

TRAINING DOCUMENTS	Doc. Nr.:	INF-021-TD
Title: Syllabus for Magnetic Testing Training – Level	Revision No.:	00
1, 2, and Level 3	Valid from:	16.02.2024

1 REASON FOR LATEST REVISION

Revision No.:	Keywords:	Chapter:	Valid from:	Respon.
00	Development document	All	16.02.2024	Ch.Dürager

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	Train	ing Content	L1	L2	L3
Basic physical	Magnetism	Effetcs on Magnetism	Х	Х	
information		Magnetic Fields	Х	Х	
		Magnetic filed strength	Х	Х	1
		Permeability	Х	Х	
		Magnetic Flux Density	Х	Х	
		Magnetic Flux	Х	Х	

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



TRAINING DOCUMENTS	Doc. Nr.:	INF-021-TD
Title: Syllabus for Magnetic Testing Training – Level	Revision No.:	00
1, 2, and Level 3	Valid from:	16.02.2024

Chapter	Train	ing Content	L1	L2	L3
		Magnetization curve	х	х	
		(hysteresis curve)	^	^	
		Required field strength	Х	Х	
	Magnetic Field /	Basic principles of magnetism	Х	Х	
	Magnetic Field in	Ferromagnetism	Х	Х	
	Material	Matter in a magnetic field	Х	Х	
		Comparison of electrical			
		systems/hydraulic systems	Х	х	
		and magnetism			
		Properties of ferrite	Х	Х	
		Magnetic fields	Х	Х	
		Excitation	Х	Х	
		Magnetic field strength	Х	Х	
		Permeability	Х	Х	
		Magnetic flux	Х	Х	
		Magnetization curves	Х	Х	
		Properties of ferrites	Х	Х	1
	Magnetisation /	Necessary magnetization	Х	Х	-
	Demagnetization	Demagnetization	Х	Х	
		Demagnetization Methods	Х	Х	
	Electrical Variables	Electric Voltage	х	Х	1
		Electric Current		Х	
		Frequency	Х	Х	
		Electrical Resistance	Х	Х	
		Phase Shift			
		Electrical Power			
		Effects of electric currents	Х	Х	1
	Electromagnetic	Transformer	Х	Х	
	Induction	Skin Effect	Х	Х	
	Magnetic field around	Magnetic field strength within	Х	х	2
	electrical conductors	and around electrical			
		conductors			
		Magnetic Flux density within	Х	Х	
		and around electrical			
		conductors			
	Ferromagnetic Materials	Magnetic shearing with coil	Х	Х	2
	in a magnetic field	magnetization			
		Particularities of yoke	Х	Х	
		magnetization			
		Demonstration of adequate	Х	Х	
		magnetization			
	Demonstration of	Field strength measurements	Х	Х	2
	adequate field strengths				
	Demagnetization	Demagnetization methods	Х	Х	

²The training content is required for Level 3 and is not taught in the training course. but is part of the general examination



TRAINING DOCUMENTS	Doc. Nr.:	INF-021-TD
Title: Syllabus for Magnetic Testing Training – Level	Revision No.:	00
1, 2, and Level 3	Valid from:	16.02.2024

Adequate measurements of residual field strengthXXUV-A-radiationUV-A irradiation unitsXSpectral range of UV-A radiatorsXViewing conditionsXViewing conditionsXeyeColor discrimination capability Brightness-dark adaptationTest SpecimensRequirements for the specimenXApplication techniqueGeneral Information Separate excitationXApplication techniqueGeneral Information Separate excitationXView MagnetizationXXView MagnetizationXXCircular magnetizationXXView MagnetizationXXCircular magnetizationXXSeparate excitation techniqueSeparate excitation Combined techniquesXCombined techniqueCombination of 2 D.C. fieldsXXCombination of D.C. and A.C. fieldsXX	
Spectral range of UV-A radiatorsXProperties of the human eyeViewing conditionsXVisual acuityXXColor discrimination capabilityXXColor discrimination capabilityXXBrightness-dark sensitivityXXBrightness-dark adaptationXXBrightness-dark adaptationXXTest SpecimensRequirements for the specimenXXPreparation of the test specimenXXXApplication techniqueGeneral Information Separate excitationXXXUsing and the constraintXXXXCircular magnetization techniqueXXXXCombination of 2 D.C. fields oCombination of D.C.XXX	
Properties of the human eyeViewing conditionsXProperties of the human eyeVisual acuityXXColor discrimination capabilityXXColor discrimination capabilityXXBrightness-dark sensitivityXXBrightness-dark adaptationXXAstigmatismXXTest SpecimensRequirements for the specimenXXPreparation of the testXXXApplication techniqueGeneral InformationXXSelf-excitationXXX• Self-excitationSeparate excitationXX• Self-excitation-XX• Self-excitationX• Voke Magnetization-XX• Combination of 2 D.C. fields-XX	
Properties of the human eyeViewing conditionsXProperties of the human eyeVisual acuityXXColor discrimination capabilityXXColor discrimination capabilityXXBrightness-dark sensitivityXXBrightness-dark adaptationXXAstigmatismXXTest SpecimensRequirements for the specimenXXPreparation of the testXXXApplication techniqueGeneral InformationXXSelf-excitationXXX• Self-excitationSeparate excitationXX• Self-excitation-XX• Self-excitationX• Voke Magnetization-XX• Combination of 2 D.C. fields-XX	
Properties of the human eyeVisual acuityXXXColor discrimination capabilityXXXColor discrimination capabilityXXXBrightness-darkness adaptationXXXBrightness-dark adaptationXXXTest SpecimensRequirements for the specimenXX3Application techniqueGeneral InformationXXXGeneral InformationXXXX• Self-excitationXXXX• Self-excitationSeparate excitationSeparate excitationXX• Yoke MagnetizationCombined techniquesCombined techniquesXX• Yoke MagnetizationXXXX• Combination of 2 D.C. fields• Combination of D.C.XX	
Properties of the human eyeVisual acuityXXXColor discrimination capabilityXXXColor discrimination capabilityXXXBrightness-darkness adaptationXXXBrightness-dark adaptationXXXTest SpecimensRequirements for the specimenXX3Application techniqueGeneral InformationXXXGeneral InformationXXXX• Self-excitationXXXX• Self-excitationSeparate excitationSeparate excitationXX• Yoke MagnetizationCombined techniquesCombined techniquesXX• Yoke MagnetizationXXXX• Combination of 2 D.C. fields• Combination of D.C.XX	
eyeColor discrimination capabilityXXContrast sensitivityXXBrightness-darkness adaptationXXBrightness-dark adaptationXXAstigmatismXXTest SpecimensRequirements for the specimenXXApplication techniqueGeneral InformationXXSeparate excitationXXXCircular magnetizationXXXSeparate excitationSeparate excitationXXSugnetizationXXXCombinadi MagnetizationXXXCombined techniqueCombination of 2 D.C. fieldsXX	
Contrast sensitivityXXBrightness-darkness adaptationXXBrightness-dark adaptationXXAstigmatismXXTest SpecimensRequirements for the specimenXXPreparation of the test specimenXX3Application techniqueGeneral InformationXXSelf-excitation techniqueXXXCircular magnetization spearate excitation separate excitation solutional MagnetizationXXVoke Magnetization Coil Magnetization solution of 2 D.C. fields solution of D.C.XX	
Brightness-darkness adaptationXXBrightness-dark adaptationXXBrightness-dark adaptationXXAstigmatismXXTest SpecimensRequirements for the specimenXXPreparation of the test specimenXX3Application techniqueGeneral Information General InformationXXX• Self-excitation • Separate excitation • Magnetic flow techniqueXXX• Congitudinal Magnetization • Coil Magnetization • Combination of 2 D.C. fields • Combination of D.C.XX	
adaptationImage: constraint of the second secon	
Brightness-dark adaptationXXAstigmatismXXTest SpecimensRequirements for the specimenXXPreparation of the testXX3Application techniqueGeneral InformationXXXCircular magnetizationXXX• Self-excitationXXX• Self-excitation• Magnetic flow techniqueLongitudinal Magnetization-XX• Coll MagnetizationX• Combination of 2 D.C. fieldsX	
AstigmatismXXTest SpecimensRequirements for the specimenXXPreparation of the test specimenXX3Application techniqueGeneral Information Circular magnetization & Self-excitation & Self-excitation & Magnetic flow techniqueXXXLongitudinal Magnetization & Yoke Magnetization & Combination of 2 D.C. fields & Combination of D.C.XX	
Test SpecimensRequirements for the specimenXXPreparation of the test specimenXX3Application techniqueGeneral InformationXXXCircular magnetization self-excitation is Self-excitation wtechniqueXXXSelf-excitation is Self-excitation is Self-excitation is Self-excitation is Self-excitation is Combined techniqueXXXCongitudinal Magnetization is Coil Magnetization is Combined techniques is Combination of 2 D.C. fields is Combination of D.C.XX	
specimenspecimenspecimenApplication techniqueGeneral InformationXXApplication techniqueGeneral InformationXXCircular magnetizationXXX• Self-excitationXXX• Self-excitation• Magnetic flow technique• Congitudinal MagnetizationX• Coli MagnetizationX• Combined techniquesX• Combination of 2 D.C. fieldsX	
Preparation of the test specimenXXX3Application techniqueGeneral InformationXXXGeneral InformationXXXXCircular magnetizationXXX• Self-excitation• Separate excitation• Separate excitation• Magnetic flow technique• Yoke Magnetization• Yoke Magnetization• Coil Magnetization• XX• Combined techniques• XX• Combination of 2 D.C. fields• Combination of D.C.X	
Application technique General Information X X X Application technique General Information X X X Circular magnetization X X X X • Self-excitation • Self-excitation • X X X • Self-excitation • Magnetic flow • • X X • Longitudinal Magnetization • X • X • Yoke Magnetization • X • X • Combined techniques • • X • Combination of 2 D.C. fields • Combination of D.C. •	
Application techniqueGeneral InformationXXXCircular magnetizationXXX• Self-excitation• Separate excitation• Magnetic flow technique• Magnetization• Magnetic flow technique• Yoke Magnetization• X• Coil Magnetization• Coil Magnetization• X• Combined techniques• X• X• Combination of 2 D.C. fields• Combination of D.C.• Combination of D.C.	
Circular magnetizationXXX•Self-excitation•Separate excitation•Magnetic flow technique••Longitudinal Magnetization•X•Yoke Magnetization••Coil Magnetization••Combined techniquesX•Combination of 2 D.C. fields••Combination of D.C.•	
Self-excitation Separate excitation Separate excitation Magnetic flow technique Longitudinal Magnetization Yoke Magnetization Coil Magnetization Combined techniques Combination of 2 D.C. fields Combination of D.C.	
Separate excitation Magnetic flow technique Longitudinal Magnetization Yoke Magnetization Coil Magnetization Combined techniques Combination of 2 D.C. fields Combination of D.C.	
 Magnetic flow technique Longitudinal Magnetization Yoke Magnetization Coil Magnetization Combined techniques Combination of 2 D.C. fields Combination of D.C. 	
technique Image: Construction of the second sec	
Longitudinal Magnetization X • Yoke Magnetization Coil Magnetization • Coil Magnetization X • Combined techniques X • Combination of 2 D.C. fields • Combination of D.C. • Combination of D.C.	
 Yoke Magnetization Coil Magnetization Combined techniques Combination of 2 D.C. fields Combination of D.C. 	
Coil Magnetization Combined techniques Combination of 2 D.C. fields Combination of D.C.	
Combined techniques X • Combination of 2 D.C. fields • Combination of D.C.	
 Combination of 2 D.C. fields Combination of D.C. 	
fields Combination of D.C. 	
Combination of D.C.	
and A.C. fields	
Combination of 2 A.C.	
fields	
Phase shifted fields	
Other Magnetization	
technique	
Measurement of	
Magnetization:	
Field Strength	
Measurement with a	
Hall probe	
Other field strength	
indicators	
Measurement of flux	
density	
Test Equipment Portable Equipment X X 4 Equipment 4	
Additional Equipment X X	



TRAINING DOCUMENTS	Doc. Nr.:	INF-021-TD
Title: Syllabus for Magnetic Testing Training – Level	Revision No.:	00
1, 2, and Level 3	Valid from:	16.02.2024

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

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

⁴ The training content is required for Level 3 and is not taught in the training course. but is part of the general examination



TRAINING DOCUMENTS	Doc. Nr.:	INF-021-TD
Title: Syllabus for Magnetic Testing Training – Level	Revision No.:	00
1, 2, and Level 3	Valid from:	16.02.2024

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



TRAINING DOCUMENTS	Doc. Nr.:	INF-021-TD	
Title: Syllabus for Magnetic Testing Training – Level	Revision No.:	00	
1, 2, and Level 3	Valid from:	16.02.2024	

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