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BINDT
THE BRITISH INSTITUTE OF
NON-DESTRUCTIVE TESTING



APPROVED TRAINING ORGANISATION

NASA 303 Eddy Current Testing Curriculum

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Revision control sheet:

Rev No:	Date:	Compiled by:	Reviewed by:	Revision Description:
0	04-Jan-2020	Meyuri Moodley	Nish Kanhaye	Implemented into QMS.

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1.0 Course Duration:

- 1.1 Level 1 and 2 Combined:
- a) The minimum training hours administered in Level 1 shall be 40.
 - b) The minimum training hours administered in Level 2 shall be 40.
 - c) For Level 1 and 2 combined courses the total training hours shall be a minimum of 80.
- 1.2 In all cases, level 1, level 2 or combined level 1 and 2, NASA shall administer the full theory content of Level 1 and 2.

2.0 Course Content:

2.1 Theory: The table below shows theory aspects covered:

Chapter Reference:	Level 1:	Level 2:
1. Introduction, Terminology, History of NDT	<p>Generalities on NDT: What is testing? What is the purpose of NDT? At what stage of the life of a "product" is NDT performed? How does it add value? Who may carry out NDT? Main NDT methods.</p> <p>1.1 Eddy current testing: Definition: Electromagnetic interaction between a sensor and a test object conducting electricity, providing information on physical characteristics of the test object. History of the method.</p> <p>1.2 Terminology EN 1330 –1and –2 EN 1330- 5</p>	<p>Generalities on NDT: What is testing? What is the purpose of NDT? At what stage of the life of a "product" is NDT performed? How does it add value? Who may carry out NDT? Main NDT methods.</p> <p>1.1 Eddy current testing: Definition: Electromagnetic interaction between a sensor and a test object conducting electricity, providing information on physical characteristics of the test object. History of the method.</p> <p>1.2 Terminology EN 1330 –1and –2 EN 1330- 5</p>

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<p>2. Physical principles and associated knowledge</p>	<p>2.0 Fundamentals 2.1 Electricity : elements Direct current : Current, voltage, resistance, conductance, Ohm's law, resistivity, conductivity. Units, conductivity values for some metals.</p> <p>Alternating current : Sinusoidal current and voltage, amplitude, frequency, period, phase.</p> <p>2.2 Magnetism Magnetism : Magnetic field, lines of force, magnetic field strength. Permeability, flux density (induction). Flux. Hysteresis loop. Units.</p> <p>2.3 Electromagnetism Magnetic field created by a current, (wire, Coil). Electromagnetic induction phenomenon, inductance, Electromagnetic coupling. Induced currents and secondary field. Lenz's law Eddy current distribution in conducting materials - depth of penetration, amplitude, phase -characteristic frequency Impedance.</p>	<p>2.0 Fundamentals 2.1 Electricity : Direct current : Current, voltage, resistance, conductance, Ohm's law, resistivity, conductivity. Units, conductivity values for some metals.</p> <p>Alternating current : Sinusoidal current and voltage, amplitude, frequency, period, phase. Vector representation.</p> <p>2.2 Magnetism Magnetism : Magnetic field, lines of force, magnetic field strength. Permeability, flux density (induction). Flux. Hysteresis loop. Reluctance. Magneto-motive force. Units. Diamagnetism, paramagnetism, ferromagnetism.</p> <p>2.3 Electromagnetism Magnetic field created by a current, (wire, coil). Electromagnetic induction phenomenon, inductance, mutual induction. Electromagnetic coupling. Induced currents and secondary field. Lenz's law Eddy current distribution in conducting materials - planar wave: standard depth of penetration, amplitude, phase - cylindrical conductors: characteristic frequency Impedance. Complex plane representation. Impedance plane diagrams.</p>
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<p>3. Product knowledge and related capability of the method and derived techniques</p>	<p>Applications of eddy current testing: Metal sorting Measurement of a physical parameter: Conductivity, ferrite content, Thickness of coatings.</p> <p>Detection of local discontinuities (flaws).</p> <p>Capabilities : Depth of penetration, Conductive materials Non-contact, High speed, high Temperature, May be mechanised.</p> <p>Techniques: Single frequency, Multifrequency, Multiparameter.</p>	<p>Manufacturing related discontinuities (typical flaws) Service induced discontinuities (flaws).</p> <p>Material properties influencing eddy current testing: conductivity, permeability, Product characteristics influencing eddy current testing: condition (surface condition heat treatment, cold working, temperature, Etc.), shape, wall thickness, accessibility.</p> <p>Products being tested : Semi-finished products, pipes, heat exchanger tubes, mechanical parts (e.g. car, railway and aircraft industry), welds (e.g. offshore)</p> <p>Applications of eddy current testing : Metal sorting Measurement of a physical parameter: conductivity, ferrite content , Thickness of Coatings, etc.</p> <p>Detection of local discontinuities (flaws) Capabilities: - depth of penetration, conductive materials Non-contact, high speed, High temperature, may be mechanised.</p> <p>Techniques : single frequency, Multifrequency, Multiparameter. Remote field. Codes and standards.</p>
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<p>4. Equipment</p>	<p>4.0 Eddy current testing system: Instrument, probe, reference blocks.</p> <p>4.1 Relevant standards: - EN 13860-1 and EN 13860-2</p> <p>Measurements: absolute, differential, Output and signal display</p>	<p>4.0 Eddy current testing system: Instrument, probe, reference blocks.</p> <p>4.1 Relevant standards: - EN 13860-1 and EN 13860-2</p> <p>General purpose application instrument : essential functions Specific application instruments</p> <p>Probe functions: combined or separate transmit- receive</p> <p>Probe family: surface, coaxial Probe designs</p> <p>Measurements : absolute, differential, others Output and signal display</p> <p>Reference blocks : material, design, Production, storage. Mechanised equipment standards</p>
<p>5. Information prior to testing</p>	<p>Information on the product : Grade, metallurgical condition, shape. Type of discontinuities anticipated and location, duty of the product. Extent of examination.</p> <p>Information on test conditions : temperature, humidity, access, availability, unwanted interfering signals, Electric and/or magnetic disturbances.</p>	<p>Information on the product : Grade, metallurgical condition, shape. Type of discontinuities anticipated and location, duty of the product. Extent of examination.</p> <p>Information on test conditions : temperature, humidity, access, availability, unwanted interfering signals, Electric and/or magnetic disturbances.</p> <p>Preparation of written instructions</p>

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6. Testing	<p>Reference blocks : design, production, Storage.</p> <p>Operating conditions: Excitation frequency and if necessary auxiliary frequencies Probe speed, probe clearance, probe vibration and centring Calibration curves</p> <p>Settings : data acquisition procedure/instructions</p>	<p>Reference blocks : design, production, Storage.</p> <p>Probe: selection, as a result of the information in 5, Operating conditions as a result of the information in 5: Excitation frequency and if necessary auxiliary frequencies. Probe speed, probe clearance, probe Vibration and centring. Calibration curves.</p> <p>Settings : data acquisition procedure</p>
7. Evaluation And Reporting	<p>7.0 Evaluation Not applicable</p> <p>7.1 Reporting Examination report</p>	<p>7.0 Evaluation. Characterisation of the indications : single frequency analysis, multifrequency analysis, Data analysis procedure.</p> <p>7.1 Reporting Reporting level Examination report</p>
8. Assessment	Not applicable	Acceptance criteria Codes standards
9. Quality aspects	<p>Personnel qualification (according to EN ISO 9712) Equipment verification</p>	<p>Personnel qualification (according to EN ISO 9712) Equipment verification Written instructions Traceability of documents</p>
10. Developments	Not applicable	General information

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2.2 Practical: The table below shows practical aspects covered:

Level 1	Level 2
Pre-test checks and calibrations Surface preparation and pre-cleaning. Identifying specimen reference points. Testing of specimens in accordance to instructions. Reporting of defects. Instruction writing. Equipment selection.	<i>Level 1 content plus:</i> Additional pre-test checks and calibrations. Interpretation of codes, specifications and acceptance criteria's. Interpretation and evaluation of defects.

3.0 Learning outcomes:

3.1 Upon completion of training, students should be able to carry out and understand the following regarding Eddy Current Testing:

Level 1	Level 2
Basic principles General advantages and limitations Discontinuity categories Carry out pre-test checks, set up equipment, carry out tests and report results according to written instructions	Basic principles General advantages and limitations Discontinuity associated with manufacturing processes, categories and types Select test technique to be used Interpret codes, specifications and procedures. Compile instructions according to specifications, codes or procedures Carry out pre-test checks, set up equipment, perform tests and report results Interpret and evaluate test results according to specifications, codes or procedures

4.0 Course Outcome:

4.1 Successful Completion of Training:

Upon successful completion of the course, a successful completion of training certificate at the level attempted will be issued which meets eligibility to undertake the external PCN examination.

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