

E-630

▲ Who should attend?

Graduate engineers and technicians involved in inspection and maintenance of welded equipment and pipes in the petroleum, production, refining, petrochemical and chemical industries.

▲ Duration

5 days

▲ Dates & Location

May be organised for a single company

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▲ Course Coordinator

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Ref. **MCO / MATER-E**

METALLIC AND NON METALLIC MATERIALS AND STRENGTH OF MATERIALS

OBJECTIVES

To provide a broader knowledge of metallic and non-metallic engineering materials and understanding of the behavior of the equipments under pressure.

On completion of the course, participants know:

- the main characteristics of materials used in petroleum and chemical industries,
- the principles of design and calculation of equipment.

COURSE CONTENT

METALLURGY OF FERROUS AND NON-FERROUS METALS USED IN PROCESS INDUSTRIES AND OTHER MATERIALS

3.75 days

Overview of materials

Characteristics and physical properties
Selection, specifications and designations
Use and cost

Metal structure

Crystallography (face-centered, body-centered and hexagonal structures)
The alloy diagrams and the phase rule
The iron - carbide diagram
Iron and steel making - Ingot stage (casting, forging, rolling)

Effects of alloying elements

On hardenability and physical and mechanical properties
On the allotropic transformation of pure iron

Heat treatments

Hardening and tempering
Annealing and stress relieving

Carbon steels, low alloy steels and alloy steels

Different equilibrium diagrams: iron, carbon, chromium, nickel system; Schaeffler diagram
Different types of steels: low chromium molybdenum steels; stainless steels (classification, properties, sigma phase)

Refractory alloys for high temperature

High creep resistance, carburization and oxidation resistance
Classification versus temperature

Non-ferrous metals and cryogenic metals

Copper and its alloys, aluminium and its alloys
Nickel and its alloys, titanium, tantalum, zirconium, cobalt

Plastics

Thermoplastics: rigid polyvinylchloride (PVC), polyethylene and polypropylene, PTFE and others
Thermosetters. Reinforced plastics

Other materials

Ceramics and glass
Graphite

Introduction to metallography - Practical work (if possible)

Polishing and etching
Identification of different types of corrosion

THICKNESS OF SHELLS AND TUBES OF PRESSURE VESSELS

1.25 days

Mechanical properties of materials to assess

Stress deformation diagram: tensile strength, modulus of elasticity, elongation
The importance of plasticity
Hardness and resilience
Behavior at different temperatures (creep and tensile strength versus temperature)

Rules for the design of shells and tubes

Design conditions: design pressure and design temperature, different codes, the main stresses in a cylindrical vessel: circumferential and longitudinal stress
Thickness calculation. French and US codes: vessels under internal and external pressure.
Test pressure and example