

Welding Fundamentals

Delivery Method: eLearning || Duration: 7 hours || Course Fee: 580 €

Category: Materials, Welding & NDT

Available languages: English

Certificate

On completion of the training program, the student will be awarded:

- A Certificate of **Welding Fundamentals**, issued by Bureau Veritas Solutions Marine & Offshore.

The Certificate of **Welding Fundamentals** is obtained after completing the course and passing the online test.

Presentation

This training course provides a general introduction to welding, including an introduction to metallurgy, general information concerning welding, an overview of the electric arc processes commonly used in shipbuilding and details of welding inspection.

Who the course is for

The course **Welding Fundamentals** is aimed at anyone interested in understanding the general principles of arc welding. This may include: Ship Managers, Technical Superintendents, Ship Masters, Officers and Seafarers; Shipyards Technical Staff; Surveyors; P&I and/or Insurance Inspectors; Naval Architects; Marine Engineers; Etc.

Objectives

On completion of the training, students will be able to:

- Understand the nature and know the mechanical properties of metals; Understand the production process of steel and aluminium and the application of casting and forging processes.
- Understand fundamentals of fusion welding; Know how to determine heat input and preheat temperature; Understand the influence of the thermal cycle on weld microstructure and distortion; Know the general types of welding joints and the different welding positions
- Know how to differ and recognize the arc welding processes used in shipbuilding; Understand the applicability and limitations of the different welding processes; Get familiar with common types of arc welding equipment and power sources
- Know and apply the required activities in welding inspection; Determine and arrange the scope of inspection plan for different tasks; Know the different types of weld imperfections; Understand how to perform visual inspection of welding

Program

Module 1 – Introduction to Metallurgy

- Introduction to metal structure and properties: Classification, nature of metallic bonding,
- Mechanical properties: Tensile properties, toughness, hardness
- Metal structures
- Steel microstructure: Iron-carbon phase diagram, influence of carbon and other alloying steel elements on mechanical properties, phase transformation,
- Stainless steel
- Heat treatment of steel: Normalizing, annealing, stress relief treatment, quenching and tempering
- Production of steel
- Steel casting
- Rolling processes for steel
- Production of aluminium
- Aluminium alloy products
- Casting and forging processes

Module 2 – Welding Fundamentals

- Introduction to fusion welding: Welding techniques, fusion welding processes, weld joint structure
- Weldability
- Heat input
- Measuring of welding parameters, influence of welding parameters
- Preheating: Reasons for preheating, hydrogen in the weld joint, calculation of preheating temperature, interpass temperature,
- Thermal cycle in welding: Temperature distribution, microstructure through heat affected zone, microstructure of the welded joint
- Residual stress and distortion: Distortion process during welding, post-weld heat treatment
- Types of weld joints: Edge preparation, weld types, dimensioning of weld preparation
- Welding positions

Module 3 – Arc Welding Processes

- Classification of welding processes
- Physics of electric arc: Ignition of the arc, electric arc structure, influence of the polarity
- Arc welding processes: Variants of arc welding processes, arc welding equipment
- Manual metal arc welding (MMAW)
- Submerged arc welding (SAW)
- Flux cored arc welding (FCAW)
- Metal active gas welding (MAG)
- Tungsten inert gas welding (TIG)

Module 4 – Welding Inspection

- Essential requirements of a welding inspector
- Welding inspection process
- Inspections before welding: Material identification, base material, surface conditions, joint condition, weld documentation, welding procedure specification (WPS), assembly and fabrication, control of welding equipment
- Inspections during welding: Weather protection, control and handling of filler material, control of preheat and interpass temperatures, welder's qualification, root pass control, interpass control, NDT between passes, control of heat input
- Inspections after welding: Visual control of weld surface, weld geometry, arc striking on base material, mechanical, chemical and metallographic testing, control of post weld heat treatment, control of weld repair, marking of accepted and rejected welds, monitoring of NDT
- Imperfections on weld joints: Cracks, cavities and porosity, solid inclusions, lack of fusion and penetration, imperfect shape and dimensions, miscellaneous imperfections