**5-Day Cement Industry Training Course**
**In**

# KILN HOT ALIGNMENT AND KILN MECHANICS

**Abu Dhabi - UAE, 23 – 27 Mar. 2026**

**COURSE LEVEL: ADVANCED**

## COURSE OVERVIEW:

The mechanical integrity of a rotary kiln depends on precise alignment and the harmonious movement of its massive components under extreme thermal loads. This course defines the principles of "Hot Alignment," where the kiln's axis, tire-to-roller contacts, and shell eccentricity are measured and corrected while the kiln is in operation. By mastering the mechanics of the kiln, participants will learn how to prevent premature refractory failure and mechanical fatigue.

The scope of this training includes the technical study of "Kiln Crank" (eccentricity), "Tire Creep," and the management of axial thrust. It covers the use of laser-based measuring systems and infrared thermography to evaluate the kiln's physical state. Furthermore, the course addresses the complex relationship between the kiln shell temperature and the mechanical stresses placed on the piers, bearings, and drive system.

Coverage includes detailed modules on roller adjustment (skewing), the calculation of "Hertzian Pressure" on rollers, and the maintenance of the girth gear and pinion. Participants will explore the safety protocols for working near rotating heavy machinery and the risks of "Shell Warping" due to improper heating or cooling. Attendees will gain the advanced expertise required to oversee major kiln overhauls and to implement a world-class "Kiln Mechanical Health" monitoring program.

## COURSE OBJECTIVES:

**After completion of this course, the participants will be able to:**

- Define the technical parameters of "Static" vs. "Hot" kiln alignment.
- Identify the signs of kiln misalignment: Vibration, heat, and wear.
- Understand the "Three-Pier" vs. "Two-Pier" kiln mechanical behavior.
- Measure and interpret "Tire Creep" and its impact on shell health.
- Execute precise "Roller Skewing" to manage axial thrust.
- Analyze "Shell Eccentricity" (Crank) and its effect on refractory life.
- Calculate the load distribution across the kiln piers and rollers.
- Inspect the "Girth Gear" and "Pinion" for wear and alignment.
- Manage the "Kiln Shell Temperature" to prevent mechanical distortion.
- Evaluate the condition of "Chair Pads" and tire migration.
- Use "Laser Alignment" tools for professional kiln surveys.
- Develop a predictive maintenance plan for the kiln's mechanical assets.

## TARGET AUDIENCE:

This course is intended for Mechanical Engineers, Maintenance Managers, Reliability Specialists, and Kiln Technicians.

## TRAINING COURSE METHODOLOGY:

A highly interactive combination of lectures, discussion sessions, and case studies will be employed to maximize the transfer of information, knowledge, and experience. The course will be intensive, practical, and highly interactive. The sessions will start by raising the most relevant questions and motivating everybody to find the right answers. The attendants will also be encouraged to raise more of their questions and to share in developing the right answers using their analysis and experience. There will also be some indoor experiential activities to enhance the learning experience. Course material will be provided in PowerPoint, with necessary animations, learning videos, and general discussions.

The course participants shall be evaluated before, during, and at the end of the course.

## COURSE CERTIFICATE:

National Consultant Centre for Training LLC (NCC) will issue an Attendance Certificate to all participants completing a minimum of 80% of the total attendance time requirement.

## COURSE OUTLINE / COURSE CONTENT:

### MODULE 1: KILN MECHANICAL FUNDAMENTALS

- The rotary kiln as a "Flexible Beam" on multiple supports.
- Impact of "Slope" and "Rotation Speed" on mechanical stress.
- Understanding "Thermal Expansion" of the kiln shell.
- Forces acting on the kiln: Gravity, Friction, and Thermal.
- Safety rules for mechanical inspections on rotating kilns.

### MODULE 2: PRINCIPLES OF HOT ALIGNMENT

- Why "Hot" alignment? Accounting for thermal distortions.
- Defining the "Centerline" and the "Axis of Rotation."
- Horizontal vs. Vertical misalignment: Causes and effects.
- Overview of modern laser survey and optical techniques.
- Role of the "Alignment Report" in maintenance planning.

### MODULE 3: TIRES AND CHAIR PADS

- Function and design of the kiln tires (Riding Rings).
- Measuring "Tire Creep" (Migration) and its significance.
- The "Shrinkage" effect: Managing the gap between tire and shell.
- Wear patterns of chair pads and stop blocks.
- Lubrication of the tire-chair pad interface.

### MODULE 4: SUPPORT ROLLERS AND BEARINGS

- Roller materials and surface hardness requirements.
- Bearing types: Plain hydrodynamic vs. Antifriction rollers.
- The "Oil Bucket" and "Internal Lubrication" systems.
- Managing "Bearing Temperature" and cooling water flow.
- Inspecting for "Spalling" and "Pitting" on roller surfaces.

**MODULE 5: MANAGING KILN AXIAL THRUST**

- The theory of "Thrust Balance": Natural vs. Controlled thrust.
- The "Hydraulic Thrust Roller" function and control.
- "Roller Skewing": The art and science of "Pushing" the kiln.
- Risks of "Over-Skewing": Bearing heat and surface wear.
- Monitoring "Thrust Roller Pressure" trends in the DCS.

**MODULE 6: KILN SHELL ECCENTRICITY AND CRANK**

- Defining "Mechanical Crank" vs. "Thermal Crank."
- How shell eccentricity destroys refractory bricks.
- Using "Shell Scanners" to detect mechanical wobbles.
- Corrective actions for a "Permanent Set" or "Dog-Leg" shell.
- Impact of "Red Spots" on shell circularity.

**MODULE 7: DRIVE SYSTEM: GIRTH GEAR AND PINION**

- Alignment of the girth gear: Radial and axial run-out.
- Lubrication of the open gear: Spray systems and grease types.
- Analyzing gear "Vibration" and "Noise" signatures.
- Reversing the girth gear: When and how to do it.
- Auxiliary drive (Pony Motor) requirements and safety.

**MODULE 8: KILN SEALS AND MECHANICAL INTERFACE**

- Mechanical design of "Lamp-Shade" and "Graphite" seals.
- Managing the "Expansion" and "Movement" of the seals.
- Impact of misalignment on seal life and "False Air."
- Maintenance of the seal's tensioning and lubrication systems.
- Inspecting the seal "Wearing Plate" and internal liners.

**MODULE 9: LUBRICATION AND COOLING MECHANICS**

- Chemistry of high-temperature lubricants for kilns.
- Centralized vs. manual lubrication protocols.
- Operation of shell cooling fans to stabilize mechanics.
- Impact of "Rain" and "Wind" on the kiln's mechanical state.
- Managing the "Cooling-Down" sequence to prevent warping.

**MODULE 10: VIBRATION ANALYSIS AND NDT**

- Monitoring vibration on the main kiln drive and bearings.
- Using "Ultrasonic Testing" for roller shaft integrity.
- Crack detection in the kiln shell using Magnetic Particle Inspection.

- Interpreting "Thermography" as a mechanical health indicator.
- Baseline data collection for predictive maintenance.

**MODULE 11: PLANNING KILN MECHANICAL OVERHAULS**

- Developing a scope of work for "Tire" or "Roller" replacement.
- Heavy lifting logistics: Using "Super-Cranes" for kiln sections.
- Managing "Contractor Quality" during alignment corrections.
- Budgeting and "Return on Investment" for alignment projects.
- Post-overhaul "Commissioning" and alignment verification.

**MODULE 12: COURSE ASSESSMENT AND STRATEGIC REVIEW**

- Final exam on kiln mechanics and hot alignment.
- Case study: Solving a chronic "Overheating Bearing" problem.
- Summary of "Best Practices" for kiln longevity.
- Course feedback and closing ceremony.