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# Refractory Lining and Hot Equipment Reliability: Furnaces, Boilers and Kilns Course

25 – 29 January 2027  
Tokyo





## Refractory Lining and Hot Equipment Reliability: Furnaces, Boilers and Kilns Course

**Ref:** 233\_18400 **Date:** 25 – 29 January 2027 **Location:** Tokyo **Fees:** 6900 GBP

### Programme Summary

Refractory lining and hot equipment reliability across furnaces, boilers and kilns is the subject of this five-day training course for maintenance, reliability and turnaround leaders at advanced level, culminating in a hot equipment refractory strategy for their plant. Refractory and insulation failures cause hot spots, unplanned shutdowns and extended turnarounds, yet the work is often left to contractors with little owner oversight. The approach moves from material behaviour and failure mechanisms, through design and installation control, to inspection, turnaround planning and life-cycle decisions. Mars Training Centre UK delivers this programme in refractory lining and hot equipment reliability.

### The Business Case

A failed lining can force a heater, boiler or kiln offline within hours, and a poorly executed repair often fails again before the next planned outage. Leaders who specify the right materials, control installation and dry-out, and read inspection data critically extend run lengths, shorten turnarounds and reduce energy lost through damaged linings and insulation across every hot production unit on site.

- Unplanned Downtime From Hot Spots: Falls as linings are selected, installed and inspected against defined acceptance criteria.
- Turnaround Duration and Cost: Reduces as refractory scope, materials and contractors are planned and qualified in advance.
- Heat Loss and Fuel Use: Drops as damaged insulation and linings are found and repaired on a risk basis.

### Principles and Evidence Base

- API 936: Refractory installation quality control, inspection and testing of monolithic linings frame the installation and acceptance work in Session 3.
- API 560: Fired heater practice for refractory and insulation informs the design and specification review in Session 2.
- API 583: Guidance on corrosion under insulation and fireproofing shapes the insulation integrity work in Session 4.
- Heat Transfer and Thermal Shock Principles: Conduction, expansion and thermal cycling explain the failure mechanisms analysed in Session 1.



## Intended Participants

- Leaders accountable for the reliability of fired heaters, boilers, reformers and kilns.
- Turnaround managers who scope, schedule and budget refractory and insulation work.
- Inspection heads who define and verify acceptance criteria for hot equipment.
- Engineering managers who approve refractory specifications and contractor procedures.

The programme serves refining, petrochemicals, power generation, cement and steel plants.

## Learning Outcomes

1. Participants will be able to diagnose refractory and insulation failures from field evidence and operating history.
2. Participants will be able to evaluate brick, castable and ceramic fibre options for given service conditions.
3. Participants will be able to construct installation, anchoring and dry-out requirements with acceptance tests.
4. Participants will be able to prioritise inspection and repair using thermography and risk ranking.
5. Participants will be able to justify refractory turnaround scope, contractor selection and life-cycle cost decisions.

## Programme Structure

### Day 1: Refractory Lining Fundamentals and Failure Mechanisms

Why do linings and insulation fail in hot service?

- Heat Transfer, Thermal Expansion and Thermal Shock
- Chemical Attack, Slag Penetration and Spalling
- Anchor Failure and Lining Detachment
- Hot Spot Patterns on Heaters, Boilers and Kilns
- Failure Investigation and Root Cause Records

### Day 2: Material Selection and Design Review

Which lining system suits each zone and duty?

- Dense and Insulating Refractory Bricks
- Castables, Gunning Mixes and Plastic Refractories
- Ceramic Fibre Modules and Blankets
- Fired Heater Lining Practice Under API 560
- Anchor Systems and Expansion Allowance Design



### Day 3: Installation Control, Dry-Out and Acceptance

How is a lining installed and accepted so that it performs?

- Installation Quality Control Under API 936
- Casting, Gunning and Ramming Methods
- Sample Panels and Physical Property Testing
- Curing and Dry-Out Schedules
- Contractor Qualification and Hold Points

### Day 4: Inspection, Insulation Integrity and Turnaround Planning

How are hot equipment risks found and planned into outages?

- Infrared Thermography Surveys and Trending
- Corrosion Under Insulation Guided by API 583
- Risk Ranking of Refractory and Insulation Defects
- Refractory Scope Definition for Turnarounds
- Hot Repairs and Temporary Measures

### Day 5: Applying the Hot Equipment Refractory Strategy

Is the refractory strategy for the participant's plant ready for approval?

- Applying Day 1 Failure Analysis to Plant History
- Using Day 2 Selection Criteria for Upcoming Replacements
- Building Day 4 Inspection Findings Into the Next Turnaround
- Life-Cycle Cost Comparison of Repair Options
- Completing the Hot Equipment Refractory Strategy

### Methodology

The programme relies on case analysis of lining failures and turnaround projects on fired heaters, boilers, reformers and rotary kilns. Participants review real specifications, thermography images and dry-out records, challenge contractor procedures and rank repair options by risk and cost. Peer review tests each plant strategy before it is finalised.

- Suggested activity: Diagnosing a heater hot spot from thermography and operating data.
- Suggested activity: Reviewing a contractor's dry-out procedure against acceptance criteria.
- Suggested activity: Scoping refractory work for a kiln shutdown.



## Capstone Output

Each participant completes a hot equipment refractory strategy for their plant. It contains a failure history review, a material selection matrix, installation and acceptance requirements, a risk-ranked inspection plan, a turnaround scope and a life-cycle cost comparison. It supports budget requests and contractor briefs.

## Frequently Asked Questions

### **Is refractory lining and hot equipment reliability training suitable for plant managers?**

Yes. It is set at advanced level for leaders who own the reliability of hot equipment, and assumes experience of maintenance, inspection or turnaround management.

### **Which standards does the refractory lining and hot equipment reliability programme rest on?**

It rests on API 936 for installation quality control, API 560 for fired heater practice and API 583 for corrosion under insulation.

### **How is the hot equipment refractory strategy used at work?**

You can use it to justify refractory budgets, define turnaround scope, brief contractors and set inspection priorities for hot equipment.