MAGNETIC PARTICLE TESTING

Qualification training according to the ISO 9712

MT

PROCESS	SYSTEM	METHOD	LEVEL / TECHNIQUE	SECTOR	CODE	VALID FROM	PREPARED BY
NDT	**ISO 9712**	MT	1, 2, 3	MS, w, t	-	**1 / 2023**	**PAČAN**

INTRODUCTION

Purpose of Magnetic-particle Testing method (MT, sometimes also referenced as MPI) is detection of surface, in some cases also subsurface defects in ferromagnetic parts and components.

MT qualified personnel has to have knowledge of its **physics principles**, be familiar with overall **requirements of most widely codes and standards**, be able to expand them to new applications and be **able to perform and document testing**.

Training focuses on **gaining knowledge and essential skills** to be further strengthened when collecting experience. Duration and content of the training **depends on the qualification level pursued** as well as the **product or industrial sector selected** (e.g. welding, casting, multisector applications etc.).

Training are designed to prepare participants for all examination parts – **general** (physics principles), **specific** (use of standards and codes), and **practical** (performance of the method) acc. to EN ISO 9712 in the ATG CERT Examination Center.

RECOMMENDED PUBLICATIONS

ATG publications

- MT – Magnetic Particle Testing, Level 1, 2 (ATG handbook)
- MT – Collections of formulas (published by ATG)

Other publications

- Personnel Training Publications: Magnetic Particle Testing (MT) Programmed Instruction Series (ASNT handbook)
- Level III Study Guide: Magnetic Particle Testing Method (MT) (ASNT handbook)
- Relevant Discontinuities – Magnetic Particle and Liquid Penetrant Testing (MT & PT) (ASNT handbook)
- Nondestructive Testing Handbook, Third Edition: Volume 8, Liquid Penetrant Testing (ASNT handbook)

SYLLABUS COVERAGE

Training provides theoretical and practical training to understand Magnetic-particle Testing (MT) principles, be familiar with various types of equipment, accessories, and other aids, and handling of tested parts and components to perform safely Magnetic-particle Testing, report (and evaluate for Level 2 and Level 3) results of the testing.

TRAINING DURATION

SECTOR		LEVEL I	LEVEL II	LEVEL III
MS	Multisector	3 d (24 h)	5 d (40 h)	4 d (32 h)
w	Welds	3 d (24 h)	2 d (16 h)	4 d (32 h)
t	Tubes	3 d (24 h)	2 d (16 h)	4 d (32 h)

BODY OF KNOWLEDGE – DISCONTINUITIES OF MATERIALS

Content of this body of knowledge does not have dedicated part of exam, however it can be indirectly included in other examination parts.

	SUBJECT	LEVEL I	LEVEL II	LEVEL III
1	**Types of discontinuities**			
1.1	Differentiation of discontinuities based on their initiation	☐	☑	☑
1.2	Discontinuities of castings	☑	☑	☑
1.3	Discontinuities of forgings	☑	☑	☑
1.4	Discontinuities of welds	☑	☑	☑
1.5	Heat treatment	☑	☑	☑
1.6	Discontinuities initiated during processing and service	☑	☑	☑
1.6.1	Abrasion cracks	☐	☑	☑
1.6.2	Material fatigue	☐	☑	☑
1.6.3	Stress corrosion	☐	☑	☑
1.6.4	Creep	☐	☑	☑
1.7	Figures	☑	☑	☑

BODY OF KNOWLEDGE – GENERAL PART

	SUBJECT	LEVEL I	LEVEL II	LEVEL III
1	**Introduction**			
1.1	Introduction, terminology, purpose and history	☑	☑	☑
2	**Physical principles and associated knowledge**			
2.1	Basic physical phenomena	☑	☑	☑
2.2	Detailed phenomena description, special applications	☐	☑	☑
2.3	Influences of various parameters and heat treatment	☐	☐	☑
3	**Equipment**			
3.1	Magnetization equipment	☑	☑	☑
3.1.1	Various types of magnetizing equipment	☐	☑	☑
3.1.2	Mobile or stationary equipment using magnetic flow or current flow technique	☐	☑	☑
3.1.3	Automatic and robotized with automatic detection (magnetic leakage field)	☐	☐	☑
3.2	Choice of the technique for magnetization	☐	☑	☑
3.3	Viewing conditions, general principles	☑	☑	☑
3.4	Measurement and calibration	☑	☑	☑
3.5	Demagnetization	☑	☑	☑
4	**Information prior to the test**			
4.1	Preparation of written instructions	☐	☑	☑
4.2	Application of written instructions	☑	☑	☑

	SUBJECT	LEVEL I	LEVEL II	LEVEL III
4.3	Identification or designation of material	☐	☑	☑
4.4	Documentation	☑	☑	☑
4.5	Presentation of the standards, codes and procedures	☑	☑	☑
4.6	Preparation of written procedure	☐	☐	☑
5	**Testing**			
5.1	Testing according to the written instructions	☑	☑	☑
6	**Evaluation and reporting**			
6.1	Classification of indications	☑	☑	☑
6.2	Test report	☑	☑	☑
6.3	Basics of evaluation	☐	☑	☑
6.4	Evaluation and verification of the indication	☐	☑	☑
6.5	Written procedure with check of test reports according to corresponding standards	☐	☑	☑
6.6	Written procedure	☐	☐	☑
7	**Assessment**			
7.1	Assessment of discontinuities and their influence on material	☐	☑	☑
8	**Quality aspects**			
8.1	Personnel qualification in ac. with ISO 9712	☑	☑	☑
8.2	Equipment verification, written instructions, traceability of documentation	☐	☑	☑
8.3	Other NDT qualification and certification systems	☐	☐	☑
8.4	A review of NDT application and product standards	☐	☑	☑
9	**Environmental and safety conditions**			
9.1	Safety data sheet	☐	☑	☑
9.2	Health, safety and electric risks hazards – above all	☑	☑	☑
9.3	Other hazards: fire hazards, risk related to the UV radiation,…	☐	☐	☑

BODY OF KNOWLEDGE – SPECIFIC PART

The content of specific part is modified according to product sector which is covered by training. Multisector includes standards from all sectors. Level of detail paid to particular documents depends on the level of the training (Level I, Level II or III).

	STANDARD	LEVEL I	LEVEL II	LEVEL III
1	**General methodology**			
EN 1330-7	Non-destructive testing. Terminology. Terms used in magnetic particle testing	☑	☑	☑
EN ISO 3059	Non-destructive testing. Penetrant testing and magnetic particle testing. Viewing conditions	☑	☑	☑
EN ISO 9934-1	Non-destructive testing. Magnetic particle testing. General principles	☑	☑	☑
EN ISO 9934-2	Non-destructive testing. Magnetic particle testing. Detection media	☑	☑	☑
EN ISO 9934-3	Non-destructive testing. Magnetic particle testing. Equipment	☐	☑	☑

	STANDARD	LEVEL I	LEVEL II	LEVEL III
2	**Welds**			
EN ISO 17638	Non-destructive testing of welds. Magnetic particle testing	☑	☑	☑
EN ISO 23278	Non-destructive testing of welds. Magnetic particle testing of welds. Acceptance levels	☐	☑	☑
EN ISO 17635	Non-destructive testing of welds. General rules for metallic materials	☑	☑	☑
3	**Forgings**			
EN 10228-1	Non-destructive testing of steel forgings. Magnetic particle inspection	☑	☑	☑
	Acceptance criteria	☐	☑	☑
4	**Castings**			
EN 1369	Founding. Magnetic particle testing	☑	☑	☑
	Acceptance criteria	☐	☑	☑
5	**Tubes**			
EN ISO 10893-5	Non-destructive testing of steel tubes. Magnetic particle inspection of seamless and welded ferromagnetic steel tubes for the detection of surface imperfections	☐	☑	☑

BODY OF KNOWLEDGE – PRACTICAL PART

In the practical part of the training the trainees practice working with instructions and procedures as well as knowledge gained from the standards discussed in the specific part. Training and examination specimens are representative for given product sectors.

	SUBEJCT	LEVEL I	LEVEL II	LEVEL III
1	**General**			
1.1	Measurement of viewing conditions	☑	☑	☑
1.2	Process verification	☑	☑	☑
1.3	Setting the apparatus	☑	☑	☑
2	**Testing**			
2.1	Testing process	☑	☑	☑
2.2	Test report processing	☑	☑	☑
2.3	Evaluation of indications	☐	☑	☑

BODY OF KNOWLEDGE – DOCUMENTATION

In the practical part of the training the trainees practice dealing with process documentation from reporting results to reports, drafting instructions and procedures.

	SUBEJCT	LEVEL I	LEVEL II	LEVEL III
1	**Test Report**			
1.1	Purpose	☑	☑	☑
1.2	Tested part	☑	☑	☑
1.3	Testing conditions	☑	☑	☑
1.4	Reporting findings	☑	☑	☑
1.5	Evaluation	☐	☑	☑
2	**Written Instruction**			
2.1	Validity range	☐	☑	☑
2.2	Personnel requirements	☐	☑	☑
2.3	Inspection range and area of interest	☐	☑	☑
2.4	Equipment and accessories	☐	☑	☑
2.5	Testing parameters and their verification	☐	☑	☑
2.6	Evaluation, acceptance criteria	☐	☑	☑
2.7	Reporting	☐	☑	☑
2.8	Post-testing activity	☐	☑	☑
3	**Written Procedure**			
3.1	Validity range	☐	☐	☑
3.2	Personnel requirements	☐	☐	☑
3.3	Inspection range and scheduled plan	☐	☐	☑
3.4	Equipment, accessories and control activities	☐	☐	☑
3.5	Setting of parameters	☐	☐	☑
3.6	Testing parameters	☐	☐	☑
3.7	Evaluation, acceptance criteria	☐	☐	☑
3.8	Documentation	☐	☐	☑
3.9	Post-testing activity	☐	☐	☑