

VISUAL TESTING



Qualification training according to the ISO 9712

PROCESS	SYSTEM	METHOD	LEVEL / TECHNIQUE	SECTOR	CODE	VALID FROM	PREPARED BY
NDT	ISO 9712	VT	1, 2, 3	MS, dw, dc, dw+t	-	1 / 2023	BARTÁK

INTRODUCTION

Purpose of Visual Testing method (VT) is detection of surface defects in industrial parts and components using unaided or aided sight.

UT 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

- VT – Visual Testing, Level 1, 2 (ATG handbook)
- VT – Collections of formulas (published by ATG)

Other publications

- Personnel Training Publications: Visual Testing (VT) Programmed Instruction Series (ASNT handbook)
- Level III Study Guide: Visual Testing Method (VT) (ASNT handbook)
- Relevant Discontinuities – Visual Testing (VT) (ASNT handbook)
- Nondestructive Testing Handbook, Third Edition: Volume 9, Visual Testing (ASNT handbook)

SYLLABUS COVERAGE

Training provides theoretical and practical training to understand Visual Testing (VT) principles, be familiar with various types of equipment, accessories, and other aids, and handling of tested parts and components to perform safely Visual 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)	2 d (16 h)	3 d (24 h)
dw	Welds	N/A	3 d (24 h)	N/A
dc	Castings	N/A	3 d (24 h)	N/A
dw+t	Welds and Tubes	N/A	4 d (32 h)	N/A

BODY OF KNOWLEDGE – DISCONTINUITIES OF MATERIALS

Content of this body of knowledge does not have dedicated part of examination, 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	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.2	Discontinuities of castings	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.3	Discontinuities of forgings	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.4	Discontinuities of welds	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.5	Heat treatment	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.6	Discontinuities initiated during processing and service	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.6.1	Abrasion cracks	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.6.2	Material fatigue	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.6.3	Stress corrosion	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.6.4	Creep	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

BODY OF KNOWLEDGE – GENERAL PART

SUBJECT		LEVEL I	LEVEL II	LEVEL III
1	Physical Principles			
1.1	Principle of visual testing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.2	Light	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.2.1	Nature	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.2.2	Propagation	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.2.3	Measurement	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.3	Geometrical optics, reflection and refraction	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.4	Mirrors, lenses	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.5	Light guiding system	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.6	Human eye	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	Visual Testing Principles			
2.1	Areas of VT exploitation	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2.2	Contrast	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2.3	Illumination	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2.4	Geometry of observation	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2.5	Visual ability	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2.5.1	Accommodation and adaptation	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2.5.2	Optical illusions	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2.6	Working techniques of visual testing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2.6.1	Direct and indirect visual testing	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

SUBJECT		LEVEL I	LEVEL II	LEVEL III
2.6.2	General visual testing	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2.6.3	Local visual testing	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3	Equipment			
3.1	Photometers	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3.2	Sources of light	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3.3	Illumination system	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3.4	Tools and aids for VT	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3.4.1	Magnifying glass, microscope	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3.4.2	Non-planar mirrors	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3.4.3	Endoscopes	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3.5	Photoelectric sensors	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3.6	CCTV	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3.7	CCTV performance tests	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

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 ISO 17635	Non-destructive testing of welds. General rules for metallic materials	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
EN 13018	Non-destructive testing. Visual testing. General principles	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
EN 1330-10	Non-destructive testing. Terminology. Terms used in visual testing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
EN 13927	Non-destructive testing. Visual testing. Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
EN ISO 8785	Geometrical product specification (GPS). Surface imperfections. Terms, definitions and parameters	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
EN ISO 4287	Geometrical product specification (GPS). Surface texture: Profile method. Terms, definitions and surface texture parameters	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2	Castings			
EN 1370	Founding - Examination of surface condition	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
EN 1559	Founding - Technical conditions of delivery. General	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
MSS-SP-55	Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components - Visual Method for Evaluation of Surface Irregularities	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
ASTM A 802	Standard Practice for Steel Castings, Surface Acceptance Standards, Visual Examination	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3	Welds			
EN ISO 6520-1	Welding and allied processes. Classification of geometric imperfections in metallic materials. Fusion welding	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
EN ISO 6520-2	Welding and allied processes. Classification of geometric imperfections in metallic materials. Welding with pressure	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

STANDARD		LEVEL I	LEVEL II	LEVEL III
EN ISO 5817	Welding. Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded). Quality levels for imperfections	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
EN ISO 10042	Welding. Arc-welded joints in aluminum and its alloys. Quality levels for imperfections	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
EN ISO 13919-1	Welding. Electron and laser beam welded joints. Guidance on quality levels for imperfections. Steel	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
EN ISO 17637	Non-destructive testing of welds. Visual testing of fusion-welded joints	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
EN ISO 17635	Non-destructive testing of welds. General rules for metallic materials	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
EN 12952-6	Water-tube boilers and auxiliary installations. Inspection during construction; documentation and marking of pressure parts of the boiler	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
EN 12952-5	Shell boilers. Inspection during construction, documentation and marking of pressure parts of the boiler	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
EN 12953 - 5	Shell boilers. Inspection during construction, documentation and marking of pressure parts of the boiler	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
EN 13445 - 5	Unfired pressure vessels. Inspection and testing	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
EN 12732	Gas infrastructure. Welding steel pipework. Functional requirements	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	ASME BPV Code Section V/ Art. 1	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	ASME BPV Code Section V/ Art. 9	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	ASME BPV Code Section VIII, Div.1	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4	Pipings And Forgings			
EN 10163-1	Delivery requirements for surface condition of hot-rolled steel plates, wide flats and sections. General requirements	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
EN 10163-2	Delivery requirements for surface condition of hot-rolled steel plates, wide flats and sections. Plate and wide flats	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
EN 10163-3	Delivery requirements for surface condition of hot-rolled steel plates, wide flats and sections. Sections	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
EN 13480-5	Metallic industrial piping. Inspection and testing	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

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.

SUBJECT		LEVEL I	LEVEL II	LEVEL III
1	General			
1.1	Measurement of illumination intensity	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.2	Gauges and tools for direct local VT	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.3	Endoscopes	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

	SUBEJCT	LEVEL I	LEVEL II	LEVEL III
2	Testing According To Instructions			
2.1	Visual testing of welds	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2.2	Visual testing of castings	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2.3	Visual testing of bores (with boroscopes)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2.4	Visual testing of aerospace assemblies	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3	Evaluation Of Products Quality			
3.1	Welds	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3.2	Forgings	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3.3	Castings	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

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	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.2	Tested part	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.3	Testing conditions	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.4	Reporting findings	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1.5	Evaluation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	Written Instruction			
2.1	Validity range	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2.2	Personnel requirements	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2.3	Inspection range and area of interest	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2.4	Equipment and accessories	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2.5	Testing parameters and their verification	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2.6	Evaluation, acceptance criteria	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2.7	Reporting	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2.8	Post-testing activity	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3	Written Procedure			
3.1	Validity range	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3.2	Personnel requirements	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3.3	Inspection range and scheduled plan	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3.4	Equipment, accessories and control activities	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3.5	Setting of parameters	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3.6	Testing parameters	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3.7	Evaluation, acceptance criteria	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3.8	Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3.9	Post-testing activity	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>