1 REASON FOR LATEST REVISION

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2 SCOPE OF APPLCATION

This document contains the information about the training syllabus for the NDT training course "Magnetic 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 reequipments 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
	2020	Training book IMITec NDT Training School.
EN 4179	2017	Aerospace series – Qualification and approval of personnel for non-destructive testing.
ASTM 1444	2022	Standard Practice for Magnetic Particle Testing for Aerospace
Magnetic Testing	Vol. 8	MPI Handbook ASNT
Syllabus -Magnetic Testing	2019	NANDTB-Germany

4 SYLLABUS EDDY CURRENT TESTING

Chapter	Training Content		L1	L2	L3
Basic physical information	Magnetism	Effetcs on Magnetism	X	**X**	[1]
		Magnetic Fields	X	**X**	
		Magnetic filed strength	X	**X**	
		Permeability	X	**X**	
		Magnetic Flux Density	X	**X**	
		Magnetic Flux	X	**X**	

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

Chapter	Training Content		L1	L2	L3
		Magnetization curve (hysteresis curve)	X	**X**	
		Required field strength	X	**X**	
	Magnetic Field / Magnetic Field in Material	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**	1
	Magnetisation / Demagnetization	Necessary magnetization	X	**X**	
		Demagnetization	X	**X**	
		Demagnetization Methods	X	**X**	
	Electrical Variables	Electric Voltage	**X**	**X**	1
		Electric Current		X	
		Frequency	X	**X**	
		Electrical Resistance	X	**X**	
		Phase Shift			
		Electrical Power			
		Effects of electric currents	X	**X**	1
	Electromagnetic Induction	Transformer	X	**X**	
		Skin Effect	X	**X**	
	Magnetic field around electrical conductors	Magnetic field strength within and around electrical conductors	X	**X**	2
		Magnetic Flux density within and around electrical conductors	X	**X**	
	Ferromagnetic Materials in a magnetic field	Magnetic shearing with coil magnetization	X	**X**	2
		Particularities of yoke magnetization	X	**X**	
		Demonstration of adequate magnetization	X	**X**	
	Demonstration of adequate field strengths	Field strength measurements	X	**X**	2
	Demagnetization	Demagnetization methods	X	**X**	

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Chapter	Training Content		L1	L2	L3
		Adequate measurements of residual field strength	X	**X**	
	UV-A-radiation	UV-A irradiation units		X	
		Spectral range of UV-A radiators		X	
		Viewing conditions		X	
	Properties of the human eye	Visual acuity	X	**X**	[2]
		Color discrimination capability	X	**X**	
		Contrast sensitivity	X	**X**	
		Brightness-darkness adaptation	X	**X**	
		Brightness-dark adaptation	X	**X**	
		Astigmatism	X	**X**	
	Test Specimens	Requirements for the specimen	X	**X**	
		Preparation of the test specimen	X	**X**	[3]
	Application technique	General Information	X	**X**	**X**
		Circular magnetization • Self-excitation • Separate excitation • Magnetic flow technique	X	**X**	**X**
		Longitudinal Magnetization • Yoke Magnetization • Coil Magnetization			**X**
		Combined techniques • Combination of 2 D.C. fields • Combination of D.C. and A.C. fields • Combination of 2 A.C. fields • Phase shifted fields • Other Magnetization technique			**X**
		Measurement of Magnetization: • Field Strength Measurement with a Hall probe • Other field strength indicators • Measurement of flux density			
Test Equipment	Equipment	Portable Equipment	X	X	[4]
		Additional Equipment	X	X	

Chapter	Training Content		L1	L2	L3
and auxiliary means		Demagnetization coils	X	X	
	Test Media per ISO 9934-2 and AMS 2641	Fluorescent and non Fluorescent test media	X	X	[3]
		Mixing of test medium suspensions		X	
	Irradiation unit for reference blocks and Equipment	UV-A Irradiation Units		X	**X**
		Measurement Equipment for Lighting and irradiation.		X	**X**
		Reference Blocks for test media monitoring		X	**X**
		Reference Blocks for Equipment Monitoring			**X**
	Measurement of tangential field strength	Field strength measuring devices	X	**X**	**X**
		Handling the Berthold Test Body and Pie Indicator according to ASTM 1444	X	**X**	**X**
		Test Specimens for Magnetization Checks			
Test Performance	General Information	General Information on Performing the Test	X	**X**	**X**
		Prerequisites for test specimens and test equipment		**X**	**X**
		Definition of the different testing technique		**X**	**X**
	Procedure	Selection of the Magnetization Method		**X**	**X**
		Preparation and Clamping of the Component		**X**	**X**
		Magnetization of the Component		**X**	**X**
		Chronological Sequence of test steps			
		Interpretation and analysis of MP Indications			
		Cleaning and Application of Surface Protection after the test			
Facility and Test Equipment	Magnetic Inspection Systems	Portable Systems	X	**X**	**X**
		Stationary Systems	X	**X**	**X**
	Lighting and Irradiation Facility	White light Observation	X	**X**	[4]
		UV-A Light Observation	X	**X**	

[3] The 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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Chapter	Training Content		L1	L2	L3
Reference Blocks		Purpose of the Reference Blocks	X	X	[5]
		Reference Blocks for Control of Test Media	X	X	
		Reference Blocks for Checking Magnetic Direction	X	X	
Test Equipment		Test Medium Categories	**X**	**X**	**X**
		Fluorescent Test Media	X	**X**	**X**
Interpretation of Indications and Evaluation		Individual Indications	X	X	**X**
		Indications with Irregular Distribution		X	**X**
		Indications in Series		X	**X**
Procedure Monitoring	Monitoring of the Magnetization Devices	Stationary Equipment	X	X	**X**
		Portable Magnetization equipment	X	X	**X**
		Monitoring of the Equipment	X	X	**X**
	Demagnetization Equipment	Monitoring of the Demagnetization Unit	X	X	**X**
		Demagnetization Coils	X	X	**X**
		Demagnetization on Static Systems	X	X	**X**
		Procedure monitoring of demagnetization Equipment	X	X	**X**
	MPI Test Media	Preparation of MPI Test Media	X	X	**X**
		Monitoring of the Indication Capability	X	X	**X**
	White Light and UV-A Light	White Light and UV-A Light Equipment	X	X	**X**
		UV-A Light Measurements	X	X	**X**
		LED Technology	X	X	**X**
		White Light Meaurements	X	X	**X**
		Procedure for Monitoring UV-A Light	X	X	**X**
Limitation on MPI Testing		Comparison with other Surface Testing Methods	X	X	**X**
		Detectable Defect Size	X	X	**X**
		Other NDT Methods	X	X	**X**
Material Science	Material Defects during Manufacturing	• Inclusions • Pores • Segregations • Cracks	X	X	**X**
	Defects caused by Material Processing	• Rolling and Forging Defects • Turning, grinding defects • Defects due to electroplating processes	X	X	**X**

Chapter	Training Content		L1	L2	L3
		• Defect caused by hardening			
	Defects caused by operational loads	• Cracks • Corrosion	X	X	**X**
Standards and Regulations		ISO 9934 and ASTM 1444	X	X	**X**
		NDT Written Instruction	X	X	**X**
		Company Internal Procedure	X	X	**X**
Environmental Protection and Safety regulations	Based on Swiss Requirements		X	X	**X**