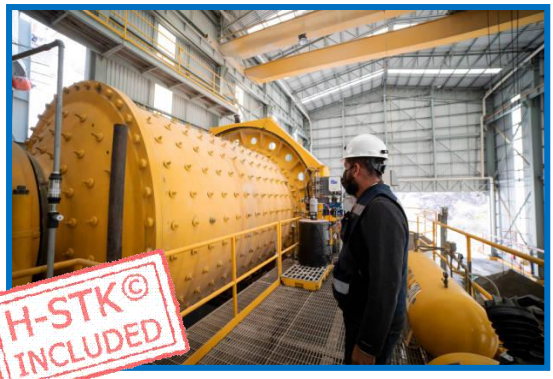
COURSE OVERVIEW PE1050
Process Engineering Clinker & Cement Grinding

Course Title
Process Engineering Clinker & Cement Grinding



Course Date/Venue
Session 1: June 15-19, 2025/Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE
Session 2: July 13-17, 2025/Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE

Course Reference
PE1050

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description


This practical and highly-interactive course includes real-life case studies and exercises where participants will be engaged in a series of interactive small groups and class workshops.

This course is designed to provide participants with a detailed and up-to-date overview of Process Engineering Clinker & Cement Grinding. It covers the clinker formation, its importance and the types of cement and standard in cement manufacturing; the clinker properties affecting grindability, basics of comminution and grinding theory and cement grinding flow sheet; the equipment in grinding circuits; the ball mills, vertical roller mills (VRM) and roller presses and safety and environmental considerations; the ball mill system, ball charge and grinding media management; the mill operation parameters; and the control and separator operation and efficiency.

Further, the course will also discuss the process measurements and instrumentation, the common problems and troubleshooting and the vertical roller mill (VRM); the components, hydraulic system, tensioning mechanism, gas flow, circulation loop, material drying and grinding mechanisms; the roller press in semi-finish and finish grinding; the lubrication and maintenance practices; and troubleshooting of VRM and roller press.

During this interactive course, participants will learn the role of grinding aids and additives and process optimization techniques and Blaine and particle size distribution (PSD); the impact of gypsum and mineral additions; the product quality parameters; the process control and automation systems and advanced grinding concepts and trends; and the cost management and benchmarking and grinding process audits and KPIs.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain an in-depth knowledge on process engineering clinker and cement grinding
- Discuss clinker formation, its importance as well as the types of cement and standards in cement manufacturing
- Recognize clinker properties affecting grindability, basics of comminution and grinding theory and cement grinding flow sheet
- Identify the equipment in grinding circuits covering ball mills, vertical roller mills (VRM) and roller presses and apply safety and environmental considerations
- Explain ball mill system, ball charge and grinding media management, mill operation parameters and control and separator operation and efficiency
- Determine process measurements and instrumentation as well as the common problems and troubleshooting
- Discuss the vertical roller mill (VRM) comprising of its components, hydraulic system, tensioning mechanism, gas flow, circulation loop, material drying and grinding mechanisms
- Employ operation and control of VRMs and determine energy efficiency in VRM versus ball mill
- Explain roller press in semi-finish and finish grinding, apply lubrication and maintenance practices and troubleshoot VRM and roller press
- Identify the role of grinding aids and additives and explain process optimization techniques and Blaine and particle size distribution (PSD)
- Explain the impact of gypsum and mineral additions as well as product quality parameters
- Carryout process control and automation systems and advanced grinding concepts and trends
- Analyze cost management and benchmarking and grinding process audits and KPIs

Exclusive Smart Training Kit - H-STK®

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of process engineering clinker and cement grinding for process engineers, production managers, plant engineers, quality control, laboratory staff, environmental and energy managers, technical service and product development teams.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

- The International Accreditors for Continuing Education and Training (IACET - USA)

Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Mr. Manuel Dalas, PEng, MSc, BSc, is a **Senior Process Engineer** with almost **30 years** of industrial experience within the **Oil & Gas**, **Refinery**, **Petrochemical** and **Refinery** industries. His expertise widely includes in the areas of **Process Engineering & Systems Failure** Analysis, **Equipment & Mechanical Integrity**, **Process Failure** Prevention, **Engineering Modifications & Systems Failures**, **Cement Manufacturing**, **Cement** Grinding Flow Sheet, **Cement** Quality & Chemistry, **Cement Kiln** Process &Operation, Root Cause Failure Analysis (**RCFA**) Techniques, **Methodology Selection** based on Specific Scenarios, **Process Plant** Optimization, **Revamping & Debottlenecking**, **Process Plant** Troubleshooting & Engineering Problem Solving, **Process Plant** Operations, **Mass & Material Balance**, **Oil & Gas Processing**, **Process Plant** Performance & Efficiency, **Crude Distillation** Process Saturated Gas Process Technology, **Crude Dehydration & Desalting**, **Crude** Stabilization Operations, **Heat Exchangers & Fired Heaters** Operation & Troubleshooting, **Pressure Vessels** Maintenance & Operation, **Piping Support**, **Ironworks**, **Rotating & Static Equipment** (**Pumps**, **Valves**, **Boilers**, **Pressure Vessels**, **Tanks**, **Bearings**, **Compressors**, **Pipelines**, **Motors**, **Turbines**, **Gears**, **Seals**), **Hydrogen Sulphide Stripping**, **Crude Oil De Salting** Process, **Gas Conditioning**, **NGL Recovery & NGL Fractionation**, **Flare** Systems, Pre-Fabrication of **Steel Structure**, Alloy Piping Pre-Fabrication, **Vertical Columns/Pressure Vessels**, **Distillation Column**, **Steel Structures**, **Construction** Management, **Building** Structures and **Electrical-Mechanical Equipment**. Currently, he is the **Technical Consultant** of the **Association of Local Authorities** of **Greater Thessaloniki** wherein he oversees mechanical engineering services while focusing on system reviews and improvements. His role involves a strategic approach to enhancing operational efficiencies and implementing robust solutions in complex engineering environments.

During his career life, Mr. Dalas has gained his practical and field experience through his various significant positions and dedication as the **Technical Manager**, **Construction Manager**, **Senior Process Engineer**, **Process Safety Engineer**, **Process Design Engineer**, **Project Engineer**, **Production Engineer**, **Construction Engineer**, **Consultant Engineer**, **Technical Consultant**, **Safety Engineer**, **Mechanical Engineer**, **External Collaborator**, **Deputy Officer** and **Senior Instructor/Trainer** for various companies including the Alpha Astika, Anamorfosis Technical Firm, EKME, ASTE, Elof Consulting and Hypergroup.

Mr. Dalas is a **Registered Professional Engineer** and has a **Master's** degree in **Energy System** from the **International Hellenic University** and a **Bachelor's** degree in **Mechanical Engineering** from the **Mechanical Engineering Technical University**, **Greece** along with a **Diploma** in **Management & Production Engineering** from the **Technical University** of **Crete**. Further, he is a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership and Management** (**ILM**), a **Certified Project Manager Professional** (**PMI-PMP**), a **Certified Instructor/Trainer**, a **Certified Energy Auditor** for **Buildings**, **Heating & Climate Systems**, a **Member** of the **Hellenic Valuation Institute** and the **Association of Greek Valuers** and a **Licensed Expert Valuer Consultant** of the **Ministry of Development and Competitiveness**. He has further delivered numerous trainings, courses, seminars, conferences and workshops internationally.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Course Fee

US$ 5,500 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the workshop for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Overview of Cement Manufacturing*** *Process Flow from Raw Meal to Finished Cement • Clinker Formation & its Importance • Types of Cement & Standards (OPC, PPC, SRC, etc.) • Role of Grinding in Overall Plant Performance*
0930 – 0945	*Break*
0945 – 1030	***Clinker Properties Affecting Grindability*** *Free Lime, Liquid Phase & Burnability Index • Clinker Nodulization & Hardness • Cooling Rate & Crystal Structure • Impact of Clinker Quality on Energy Consumption*
1030 – 1130	***Basics of Comminution & Grinding Theory*** *Principles of Size Reduction (Impact, Compression, Attrition) • Bond's Law, Rittinger's Law & Kick's Theory • Specific Surface Area & Particle Size Distribution • Grinding Energy & Work Index*
1130 – 1215	***Cement Grinding Flow Sheet*** *Pre-Crushing, Grinding, Classification & Transport • Open-Circuit versus Closed-Circuit Grinding • Role of Separators & Dynamic Classifiers • Typical Grinding Loops with Cyclones or Separators*
1215 – 1230	*Break*

1230 – 1330	***Equipment in Grinding Circuits*** *Ball Mills, Vertical Roller Mills (VRM) & Roller Presses • Separator Types & Configurations • Auxiliary Systems: Belt Conveyors, Bucket Elevators, Air Slides • Material Flow Control & Metering Systems*
1330 – 1420	***Safety & Environmental Considerations*** *Dust Generation & Suppression Techniques • Noise Control & Insulation • Explosion Risks in Grinding & Handling Systems • PPE, Interlocks & Emergency Stops*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2

0730 – 0830	***Ball Mill System Overview*** *Mill Shell Design & Internals • Grinding Media: Types, Size & Wear • Mill Drive Systems & Gear Arrangements • Importance of Mill Ventilation*
0830 – 0930	***Ball Charge & Grinding Media Management*** *Ball Charge Calculations & Loading Patterns • Wear Rates & Media Lifetime • Effects of Ball Size Distribution • Media Segregation & Top-up Practices*
0930 – 0945	*Break*
0945 – 1100	***Mill Operation Parameters & Control*** *Rotation Speed (Critical Speed Concept) • Mill Filling Level & Toe Position • Feed Size, Water Injection & Temperature Control • Monitoring of Power Consumption & Energy Efficiency*
1100 – 1215	***Separator Operation & Efficiency*** *Principle of Separation & Cut-Size (D50) • Rotor Speed & Cage Design • Fineness Adjustment Strategies • Separator Efficiency & Bypass Factor*
1215 – 1230	*Break*
1230 – 1330	***Process Measurements & Instrumentation*** *Sampling Techniques: Sieving, Blaine & PSD • Online Particle Size Measurement Tools • Mill Sound Sensors & Chamber Pressure • Flow Meters, Temperature Probes & Load Cells*
1330 – 1420	***Common Problems & Troubleshooting*** *High Residues or Blaine Fluctuations • Coating, Mill Clogging & Chamber Emptying • Vibration & Overheating Issues • False Air & Poor Material Flow*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3

0730 – 0830	***Vertical Roller Mill (VRM) Fundamentals*** *Components: Grinding Table, Rollers, Separator • Hydraulic System & Tensioning Mechanism • Gas Flow & Circulation Loop • Material Drying & Grinding Mechanisms*
0830 – 0930	***Operation & Control of VRMs*** *Start-up & Shutdown Procedures • Feed Rate & Feed Uniformity • Mill Pressure & Vibration Monitoring • Separator Speed & Reject Rate Control*
0930 – 0945	*Break*

0945 – 1100	***Energy Efficiency in VRM versus Ball Mill*** *Specific Power Consumption Comparison • Heat Recovery & Thermal Efficiency • Influence of Feed Moisture & Drying • Optimizing Gas Flow & Pressure Drop*
1100 – 1215	***Roller Press in Semi-Finish & Finish Grinding*** *Principle of High-Pressure Comminution • Roller Surface Design & Wear Protection • Role of Static & Dynamic Separators • Ball Mill/Roller Press Combined Operation*
1215 – 1230	*Break*
1230 – 1330	***Lubrication & Maintenance Practices*** *Lubrication Systems for Bearings & Gears • Filter Replacement & Oil Condition Monitoring • Inspection Intervals & Checklists • Preventive versus Predictive Maintenance*
1330 – 1420	***VRM & Roller Press Troubleshooting*** *Excessive Vibration & Wear Patterns • Low Throughput & Poor Product Quality • Issues in Material Circulation & Reject Handling • Hydraulic Failures & Accumulator Faults*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

Day 4

0730 – 0830	***Role of Grinding Aids & Additives*** *Types: Glycols, Amines, Acetates • Mechanisms: Dispersion, Agglomeration Prevention • Dosage Optimization & Effects on Mill Performance • Interaction with Clinker & Gypsum*
0830 – 0930	***Process Optimization Techniques*** *Kiln & Grinding Unit Synchronization • Online Monitoring Tools & Process KPIs • Heat & Mass Balance of the Grinding Circuit • Holistic Approach to Reduce Energy Per Ton*
0930 – 0945	*Break*
0945 – 1100	***Blaine & Particle Size Distribution (PSD)*** *Testing Methods: Blaine, Laser Diffraction, Sieving • Relationship Between Fineness & Strength • Target Fineness for Different Cement Types • Control of Cement Reactivity*
1100 – 1215	***Impact of Gypsum & Mineral Additions*** *Clinker-Gypsum Compatibility • Effect of Gypsum Dehydration on Setting Time • Role of Fly Ash, Slag & Limestone in Grinding • Storage & Blending of Additives*
1215 – 1230	*Break*
1230 – 1330	***Product Quality Parameters*** *Compressive Strength Correlation • Setting Time & Consistency • Soundness (Le Chatelier Test) • False Set & Flash Set Problems*

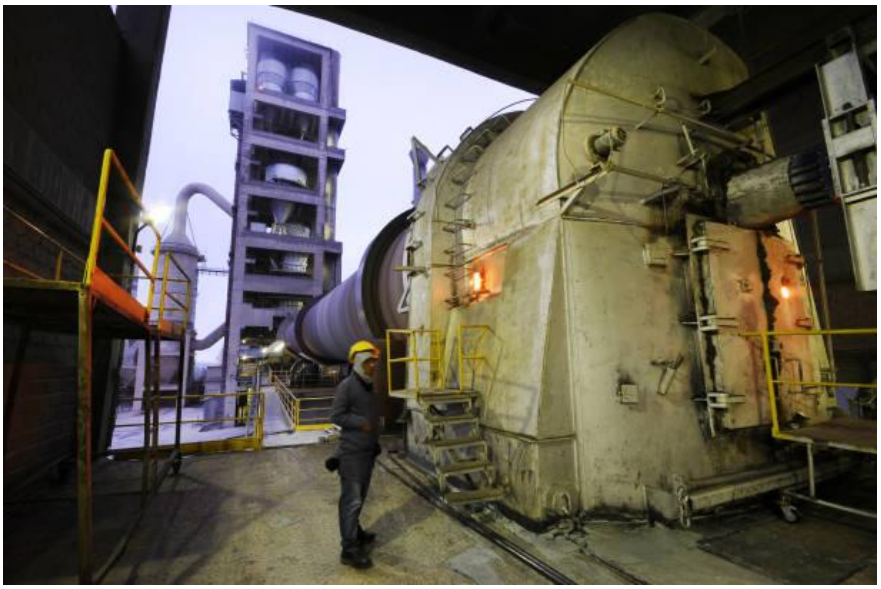
1330 – 1420	***Case Studies & Best Practices*** *Grinding performance Improvement Examples • Productivity Enhancement Strategies • Case of Energy Reduction via Process Tuning • Lessons Learned from Global Cement Plants*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

Day 5

0730 – 0830	***Process Control & Automation Systems*** *DCS/PLC Interface with Grinding Systems • Auto Loop Tuning for Mill Feed & Separator • SCADA Visualization of Key Parameters • Role of AI & Expert Systems in Cement Plants*
0830 – 0930	***Advanced Grinding Concepts & Trends*** *Hybrid Grinding Technologies • Modular & Compact Grinding Units • Use of Alternative Fuels & Raw Materials • CO_2 Footprint Reduction in Grinding Operations*
0930 – 0945	*Break*
0945 – 1100	***Cost Management & Benchmarking*** *Energy Cost Breakdown in Grinding • OPEX versus CAPEX Decision-Making • Benchmarking Against Best-Available Techniques (BAT) • Profitability Analysis & ROI Tools*
1100 – 1230	***Grinding Process Audits & KPIs*** *Steps in Conducting a Process Audit • Data Collection, Analysis & Bottleneck Identification • Key KPIs: tph, kWh/t, Blaine Stability, Throughput • Optimization Roadmap Development*
1230 – 1245	*Break*
1245 – 1345	***Group Exercise – Clinker Grinding Optimization Case*** *Teams Analyze Real Plant Data • Identify Areas for Energy Saving & Performance Gains • Recommend Equipment or Process Changes • Present Findings & Justification*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Practical Sessions

This practical and highly-interactive course includes real-life case studies and exercises:-



Course Coordinator

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