COURSE OVERVIEW PE1055
Advanced Extruder Operations

Course Title
Advanced Extruder Operations

Course Date/Venue
August 17-21, 2025/Meeting Plus 9, City Centre Rotana, Doha, Qatar

Course Reference
PE1055

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 advanced knowledge on extruder operations. It covers the extrusion processes, extruder design and configuration and polymer rheology in extrusion; the screw design and optimization, heating and cooling systems and key extrusion process variables; the process monitoring and instrumentation and the advanced control strategies, start-up and shut-down procedures, product quality parameters and data collection and statistical process control (SPC); the raw material handling and feeding systems, polymer degradation and stabilization, blending, additives and masterbatch integration and recycling and regrind processing.

During this interactive course, participants will learn the troubleshooting material issues and polymer-specific processing techniques, process troubleshooting techniques and the common defects in extruded products; the screw and barrel wear troubleshooting, die design and flow balancing issues, downtime reduction and changeover optimization and productivity and throughput optimization; the preventive and predictive maintenance, extruder alignment and mechanical inspection, quality assurance in extrusion, energy efficiency in extrusion lines and continuous improvement tools (lean/six sigma).

Course Objectives

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

- Apply and gain an advanced knowledge on extruder operations
- Discuss extrusion processes, extruder design and configuration and polymer rheology in extrusion
- Explain screw design and optimization, heating and cooling systems, safety considerations in extruder operation and key extrusion process variables
- Recognize process monitoring and instrumentation, advanced control strategies, start-up and shut-down procedures, product quality parameters and data collection and statistical process control (SPC)
- Identify raw material handling and feeding systems, polymer degradation and stabilization, blending, additives and masterbatch integration and recycling and regrind processing
- Troubleshoot material issues and recognize polymer-specific processing techniques, process troubleshooting techniques and the common defects in extruded products
- Demonstrate screw and barrel wear troubleshooting, die design and flow balancing issues, downtime reduction and changeover optimization and productivity and throughput optimization
- Carryout preventive and predictive maintenance, extruder alignment and mechanical inspection, quality assurance in extrusion, energy efficiency in extrusion lines and continuous improvement tools (lean/six sigma)

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 extruder operations for experienced extruder operators, process engineers, production supervisors, quality control technicians, maintenance technicians and other technical staff.

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 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

Haward's 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**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). 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 Fee

US$ 6,000 per Delegate. 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 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:

Dr. Lennart Johansson is currently the **Principal Consultant** of **Polymer Support Incorporation,** a company that provides **Analytical Services** to the **Plastics/Rubber Industry.** He is also the **Chairman** of the **European Colors & Additives Conference of Germany since 1995** and the **Board member** of the **Society of Plastics Engineers** (**SPE**). Dr. Johansson is an **International Expert** in **Polymers and Plastics/Rubber additives** with over **30 years** of industrial experience in this area. Further, he is an **Authority** in the **processes leading to degradation and aging of polymers for different industrial applications like tubes, pipes, cables, capacitors, films generators, motors and transformers**.

During his career life, Dr. Johansson worked as the **Manager of Process/ Polymer, & Development Engineer** for **Dyno Nobel**; as the **Senior Scientist and Project Leader** within the area of **Degradation and Stabilization of plastics**, for **ABB Corporate** where he was in charge of researches of **Aging of polymers**, **Aging of insulation liquids, Aging of cables, Improved performance for capacitors, Electrical treeing, Water treeing, Corona resistance** and **New filler materials.** Further, he worked as a **Chemical Engineer** for different **Plastics and Rubber** companies in **Sweden**, **Germany**, **Italy** and the **UK**.

Dr. Johansson has **five patents in Plastic industry**, and he published **tremendous number of Papers and proceedings**. His qualifications include **Bachelor, Master and PhD Degrees in Chemical Engineering** from **Lund University, Sweden**. Further, he is a **Certified Instructor/Trainer**.

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: ***Sunday, 17th of August 2025***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Overview of Extrusion Processes*** *Single-Screw versus Twin-Screw Extrusion • Downstream Equipment Overview • Continuous versus Batch Extrusion • Industrial Applications of Extrusion (Pipe, Film, Sheet, Profile, Compounding)*
0930 – 0945	*Break*
0945 – 1030	***Extruder Design & Configuration*** *Feed Section, Transition Section, Metering Section • Screw Geometry & Function • Barrel Types & Heating Zones • Die Types & Design Principles*
1030 – 1130	***Polymer Rheology in Extrusion*** *Viscosity & Shear Rate Relationship • Melt Flow Index (MFI) versus Real-World Performance • Behavior of Thermoplastics & Elastomers • Temperature Impact on Melt Characteristics*

1130 – 1215	***Screw Design & Optimization*** *L/D Ratio & Compression Ratio • Barrier Screws, Mixing Sections & Venting Zones • Material Compatibility with Screw Design • Wear & Corrosion Considerations*
1215 – 1230	*Break*
1230 – 1330	***Heating & Cooling Systems*** *Barrel Heating Methods (Electric, Oil, Steam) • Cooling Techniques for Screw & Barrel • Thermal Profile Setup & Zoning Strategies • Effects of Improper Temperature Control*
1330 – 1420	***Safety Considerations in Extruder Operation*** *Pressure Build-Up & Overpressure Protection • Lockout-Tagout (LOTO) & Emergency Stops • Burn & Pinch Hazards • Safe Start-Up & Shutdown Procedures*
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: ***Monday, 18th of August 2025***

0730 – 0830	***Key Extrusion Process Variables*** *Barrel Temperature & Melt Temperature Control • Screw Speed & Torque Optimization • Back Pressure & Pressure Profiles • Feed Rate Consistency & Material Throughput*
0830 – 0930	***Process Monitoring & Instrumentation*** *Thermocouples & Melt Temperature Sensors • Pressure Transducers & Load Cells • Torque Monitoring & Motor Load Trends • SCADA/HMI Integration with Extrusion Line*
0930 – 0945	*Break*
0945 – 1100	***Advanced Control Strategies*** *Closed-Loop Feedback Systems • PID Tuning for Extrusion Lines • Smart Extruder Automation & IoT • Troubleshooting Sensor Calibration Issues*
1100 – 1215	***Start-Up & Shut-Down Procedures*** *Pre-Heating & Purge Sequence • Melt Stabilization Strategy • Controlled Shutdown & Cooling Methods • Troubleshooting During Startup*
1215 – 1230	*Break*
1230 – 1330	***Product Quality Parameters*** *Melt Uniformity & Surface Finish • Dimensional Stability & Tolerance Control • Gels, Flow Marks & Contamination Detection • Quality Testing Methods for Extruded Parts*
1330 – 1420	***Data Collection & Statistical Process Control (SPC)*** *Real-Time Data Logging Techniques • Trending Charts & Alarm Thresholds • Cp/Cpk Calculations & Process Capability • Establishing Control Limits for Key Variables*
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: **Tuesday, 19th of August 2025**

0730 – 0830	***Raw Material Handling & Feeding Systems*** *Gravimetric versus Volumetric Feeders • Material Drying & Moisture Control • Hopper Design & Bridging Prevention • Bulk Handling & Conveying Systems*
0830 – 0930	***Polymer Degradation & Stabilization*** *Causes of Thermal & Oxidative Degradation • Stabilizers & Antioxidants • Residence Time Impact on Degradation • Identification of Degraded Polymer Behavior*
0930 – 0945	*Break*
0945 – 1100	***Blending, Additives & Masterbatch Integration*** *Color Masterbatches & UV Stabilizers • Lubricants, Flame Retardants & Nucleating Agents • Inline versus Offline Mixing Techniques • Dispersion Quality & Performance Consistency*
1100 – 1215	***Recycling & Regrind Processing*** *Effects of Regrind on Melt Flow & Mechanical Properties • Compatibility & Contamination Control • Managing Shrinkage, Warpage & Surface Defects • Regrind Ratios & Process Settings*
1215 – 1230	*Break*
1230 – 1330	***Troubleshooting Material Issues*** *Excessive Smoke or Odor • Bubbles, Voids & Unmelted Particles • Batch-to-Batch Inconsistencies • Black Specs & Burnt Contamination*
1330 – 1420	***Polymer-Specific Processing Techniques*** *Polyethylene versus Polypropylene versus PVC • Processing of Engineering Plastics (PA, PC, PBT) • Filled & Reinforced Polymers (Glass, Talc) • High-Temperature & High-Viscosity Polymers*
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: **Wednesday, 20th of August 2025**

0730 – 0830	***Process Troubleshooting Techniques*** *Root Cause Analysis (RCA) Methods • Systematic Problem-Solving Steps • Common Faults & Solutions (Surging, Overheating, Die Drool) • Diagnostic Data Analysis Techniques*
0830 – 0930	***Common Defects in Extruded Products*** *Surface Roughness & Melt Fracture • Warping & Dimensional Instability • Sharkskin, Bambooing & Cold Slugs • Incomplete Fill & Short Shots*
0930 – 0945	*Break*
0945 – 1100	***Screw & Barrel Wear Troubleshooting*** *Symptoms of Screw/Barrel Wear • Measuring Wear Tolerance • Material Compatibility & Coating Selection • Repair, Resurfacing & Replacement*
1100 – 1215	***Die Design & Flow Balancing Issues*** *Uneven Flow & Melt Distribution • Dead Zones & Pressure Imbalance • Die Cleaning & Maintenance • Impact of Die Swell & Extrudate Expansion*
1215 – 1230	*Break*
1230 – 1330	***Downtime Reduction & Changeover Optimization*** *Quick-Change Techniques for Dies & Screws • Lean Setups & 5S Practices • SMED (Single-Minute Exchange of Dies) Applications • Standardized Changeover Checklists*

1330 – 1420	***Productivity & Throughput Optimization*** *Cycle Time Analysis & Line Balancing • Scrap & Rework Minimization • Machine Efficiency & Uptime • Best Practices from World-Class Extrusion Operations*
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: ***Thursday, 21st of August 2025***

0730 – 0830	***Preventive & Predictive Maintenance*** *Scheduled Maintenance Planning • Critical Spare Parts Inventory • Lubrication Best Practices • Condition Monitoring & Thermography*
0830 – 0930	***Extruder Alignment & Mechanical Inspection*** *Shaft Alignment & Runout • Gearbox Inspection & Oil Analysis • Heater Band Resistance Testing • Torque Sensor & Coupler Inspection*
0930 – 0945	*Break*
0945 – 1100	***Quality Assurance in Extrusion*** *In-Line Quality Inspection Tools • Dimensional Control & Weight Consistency • SPC in Extrusion Process • Laboratory Analysis & Product Testing*
1100 – 1230	***Energy Efficiency in Extrusion Lines*** *Motor & Drive System Efficiency • Heating/Cooling Energy Recovery • Compressed Air & Vacuum Optimization • Reducing Scrap & Material Waste*
1230 – 1245	*Break*
1245 – 1345	***Continuous Improvement Tools (Lean/Six Sigma)*** *Kaizen & Root Cause Elimination • Process Mapping & Waste Identification • Use of DMAIC in Extrusion Optimization • Cross-Functional Team Engagement*
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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