <li>-Catalogue of defects</li> <li>-Test condition and application of standard:</li> <li>-Accessibility</li> <li>-Infrastructure</li> <li>-Particular test condition</li> <li>-Application standard. Overview</li> <li>-Standard and codes assigned to the test objects</li> <li>-Acceptance criteria</li> <li>Preparation of written instructions</li> <li>Documents</li> <li>Presentation of the standards, codes and procedures</li> </ul>	<p>5.0 Identification or designation materials.</p> <ul style="list-style-type: none"> <li>-Kind of manufacture.</li> <li>-Catalogue of defects</li> <li>-Test condition and application of standard:</li> <li>-Accessibility</li> <li>-Infrastructure</li> <li>-Particular test condition</li> <li>-Application standard. Overview</li> <li>-Standard and codes assigned to the test objects</li> <li>-Acceptance criteria</li> <li>Preparation of written instructions</li> <li>Documents</li> <li>Presentation of the standards, codes and procedures</li> </ul>
<p>6.0 Testing</p>	<p>6.0 Testing according to the written Instructions</p> <ul style="list-style-type: none"> <li>Surface preparation</li> <li>Cleaning, machining</li> <li>Use of contrast paint</li> <li>Magnetization, types and time of application</li> <li>Application of the detection media</li> <li>Recording of discontinuities</li> <li>Continuous technique</li> <li>Remanence technique</li> <li>Grid and covering</li> <li>Control of conditions of magnetization</li> </ul>	<p>6.0 Testing</p> <ul style="list-style-type: none"> <li>Surface preparation</li> <li>Cleaning, machining</li> <li>Use of contrast paint</li> <li>Magnetization, types and time of application</li> <li>Application of the detection media</li> <li>Continuous technique</li> <li>Remanence technique</li> <li>Grid and covering</li> <li>Control of conditions of magnetization</li> </ul>	<p>6.0 Testing</p> <ul style="list-style-type: none"> <li>Preparation of the parts and influence of the surface quality</li> <li>Means of magnetization. Values of the parameters. Continuous or simultaneous method. Remanence method . Flux indicators</li> <li>Choice of the detection media. products indicators</li> </ul>



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	<p>6.1 Treatment of the components after Test</p> <p>Residual field          Basic principle of demagnetization          Demagnetization. Industrial methods of demagnetization          Cleaning of the components</p>	<p>6.1 Treatment of the components after Test</p> <p>Residual field. Conditions requiring demagnetization. Level of residual field          Basic principle of demagnetization          Demagnetization. Industrial methods of demagnetization and influence of terrestrial magnetic field          Cleaning of the components</p>	<p>6.1 Treatment of the components after Test</p> <p>Demagnetization          Principle, minimal value of the magnetic field of demagnetization, frequency, effect of skin and calculation of magnetizing coil          Level of residual field according to the later use of material          Influence of terrestrial magnetic field          Cleaning of the components</p>
<p>7.0</p> <p>Evaluation And Reporting</p>	<p>7.0 Classification of the indications</p> <p>Welding according to EN 1290          Casting according to EN 1369          Forging according to EN 10228-1          Rolled products          Viewing conditions according to reference block          Verification the indication quality (EN ISO 3059)</p> <p>Report of simple welding, forging, rolled products and casting imperfections</p>	<p>7.0 Test report</p> <p>Check test report          Basic of evaluation          Viewing conditions (EN ISO 3059) according to reference block, other used reference blocks, calibration of test units, batch test report          Evaluation and verification the indication quality</p> <p>Report of imperfections according to EN 1290, EN 1369, EN 10228-1</p>	<p>7.0 Test report</p> <p>Written procedure with check of test reports:          Welding according to EN 1290          Casting according to EN 1371          Forging according to 10228-2          Basics of evaluation, viewing conditions (EN ISO 3059) according to reference block, other used reference blocks calibration of test units</p> <p>Evaluation verification the indication quality</p>
<p>8.0</p> <p>Assessment</p>	<p>NOT APPLICABLE</p>	<p>Assessment of discontinuities          Influence of manufacture and material</p>	<p>Assessment of discontinuities          Influence of manufacture and material</p>



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<p>9.0 Quality aspects</p>	<p>9.0 Personnel qualification (according to EN ISO 9712)</p> <p>Equipment verification</p>	<p>9.0 Personnel qualification (according to EN ISO 9712)</p> <p>Equipment verification Written instructions Traceability of documents A review of applicable NDT application and product standards</p>	<p>9.0 Personnel qualification (according to EN ISO 9712)</p> <p>Equipment verification Format of working procedures Traceability of documents A review of applicable NDT application and product standards</p>
<p>10.0 Environmental and Safety conditions</p>	<p>10.0 Health and Safety</p> <p>Electric risks hazards Risks related to the products (magnetic inks) Risks related to the ultraviolet radiation Disposal of the effluents and environmental conditions (concepts) Safety data sheet</p>	<p>10.0 Health and Safety</p> <p>Electric risks hazards Risks related to the products (magnetic inks) Risks related to the ultraviolet radiation Disposal of the effluents and environmental conditions (concepts) Safety data sheet</p>	<p>10.0 Health and Safety</p> <p>Electric risks hazards Risks related to the products (magnetic inks) Risks related to the ultraviolet radiation Disposal of the effluents and environmental conditions (concepts) Harmfulness and toxicity of the products Treatment and rejection of the effluents, environmental conditions Fire hazards Risks related to the ultraviolet radiations New techniques</p>
<p>11.0 Developments</p>	<p>(Not applicable)</p>	<p>Special installation and equipment</p>	<p>Creative and innovative special installations</p>