

TRAINING DOCUMENTS	Doc. Nr.:	INF-008-TD
Title: Syllabus for Eddy Current Training – Level 1, 2, and Level 3	Revision No.:	00
	Valid from:	06.05.2020

1 REASON FOR LATEST REVISION

Revision No.:	Keywords:	Chapter:	Valid from:	Respon.
00	Development document	All	06.05.2020	Ch.Dürager

2 SCOPE OF APPLICATION

This document contains the information about the training syllabus for the NDT training course “Eddy Current Testing – Aerospace Applications” provided by IMITec NDT Training School.

The training course is offered for Level1 (L1), Level 2 (L2), and Level 3 (L3) personnel which are intend to qualify for Non-destructive Testing personnel based on the standard EN4179 (Aerospace applications).

The syllabus covers the required course content for the general part based on the EN4179 and in some points the requirements for the specific and practical part. However, it may be necessary to adapt the specific part to the specific requirements of the candidate’s company.

2.1 Information for the reader

In principle the syllabus is provided for the different Levels. Level 3 candidates, however, are expected to have already learned and tested a large part of the theory material in the Level 2 course. These parts are required for the Level 3 course and will be tested during the final exam.

Some parts of the teaching material will be covered in the course and will be dealt with in more detail in a further course. To explain:

X = Teaching the basic knowledge,

X = Teaching of the in-depth knowledge.

3 REFERENCE DOCUMENTS

Document	Addition	Remarks / Description
Eddy Current Testing – Aerospace Applications	2020	Training book IMITec NDT Training School.
EN 4179	2017	Aerospace series – Qualification and approval of personnel for non-destructive testing.
Eddy Current Testing	2011	Aerospace Inspection Training Ltd. Training book.
Non-Destructive Techniques Based on Eddy Current Testing	2011	Article, sensors, ISSN 1424-8220, www.mdpi.com/journal/sensors
MIL-HDBK-728/2	1988	Military Handbook Eddy Current Testing
Eddy Current Testing at Level 2: Manual for Syllabi Contained in IAEA-TECDOC-628.Rev.2	NA	IAEA International Atomic Energy Agency – Training course series 48
Syllabus -Eddy current testing	2019	NANDTB-Germany

4 SYLLABUS EDDY CURRENT TESTING

Chapter	Training Content	L1	L2	L3
Basic physical information / Eddy current principle	Electrical variables			
	Electrical Voltage	X	X	
	Electrical Current	X	X	
	Frequency	X	X	
	Electrical resistance	X	X	

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Chapter	Training Content	L1	L2	L3	
		Specific electrical resistance	X	X	1
		Electrical conductivity	X	X	
		Phase shifting	X	X	
		Electrical power	X	X	
		Resistance in AC circuit	X	X	
		Angular frequency	X	X	
	Magnetism	Basic principles of magnetism	X	X	
		Ferromagnetism	X	X	
		Matter in a magnetic field	X	X	
		Comparison of electrical systems/hydraulic systems and magnetism	X	X	
		Properties of ferrite	X	X	
		Magnetic fields	X	X	
		Excitation	X	X	
		Magnetic field strength	X	X	
		Permeability	X	X	
		Magnetic flux	X	X	
		Magnetization curves	X	X	
		Properties of ferrites	X	X	
	Electromagnetic induction	Transformer	X	X	
		Self-induction	X	X	
Eddy currents		X	X		
Law of induction			X		
Skin effect			X		
Properties of eddy currents	Generation of eddy currents	X	X		
	Excitation principle of eddy currents	X	X		
	Depth of penetration of eddy currents	X	X		
	Propagation of eddy currents		X		
Basic physical information / Eddy current principle	Properties of eddy currents	Propagation interference	X	X	
		Influences on the propagation of eddy currents		X	
	Impedance	Coil impedance	X	X	
		Impedance graph	X	X	
Impedance	Coil impedance	General information on coil impedance	X	X	
		Nyquist plot of the impedance graph		X	
		Normalized impedance graph	X	X	
		Preparation of a normalized impedance graph	X	X	
		Influence of conductivity	X	X	

¹The training content is required for Level 3 and is not taught in the training course. but is part of the general examination

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		Influence of distance (lift-off)	X	X	
		Influence of the test frequency	X	X	
		Influence of the component thickness	X	X	
		Influence of cracks	X	X	
	Impedance graph	Structure of the impedance graph	X	X	
		Variables influencing impedance changes	X	X	
		Conductivity variations	X	X	
		Representation of eddy current signals	X	X	
Eddy current Test Equipment	Eddy current Probes	Probe overview	X	X	2
		Coil arrangements	X	X	
		Types of Circuit	X	X	
		Electrical combination of coil and device circuits		X	
		Function principle of coil systems		X	
	Eddy current test system	Function principle of eddy current test system	X	X	2
	Eddy current device	Frequency generator	X	X	
		Coil system	X	X	
		Input stage		X	
		Demodulator		X	
Eddy current Test Equipment	General	Zero-point compensation	X	X	2
		Filters	X	X	
		Phase adjuster	X	X	
		Signal representation	X	X	
	Filters	General information on filters	X	X	
		Low-pass filter	X	X	
		High-pass filter	X	X	
		Band-pass filter	X	X	
	Influence of component properties on the eddy current test	Filter selection and test speed	X	X	
		High-level and low-level conductivity		X	
		Ferromagnetic test specimen		X	
		Anisotropic conductivity, CFRP test specimen		X	
	Eddy current Techniques	Static and dynamic testing	Static test	X	
Dynamic test			X	X	
Testing using sliding probe			X	X	

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	Techniques	Measurement of specific electrical conductivity	X	X		
		Layer thickness measurement	X	X		
		Corrosion test	X	X		
		Crack test	X	X		
	Conductivity Measurement	General information on conductivity measurement	X	X		3
		Purpose of conductivity measurement	X	X		
		Measuring principle	X	X		
		Variables	X	X		
		Measurement inaccuracies				X
		Implementation				X
		Standards and regulations pertaining to conductivity measurements				X
		Conductivity measuring equipment				X
		Calibration blocks for conductivity measurements			X	
	Layer thickness measurement	Equipment and parameter selection	X	X	X	
		Test sequence methodology	X	X	X	
		Representation and analysis of measurement values			X	
		Alternative methods			X	
	Corrosion testing	Equipment and parameter selection		X	X	
		Test sequence methodology		X	X	
		Representation and analysis of measurement values		X	X	
		Typical disturbance variables		X	X	
		Residual thickness measurement			X	
		Measuring the elimination of surface corrosion			X	
	Crack testing	Layer corrosion			X	
Crack Type		X	X	3		
Static crack test using metallic components		X	X			
Signal processing, distinguishing of disturbance variables		X				

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		Influences disturbing the process		X			
		Determination of crack lengths		X			
		Crack testing with rotating probes	X	X			
		Sample defects found when inspecting holes	X	X			
	Static crack testing	General information	X	X		4	
		Types of causes for cracks	X	X			
		Determination of the crack length		X			
	Eddy current Techniques	Crack testing for detecting subsurface cracks	Signal processing, distinguishing of disturbance variables	X		X	4
			Test method	X		X	
			Influences disturbing the process	X		X	
Pulsed eddy current testing					X		
Dynamic crack test with rotating probe		Examples of possible defects	X	X	4		
		Calibration blocks		X			
		Standards and regulations		X			
		Devices for testing with rotating probes		X			
Use of automated Eddy current equipment		Determination of probe characteristics		X	X		
		Automated equipment settings		X	X		
	Measurement data acquisition		X	X			
	Scanners			X			
Procedure monitoring		Procedure monitoring in general	X	X	X		
		Calibration and reference blocks	X	X	X		
Rules and standards / test instruction	Standards	General information on standards	X	X	X		
		National standards		X	X		
		International standards		X	X		
		Process instruction			X		
	Test instruction	Requirements for a test instruction		X	X		
		Preparation of test instruction		X	X		
Example of a test instruction			X	X			
Capabilities of the method		General information on eddy current testing	X	X	X		

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	Limits of the method	X	X	X	
	Other NDT methods	X	X	X	
	Comparison with different surface crack testing methods	X	X	X	
	Comparison with test methods for subsurface cracks	X	X	X	
	Comparison with corrosion test methods	X	X	X	
Material science	Material defects generated during manufacture	Inclusions	X	X	5
		Pores	X	X	
		Shrinkage cavities	X	X	
		Segregations	X	X	
		Cracks	X	X	
	Defects generated during processing	Rolling and forging defects	X	X	
		Turning, grinding defects	X	X	
		Defects caused by hardening	X	X	
	Defects caused by operational loads	Cracks	X	X	
Corrosion		X	X		
Design concepts in Aviation	Safe-life	X	X	5	
	Fail-safe	X	X		
	Damage Tolerance	X	X		
Safety regulations	General safety regulations	X	X	X	
	Handling of test equipment and tools	X	X	X	
Practical exercises	Exercises practicing the handling of aeronautical parts	X	X	X	
	Preparation of a case study		X	X	
	Preparation of a test instruction		X	X	
	Development of a test problem			X	

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