

## Qualification training according to the ISO 9712

PROCESS	SYSTEM	METHOD	LEVEL/ TECHNIQUE	SECTOR	CODE	VALID FROM	PREPARED BY
NDT	ISO 9712	BASIC	3	MS	-	1 / 2023	ZAVADIL

## INTRODUCTION

The NDT Level 3 manages the NDT special process within his/her company and is responsible to the employer for all parts of this process and therefore must be properly prepared. They must not only be able to manage the process, but also be able to use and apply knowledge of related processes that affect defect creation.

Level 3 qualified personnel therefore has to have knowledge of its **physics principles of individual NDT methods, materials science and manufacturing technologies, structural design and personnel qualification systems.**

**BASIC training is optional, nevertheless the BASIC examination is mandatory.**

**The BASIC training does not include topics on individual NDT methods!** Every applicant should already have a knowledge of the individual NDT methods corresponding to equivalent of Level 2. For those interested in refreshing this knowledge, ATG organizes consultations that can be arranged for any number of days and NDT methods.

## RECOMMENDED MATERIALS

### ATG Materials

- BASIC - Basic exam (ATG handbook for BASIC and IWI-TM)
- NDT - Nondestructive Testing of Materials (ATG handbook for NDT basics)
- ATG handbooks for individual methods (ATG handbooks for Level 2)

### Other materials

- Hobart Institute of Welding: A Guide to Welding Process
- ASNT: Guide to BASIC Exam

## OBJECTIVE

Training provides theoretical training to understand materials engineering and NDT personnel qualification principles, so that they are able to perform all the duties associated with the NDT Level 3 role responsibly.

## TRAINING DURATION

TECHNIQUE / SECTOR		LEVEL I	LEVEL II	LEVEL III
MS	Multisector	-	-	5 d (40 h)

Training is divided into 5 main parts as follows:

- NDT Process Management (0.25 days)
- Material Properties (2 days)
- Structural design (0.75 days)
- Manufacturing Technologies (1.5 days)
- Qualification (0.5 days)

## KNOWLEDGE SUMMARY - NDT PROCESS MANAGEMENT

Summary of the basic knowledge of NDT process control in general terms, not related to specific applications in individual methods and techniques.

	TOPIC	LEVEL I	LEVEL II	LEVEL III
<b>1</b>	<b>NDT process and its role</b>			
1.1	Structure of the NDT process	-	-	☑
1.2	NDT Level 3 responsibilities in the NDT process	-	-	☑
1.3	Basic requirements for NDT Level 3	-	-	☑

## KNOWLEDGE SUMMARY - MATERIAL SCIENCE

Comprehensive introduction to the properties of metallic materials (primarily steels), their structure, typical applications and impact on their production (casting, forming) and joining (welding, soldering, gluing...).

	TOPIC	LEVEL I	LEVEL II	LEVEL III
<b>1</b>	<b>Structure of metals and alloys</b>			
1.1	Mechanical, physical and chemical properties of metals	-	-	☑
1.2	Microstructure of metals	-	-	☑
1.3	Alloys and phase diagrams	-	-	☑
1.3.1	Iron-iron carbide and iron-carbon diagram	-	-	☑
1.4	Equilibrium and non-equilibrium transformation	-	-	☑
1.5	Strengthening mechanisms in metals	-	-	☑
1.6	Heat treatment of base materials and welded joints	-	-	☑
1.6.1	Quenching	-	-	☑
1.6.2	Annealing	-	-	☑
1.6.3	Tempering	-	-	☑
1.6.4	Chemical-heat treatment	-	-	☑
<b>2</b>	<b>Steels and their weldability</b>			
2.1	Welding of steel	-	-	☑
2.1.1	Weld structure	-	-	☑
2.1.2	Cracking of welded joints	-	-	☑
<b>3</b>	<b>Cast metals, non-ferrous metals and their weldability</b>			
3.1	Cast irons, steels and susceptibility to defects	-	-	☑
3.2	Non-ferrous metals and their alloys	-	-	☑
<b>4</b>	<b>Degradation mechanisms and protective layers</b>			
4.1	Influence of a notch	-	-	☑
4.2	Corrosion	-	-	☑
4.3	Wear	-	-	☑
4.4	Creep	-	-	☑
4.5	Fatigue	-	-	☑
4.6	Radiation damage	-	-	☑
4.7	Protective layers	-	-	☑

TOPIC		LEVEL I	LEVEL II	LEVEL III
<b>5</b>	<b>Determining mechanical properties</b>			
5.1	Relationship between diagnostic, non-destructive and destructive testing	-	-	☑
5.2	Destructive testing (mechanical tests)	-	-	☑
5.2.1	Static tensile test	-	-	☑
5.2.2	Impact test	-	-	☑
5.2.3	Hardness test	-	-	☑
5.2.4	Fatigue test	-	-	☑
5.2.5	Fracture test	-	-	☑
5.2.6	Special tests	-	-	☑
5.3	Nondestructive testing	-	-	☑

## KNOWLEDGE SUMMARY – STRUCTURAL DESIGN

A summary of the basic knowledge of the principles of structural design for NDT Level 3. Only topics necessary to understand the occurrence of manufacturing and service defects due to structural design are discussed. This is not a detailed course on structural design.

TOPIC		LEVEL I	LEVEL II	LEVEL III
<b>1</b>	<b>Structural Statics</b>			
1.1	Basic terms	-	-	☑
1.2	Influence of stress	-	-	☑
1.3	Influence of temperature	-	-	☑
1.4	Deformation	-	-	☑
1.5	Rupture	-	-	☑
<b>2</b>	<b>Basics of design</b>			
2.1	Theory of elasticity	-	-	☑
2.1.1	Elasto-mechanics	-	-	☑
2.1.2	Plasticity	-	-	☑
2.2	Fatigue and fatigue strength	-	-	☑
2.2.1	Low cycle fatigue	-	-	☑
2.2.2	High cycle fatigue	-	-	☑
2.3	Weld design and shape of welded surfaces	-	-	☑
2.4	Loading mechanisms	-	-	☑

# KNOWLEDGE SUMMARY – PRODUCTION TECHNOLOGY

Basic information on manufacturing technologies for metallic and non-metallic materials and the effects leading to the formation of typical defects.

TOPIC		LEVEL I	LEVEL II	LEVEL III
<b>1</b>	<b>Steel production</b>			
1.1	Methods of steel production	-	-	☑
<b>2</b>	<b>Casting</b>			
2.1	Casting technologies	-	-	☑
2.2	Casting process	-	-	☑
2.1.1	Design of a sand mold casting	-	-	☑
2.1.2	The process of casting into a sand mold	-	-	☑
2.2	Casting heat treatment	-	-	☑
<b>3</b>	<b>Welding and related processes</b>			
3.1	Introduction to welding	-	-	☑
3.2	Oxy-fuel welding	-	-	☑
3.3	Electric arc welding	-	-	☑
3.3.1	Main welding parameters	-	-	☑
3.3.2	Electric arc	-	-	☑
3.3.3	Methods in relation to their applicability	-	-	☑
3.4	Resistance and physical welding	-	-	☑
3.4.1	Plasma and laser welding	-	-	☑
3.4.2	Friction welding	-	-	☑
3.4.3	Spot welding	-	-	☑
3.5	Related processes	-	-	☑
3.5.1	Cutting	-	-	☑
3.5.2	Brazing	-	-	☑
<b>4</b>	<b>Forming</b>			
4.1	Properties of formed products	-	-	☑
4.1.1	Effect of forming temperature	-	-	☑
4.1.2	Lubrication of forming tools	-	-	☑
4.2	Classification of forming technologies	-	-	☑
4.2.1	Longitudinal sheet rolling	-	-	☑
4.2.2	Forging	-	-	☑
<b>5</b>	<b>Other manufacturing technologies</b>			
5.1	Production of seamless and welded tubes	-	-	☑
5.2	3D printing of metals	-	-	☑

# KNOWLEDGE SUMMARY – PERSONNEL QUALIFICATION

Detailed explanation of the NDT qualification process from the perspective of different qualification systems.

TOPIC		LEVEL I	LEVEL II	LEVEL III
<b>1</b>	<b>Qualification systems</b>			
1.1	Independent qualification	-	-	☑
1.2	Employer qualifications	-	-	☑
<b>2</b>	<b>ISO 9712</b>			
2.1	Philosophy	-	-	☑
2.1.1	Role of the certification body	-	-	☑
2.2	Detailed analysis of ISO 9712	-	-	☑
2.3	Levels of qualification	-	-	☑
2.4	Quality management system and governing documents	-	-	☑
2.4.1	What is meant by ISO 9712 as a qualification system?	-	-	☑
2.4.2	Written instructions	-	-	☑
2.4.3	Written procedures	-	-	☑
2.4.4	Relationship to ISO 9001	-	-	☑
2.5	Related qualification systems	-	-	☑
2.5.1	ISO 20807	-	-	☑
2.5.2	ASNT Level II / III	-	-	☑
2.5.3	ASNT ACCP / ASNT 9712	-	-	☑
2.6	Link to ISO/IEC 17024	-	-	☑
<b>3</b>	<b>SNT-TC-1A</b>			
3.1	Philosophy	-	-	☑
3.1.1	Role of the employer	-	-	☑
3.1.2	Role of the Level III	-	-	☑
3.3	Quality management system and governing documents	-	-	☑
3.3.1	Written Practice	-	-	☑
3.3.2	Technical Performance	-	-	☑
3.4	Related qualification systems	-	-	☑
3.4.1	ASNT CP-189	-	-	☑
3.4.2	EN 4179 / NAS 410	-	-	☑
<b>4</b>	<b>Other systems</b>			
4.1	EN 4179 / NAS 410	-	-	☑
4.1.1	Role of the employer	-	-	☑
4.1.2	Responsible Level 3	-	-	☑
4.1.3	Role of NANDTB	-	-	☑
4.2	ASME ANDE-1	-	-	☑
4.1.1	Performance-based experience	-	-	☑
4.1.3	Qualification / Continuity card	-	-	☑
4.1.2	Practical examination	-	-	☑