5-Day Cement Industry Training Course
In

GRINDING TECHNOLOGY (SITE VISIT)

Cairo - Egypt, 21 – 25 Dec. 2026

COURSE LEVEL: BASIC

COURSE OVERVIEW:

Grinding technology is the most energy-intensive stage of cement production, responsible for achieving the specific surface area required for hydraulic reactivity. This course defines the mechanical principles of comminution, focusing on the equipment used to grind raw materials and clinker. By exploring the physics of impact, attrition, and compression, participants will understand how fine powders are produced at an industrial scale.

The scope of this training includes a comprehensive look at both traditional Ball Mills and modern Vertical Roller Mills (VRM). It covers the internal components of the mills—such as liners, diaphragms, and grinding media—and the auxiliary equipment that supports the grinding circuit. Furthermore, the course addresses the role of the separator in classifying material and the importance of "closed-circuit" grinding for efficiency and quality.

Coverage includes detailed modules on mill ventilation, moisture control, and the use of grinding aids to improve throughput. Through a guided site visit to the milling departments, participants will observe the real-time operation of high-capacity grinding units and the physical characteristics of the material at different stages. Attendees will gain a foundational understanding of the "Grinding Curve" and the factors that influence the specific power consumption (kWh/ton) of the milling process.

COURSE OBJECTIVES:

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

- Describe the fundamental purpose of grinding in cement manufacturing.
- Identify the main components of a Ball Mill and a Vertical Roller Mill.
- Explain the difference between "Open-Circuit" and "Closed-Circuit" grinding.
- Understand the role of grinding media (balls) and their size distribution.
- Identify the function of the mill's internal diaphragms and liners.
- Explain how a high-efficiency separator classifies fine and coarse material.
- Describe the process of drying material within a Vertical Roller Mill.
- Monitor mill operational parameters like motor load and mill differential pressure.
- Understand the importance of "Blaine" (fineness) and "Residue" on sieves.
- Identify the safety hazards associated with high-vibration and noise areas.
- Describe the function of the mill's lubrication and cooling systems.
- Relate the mill's performance to the final cement strength and quality.

TARGET AUDIENCE:

This course is intended for Junior Operators, Maintenance Technicians, Quality Control Staff, and New Graduate Engineers.

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: INTRODUCTION TO GRINDING PRINCIPLES

- The science of comminution: Why do we grind?
- Relationship between particle size and cement hydration.
- Introduction to the Bond Work Index and material hardness.
- Overview of the grinding process flow sheet.
- Safety rules for visiting the grinding department.

MODULE 2: BALL MILL TECHNOLOGY AND COMPONENTS

- Mechanical design of the horizontal Ball Mill.
- First chamber vs. Second chamber functions.
- Types of liners: Lifting, classifying, and corrugated.
- Internal diaphragms: Controlling material flow and gas velocity.
- Mill drive systems: Girth gears, pinions, and central drives.

MODULE 3: GRINDING MEDIA MANAGEMENT

- Selection of grinding ball material and hardness.
- Calculating the "Ball Charge" and filling degree.
- Impact of ball size distribution on grinding efficiency.
- Wear rates and the "Re-sorting" process of media.
- Safe procedures for loading and unloading grinding balls.

MODULE 4: VERTICAL ROLLER MILL (VRM) FUNDAMENTALS

- Operating principles: Compression and shear on a rotating table.
- Main components: Rollers, table, rockers, and hydraulic system.
- The integrated classifier: Achieving fineness in one step.
- Drying functions: Using kiln gases for high-moisture materials.
- Vibration management and "Water Injection" techniques.

MODULE 5: THE SEPARATOR AND CLASSIFICATION

- Evolution of separators: From static to high-efficiency dynamic.
- The "Tromp Curve": Evaluating separation efficiency.
- Adjusting rotor speed and air flow for fineness control.
- Managing the "Reject" or "Tailings" return circuit.
- Impact of separator performance on specific power consumption.

MODULE 6: MILL VENTILATION AND DUST COLLECTION

- Importance of air flow through the mill.
- Operating the mill fan and managing circuit pressure.
- Role of the Bag Filter in the grinding circuit.
- Cooling the mill: Using air and water spray systems.
- Preventing "Coatings" on grinding media and liners.

MODULE 7: AUXILIARY EQUIPMENT AND TRANSPORT

- Operation of bucket elevators and air slides.
- Weigh-feeders: Ensuring accurate material proportions.
- Magnetic separators and metal traps for mill protection.
- Lubrication units for mill bearings and gearboxes.
- Cement coolers: Protecting the product before silo storage.

MODULE 8: PROCESS PARAMETERS AND QUALITY CONTROL

- Monitoring the "Electronic Ear" for mill load detection.
- Understanding motor amperage and mill torque.
- Defining "Blaine" and its impact on cement performance.
- Laboratory testing: Sieve analysis and particle size distribution.
- Influence of gypsum and additives on the grinding process.

MODULE 9: OPERATIONAL SAFETY AND NOISE CONTROL

- Managing noise levels in the mill building.
- Guarding of rotating parts and conveyor nip points.
- Safe entry procedures for mill internal inspections.
- Dust explosion risks in coal and raw mill systems.
- Heat hazards and high-pressure hydraulic safety.

MODULE 10: SITE VISIT: PRACTICAL MILL INSPECTION

- Walk-through of a Ball Mill vs. VRM installation.
- Observing the lubrication system and hydraulic power pack.
- Viewing the local control panel and process instruments.

- Visual inspection of the separator and return circuit.
- Q and A session with the mill operator.

MODULE 11: COMMON OPERATIONAL CHALLENGES

- Identifying "Mill Plugging" and "Overfilling."
- Dealing with high vibrations in Vertical Roller Mills.
- Managing "False Air" ingress in the mill circuit.
- Troubleshooting inconsistent fineness readings.
- Reducing "Start-Stop" cycles for energy efficiency.

MODULE 12: COURSE WRAP-UP AND FINAL ASSESSMENT

- Final quiz on grinding technology and terminology.
- Review of the site visit observations.
- Summary of key takeaways for operational efficiency.
- Course feedback and closing remarks.