Principles of Heat Treatment

A one day course providing delegates with a sound understanding of the beneficial effects of heat treatment to a range of ferrous & light metal alloys.

Course aims
This course outlines the basic metallurgical principles of heat treatment, the fundamentals of furnace design & operation and concludes with an explanation of testing & quality control procedures.

Who should attend
Anyone requiring an overall understanding of the principles & practicalities of heat treatment. This includes purchasers & vendors of heat treatment services, design engineers & quality control technicians.

A module of the QCF level 3 Certificate in Metallurgy qualification.

“The trainer was very knowledgeable and showed he had a wealth of experience.”
Anna Watson, Perkins Engines Co Ltd

“The day was a great success with good content and great catering.”
Ian Armour, Barden UK

Contact us
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**Principles of Heat Treatment**

### Why Heat Treat?
- Modifying mechanical properties
- Improve cosmetic appearance
- Crystallography of metals
- Influence of grain size
- Effects of alloying elements

### Strengthening Mechanisms
- What is strength?
- Lattice strain
- Crack propagation
- Solid solutions
- Martensitic transformations
- Precipitates & grain boundaries
- Phase diagrams
- CCT diagrams

### Heat Treatment Terminology
- Homogenisation
- Solution treatment
- Normalising
- Annealing
- Precipitation treatment
- Tempering
- Ageing
- Stress relieving

### Engineering the Next Generation

### Heating, Soaking, Cooling, Quenching
- How hot is hot enough?
- How long is long enough?
- How quickly is quick enough?

### Furnaces & Furnace Issues
- Batch furnaces
- Continuous furnaces
- Choice of fuel – gas, electricity, fuel oil
- Burner types
- Atmosphere control
- Furnace linings
- Furnace control & monitoring

### Accreditation & Testing
- API 6a, NORSOK, NADCAP
- Chemical analysis
- Tensile tests
- Impact tests
- Hardenability tests
- Corrosion tests
- Microstructure & macrostructure
- Creep & stress rupture tests

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Learning Outcomes

- Explain why heat treatment is required for steels, nickel, titanium and aluminium alloys
- Appreciate the influence of heat treatment on microstructure and hence on materials properties
- Compare and contrast the attributes and control characteristics of electrical resistance, induction, gas and fuel oil fired furnaces
- Specify physical test procedures and explain their relevance in a formal quality control environment

Other Continuous Professional Development (CPD) Services

Metals Processing
- Casting of Metals
- Hot & Warm Forging
- Introduction to Heat Treatment
- Heat Treatment for Professionals
- Machining of Metals
- Welding of Metals
- Powder Metallurgy

In-Service Performance
- Introduction to Corrosion
- Combating Metal Corrosion
- Introduction to Fatigue
- Failure Analysis & Prevention
- Mechanical Testing
- Non-Destructive Testing
- Quality Assurance

Metals & alloys
- Carbon & Alloy Steels
- Stainless Steels
- Titanium Metallurgy
- Nickel Metallurgy
- Aluminium Metallurgy

Higher Education
BSc, BENg, MSc, MEng & PhD Courses in
- Mechanical Engineering
- Electrical / Electronic Engineering
- Materials Engineering
- Manufacturing
- Machining
- Advanced Manufacturing Management

Leadership & Management
(ILM Levels 2, 3, 5)
- Service Improvement
- Coaching & Mentoring

Certificate in Metallurgy
QCF Level 3

Apprenticeships
- Mechanical
- Electrical
- Manufacturing
- Materials
- Fabrication
- Machining
- Composites
- Design

Metals Applications
- Subsea Application of Metals
- Metals for Aerospace
- Metals for Gas Turbine Applications

Certificate in Metallurgy
QCF Level 3