



AFRICAN NDT CENTRE
COURSE CURRICULUM
VISUAL TESTING LEVEL 1, 2 and 3

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Contents	Level 1	Level 2	Level 3
1.0 Introduction, Terminology, purpose & history of NDT	1.0 History of NDT History of Visual Testing Purpose of NDT Definition of visual testing	1.0 History of NDT History of Visual Testing Purpose of NDT Definition of visual testing	1.0 As level 2 Use of VT as a complement to other NDT methods.
	1.1 Terminology Terminology applicable to VT EN1330-2 & EN 1330-10 Overview of VT applications	1.1 Terminology Terminology applicable to VT EN1330-2 & EN 1330-10 Extended overview of VT applications	
2.0 Physical principles of the method and associated Knowledge	2.0 Relevant standards EN 13018 VT General principles EN13927 VT Equipment Alternating Fundamentals -Vision Lighting -Transmission -Reflection -Absorption Photometry -Light levels	2.0 Relevant standards EN 13018 VT General principles EN13927 VT Equipment Fundamentals Vision -The eye, inc operation & construction -Vision limitations -Adaptation & accommodation -Disorders	2.0 As level 2, plus Goals and principles of VT A comprehensive knowledge and understanding of the physical principles and physics of light including -Optical performance -Polarization of light -Stroboscopic principles -Dispersion -Refraction and refractive index -Reflection



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	<ul style="list-style-type: none"> -Light measurement Optical principles Visual perception Material attributes <ul style="list-style-type: none"> -Colour -Surface condition -Surface preparation Environmental factors Direct and remote methods <ul style="list-style-type: none"> Vision requirements References: EN13028 EN13927 	<ul style="list-style-type: none"> Lighting <ul style="list-style-type: none"> -Physics of light <ul style="list-style-type: none"> Electromagnetic radiation Visible wavelengths -Fundamentals of light <ul style="list-style-type: none"> Transmission Reflection Absorption -Lighting measurements <ul style="list-style-type: none"> Luminance -Lighting levels -Lighting techniques -Contrast Optical principles <ul style="list-style-type: none"> -Operation of lenses -Operation of magnifiers -Image construction -Virtual images -Chromatic aberration -Geometric distortion -Magnification principles Visual perception <ul style="list-style-type: none"> -What your eyes see -What your mind sees -What others perceive -What the designer, engineer etc. want you to see Material attributes affecting the test <ul style="list-style-type: none"> -Cleanliness -Colour 	<ul style="list-style-type: none"> -Fluorescence -Advantages and disadvantages of different wavelengths of optical Radiation (UV, IR), including Colour temperature -Types of light sources, natural, artificial including laser Details of the eye including <ul style="list-style-type: none"> -Vision ranges -Effects of disorders Camera & photo sensor operation & principles <ul style="list-style-type: none"> -Optical filters -Construction of digital images and problems -Image processing -Image analysis -Image compression & Transmission -Image storage -Resolution -Video monitors -Other monitors Light meters & photometers Principles of operation of fibre bundles and lenses <ul style="list-style-type: none"> -Coherent -Incoherent Photogrammetry
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		<ul style="list-style-type: none"> -Condition -Shape -Size -Temperature -Texture -Type -Surface Finish -Surface preparation <p>Environmental & physiological factors</p> <ul style="list-style-type: none"> -Atmosphere -Comfort -Perspective -Distance -Accessing -Fatigue -Health -Humidity -Mental attitude -Position -Safety -Temperature -Cleanliness <p>Direct and remote methods vision requirements & the employers responsibility</p>	
<p>3.0</p> <p>Product knowledge and capabilities of the method and its derivate Techniques</p>	<p>The depth of knowledge required for this section is given below:</p> <p>Outline of basic flaws detectable by VT as necessary to work in a specific sector</p>	<p>The depth of knowledge required for this section is given below:</p> <p>Test objects and flaws Basic production and degradation process; Terms, origin and nature and appearance of flaws</p>	<p>Level 2, plus Evaluation of surfaces</p> <p>Roughness & waviness</p> <p>Definition of shape & geometry of flaws</p>



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	<p>References EN 970, EN 12454, EN1370, EN 5817</p> <p>Awareness of capability and limitations</p>	<p>Product technology sectors Basic metallurgy of the process/ component Welding / joining methods</p> <p>Including Cladding & Buttering: Wrought product production methods Cold working processes Heat treatment processes</p> <p>Material composition: Surface finishing methods Basic foundry technology Machining & material removal processes Polymers/composites,</p> <p>In-service aspects: Service induced flaws Mechanically Thermally Tribology Wear Chemical Electrochemical</p> <p>References EN 970, EN 12454, EN 1370, EN 10163 parts 1 to 3 inclusive, EN 5817 etc...</p> <p>Capability and limitations of VT Detectability Flaw size Shape</p>	<p>A comprehensive understanding and knowledge of the manufacturing processes and associated metallurgy & flaw types etc...</p> <p>A comprehensive understanding and knowledge of the cause and formation of in-service defects including associated metallurgy & flaw types etc...</p>
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		<p>Orientation/ position Flaw types Surface condition effects Equipment limitations Lighting effects field.</p> <p>Associated techniques Gauging Comparators Measurement Thermographic imaging Replication</p> <p>References: ISO3057</p>	
4.0 Equipment	<p>4.0 Introduction to equipment</p> <p>Mirrors Magnifiers (ref ISO 3058) Borescopes Fibrescopes Photographic & video: Imaging cameras Light sources and special lighting Gauges, templates, scales, special tools, etc. Automated systems Computer-enhanced systems Demonstration test piece Resolution targets</p>	<p>4.0 Introduction to, and applications of Equipment</p> <p>Mirrors Magnifiers (ref ISO 3058) Borescopes Fibrescopes Photographic & video: Imaging cameras Video monitors Light sources and special lighting Gauges, templates, scales, special tools, etc. Automated systems Computer-enhanced systems Demonstration test piece</p>	<p>As level 2, plus the inclusion of equipment for assessment of surface conditions</p> <p>A good understanding of equipment performance limitations & the selection of new equipment for its suitability.</p> <p>Additionally, the effect this will have on the test arrangement The evaluation of equipment to fulfil a particular task Development of verification for equipment performance, including the choice/design and application of demonstration test pieces</p>



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	<p>Or other special equipment as necessary for the test.</p> <p>Why equipment must be verified</p> <p>References: EN 13927 ISO 3058</p>	<p>Resolution targets Graticules</p> <p>Image recording, transfer & storage equipment: Equipment selection & limitations Verification of equipment</p> <p>Sizing of indications: Imaging systems Special optical systems</p> <p>Or other special equipment as necessary for the test, such as underwater, radiation resistant, etc.</p>	<p>Understanding of the procedure for control, maintenance and calibration of equipment</p>
<p>5.0</p> <p>Information prior to testing</p>	<p>5.0 Pre-test documentation (ref EN13018)</p> <p>Test instruction Written procedure (when required)</p> <p>These should specify the following aspects: Object to be tested Extent of test coverage Technique & sequence of performing test Surface condition Surface preparation The stage of manufacture or service life when testing is to be carried out The requirements of test personnel The acceptance criteria The illumination (type, level and direction)</p>	<p>5.0 Pre-test documentation (ref EN13018)</p> <p>Test instruction Written procedure or standard (when required)</p> <p>These should specify the following aspects: Object to be tested Extent of test coverage Technique & sequence of performing test Surface condition Surface preparation The stage of manufacture or service life when testing is to be carried out The requirements of test personnel The acceptance criteria</p>	<p>5.0 As level 2, plus the writing of procedures and the design of the test arrangement.</p> <p>The development & application of verification techniques including the demonstration of procedures and instructions for effectiveness.</p> <p>A thorough knowledge of complimentary NDT methods that may be referenced in written procedures.</p>



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	<p>The visual testing equipment to be used The post test documentation A demonstration test piece & inspection Checkpoints Requirement for recorded images</p> <p>References: EN13018</p>	<p>The illumination (type, level and direction) The visual testing equipment to be used The post test documentation A demonstration test piece & inspection Checkpoints Requirement for recorded images</p> <p>Development and writing of NDT instructions for level I for a given test specimen, from standards or codes</p>	
6.0 Testing	<p>6.0 How to set up a test</p> <p>Working with demonstration test pieces and resolution targets</p> <p>Practical training on test equipment and performing tests on training test pieces with known flaws to provided instructions/ procedures including equipment and test parameters.</p>	<p>6.0 How to set up and calibrate a test</p> <p>Specifying & Working with demonstration test pieces and resolution targets</p> <p>Prepare written test instructions from standards or codes for given test pieces.</p> <p>Practical training on test equipment and performing tests on training test pieces with known flaws to instructions as above including equipment and test parameters.</p>	6.0 As level 2, plus the control of procedures and instructions for their effectiveness



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<p>7.0 Evaluation And Reporting</p>	<p>7.0 Reporting the results of tests</p> <p>Reference to test standards Calibration status Reference points for location of indications Classification of indications per: instructed acceptance criteria reports and documentation reporting verification results</p>	<p>7.0 Level 1 detail, plus How to control and monitor a Level 1 test done with your guidance.</p> <p>Interpretation, evaluation & reporting of results to specifications and standards Objective/Subjective evaluation Completion of calibration forms</p>	<p>7.0 As level 2 plus how to develop report formats for ease of use and clarity.</p> <p>Organization and storage/distribution of final reports</p> <p>Investigation of suitable codes & product standards for each application Acting as a reference point for level 2 advice for interpretation and evaluation</p> <p>References: EN 13445-5 EN 12732 EN 12952 etc.</p>
<p>8.0 Assessment</p>	<p>NOT APPLICABLE</p>	<p>Classification & assessment of observations per acceptance criteria from the codes, standards or written instructions etc. or by specific reference to a level 3 where no codes or standards exist.</p> <p>By comparison By measurement Automated evaluation e.g. pattern Recognition Recording Reporting</p>	<p>Detailed knowledge of how to classify & assess observations, analyse the results and compare them to codes, standards and design specifications etc.</p> <p>How to develop codes, standards and design specifications etc. into clear acceptance criteria to be written into procedures and instructions</p> <p>Also how to find information /assistance to investigate observations not covered by codes and standards & develop acceptance criteria. The training of levels 1 & 2 for these acceptance criteria.</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 qualification 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 Other NDT qualification and certification systems A review of applicable NDT application and product standards</p>
<p>10.0 Developments</p>	<p>NOT APPLICABLE</p>	<p>General information</p>	<p>The importance of investigating current and developing technology and methods of application</p> <p>Summary of latest developments</p>