Sumitomo SHI DEMAG

Injection Moulding Training Courses

Cogent
Cogent Skills Partner

I·M3
Quality Assured & PD Approved 2024

BPF
MEMBER OF THE BRITISH PLASTICS FEDERATION

Progressive, structured and relevant training courses

Introduction

Sumitomo (SHI) Demag UK has developed a range of injection moulding courses to address the skills shortage seen within the plastics industry. We train not only our customers, but also anyone who wishes to further enhance their knowledge of the injection moulding process to make financial gains.

The core training programme delivers high quality injection moulding training. The courses are designed to be modular and offer a logical progression from basic tool setting to advanced injection moulding using scientific injection moulding and mathematical principles used on the higher-level courses. The MMount, TSett, PTech, TShoot and AIM course all have a formal assessment on the last day of the course.

For anyone with existing injection moulding experience who may wish to join the programme at a later stage, please speak to our training department who can advise on the appropriate course level after sitting a pre-course analysis to assess the delegates current knowledge.

Benefits For Your Company

- Staff retention.
- Improved quality.
- Improved OEE.
- Faster cycle times.
- Higher profits.
- Increased productivity.

Introduction to Injection Moulding (IIM)

The IIM course is designed to deliver an understanding of the fundamental principles of the injection moulding process and associated ancillary equipment to ensure safe working practices.

Ideal delegates for attendance

- Office based personnel
- Injection moulding operators
- Maintenance and toolroom personnel
- Material handlers
- Product designers
- Supervisors and team leaders

Course duration: 3 days

1 day theory, 2 days practical
09:30 to 16:00hrs

Day 1 Theory

- Basic Injection moulding machine design.
- The injection moulding cycle.
- Basic injection and clamp unit design and functions.
- Basic mould tool design.
- Basic introduction to polymer materials.
- Common injection moulding faults.

Day 2 & 3 Practical

- Delegate to enter parameters into the machine from a given parameter setting sheet.
- Machine safety checks.
- Mould protection understanding.
- Melt and mould temperature readings..
- Adjustments made to the injection, holding and cooling phase.

Mould Mounting (MMount)

The MMount course is aimed at individuals new to injection moulding and mould mounting with focus on the potential hazards, safety requirements and responsibilities with mould mounting. To demonstrate the critical safety requirements required the delegate will conduct mould changes under tutor guidance with continuous feedback throughout the mould mounting process.

Ideal delegates for attendance

- Progression for an experienced injection moulding operator and trainee tool setter new to mould mounting. It will suit those who have attended the TSett course and are going to attend the **TSett Practical End Test.**
- Any other personnel involved with mould changing as part of production requirements or mould tool trials.

Course duration: 3 days

1 day theory, 2 days practical
09:30 to 16:00hrs

Please note: Safety shoes are required during mould changes.

Day 1 Theory

- Items to be considered before a mould change is started.
- The use of lifting equipment and safe working load (SWL).
- Fundamentals of Single Minute Exchange of Die (SMED).
- Mould clamping and methods available.
- Toggle and direct hydraulic lock mechanisms.
- Basic mould design and mould maintenance.
- Sprue bush and nozzle relationship.
- Ancillary equipment and fluid services connected to the mould.
- Checking and optimising mould safety.
- Machine safety checks.

Day 2 & 3 Practical

- Preparation checks to ensure mould fitment.
- Basic SMED principles before commencement of a mould change.
- Conduct a mould change safely and efficiently under tutor guidance.
- Set the clamp unit from zero.
- Check and optimise mould safety.
- Conduct machine safety checks.
- Formal assessment.

Tool Setting (TSett)

The TSett course is designed to give delegates the fundamental principles involved in the injection moulding environment and safety requirements. Attending both the MMount and TSett course allows the delegate to attend the 0.5-day **Tool Setter Practical End Test**, which demonstrates both theoretical and practical knowledge. The delegate must pass the TSett theory exam first.

TSett covers machine, mould and material with theoretical teaching and machine practical exercises. There is a formal assessment at the end of the course.

Ideal delegates for attendance

- Injection moulding operators
- Trainee tool setters
- Trainee apprentice (level 2 underpinning knowledge)
- Material handlers

Course duration: 3 days

1 day theory, 2 days practical
09:30 to 16:00hrs

Please note: Day 2 Introduction to health and safety before machine practical

Day 1 Theory

- The injection moulding cycle.
- The injection moulding machine.
- Mould tool design.
- Cold and hot runner mould tools
- Ejection methods.
- Mechanical and hydraulic core movement.
- Polymer materials.
- Thermoplastic and thermosetting.
- Polymer handling and application.
- Regrinding.
- Colouring plastics.
- Common injection moulding faults, causes and remedies.

Day 2 & 3 Practical

- Delegate to enter parameters into the machine from a given parameter setting sheet.
- Machine safety checks completed in-line with HSE guidelines.
- Melt and mould temperature checks.
- Optimise mould safety.
- Injection phase – demonstrate how injection pressure affects injection speed.
- Holding phase – selection of a suitable holding pressure for a conclusive gate freeze off study.
- Cooling phase – Investigate cooling time reduction to achieve the specified cycle time on the quality specification.
- Formal assessment.

Process Technician (PTech)

The PTech course is designed to provide deeper knowledge and understanding of the machine, mould, and material, through theoretical teaching and machine practical exercises. Delegates will gain the ability to set a machine from zero to producing components to a given specification, in an efficient and timely manner.

To enrol on the course the delegate should have ideally attended the Tool Setter (TSett) course and passed. A delegate who is working within the injection moulding environment and having gained minimum 12 months' experience may be considered for course attendance, or by taking a pre-course assessment demonstrating sufficient level of understanding at Level 2 to attend the PTech course at Level 3.

The PTech course covers Part 1 of Faults, Causes and Remedies in relation to process trouble shooting. For a thorough understanding of Faults, Causes and Remedies and the interaction of the process parameters then attend Part 2 on the Trouble Shooting (TShoot) course. The combined Part 1 (PTech) and Part 2 (TShoot) gives the delegate the complete theoretical tuition, but in modular form to allow full learning of this complex subject.

Ideal delegates for attendance

- Apprentice looking to gain Level 3 underpinning knowledge for injection moulding.
- Tool Setter following attendance and passing the theory assessment on the TSett course.

Course duration: 3 days

Blend of theoretical practical tuition
09:30 to 16:00hrs

Day 1 Theory

- Injection moulding machine technology.
- Specific pressure and screw relationship.
- Setting the clamp and injection unit from zero. (Electric & hydraulic set)
- Calculate clamp force.
- Mould design technology.
- Plastic materials technology.
- Injection moulding process faults Part 1. (Attend TShoot for Part 2.)
- Health and safety.

Day 2 & 3 Practical

- Setting of the clamp and injection unit.
- Calculate clamp force.
- Machine safety checks.
- Check and optimise mould safety.
- Measure actual values for melt and mould temperature.
- Optimise the moulding cycle to achieve a given specification.
- Verify optimisation through statistical process control (SPC).
- Formal assessment.

Tool Setter (TSett) / Process Technician (PTech) Practical End Tests

To attend the TSett or PTech Practical End Test the delegate must have attended the TSett or PTech course and passed the theory test. Successfully passing the TSett or PTech course, the delegate would be invited to attend a half day Practical End Test. Attendance for the Practical End Test must be no longer than six months after passing the Knowledge Theory Test.

Delegates who have passed TSett or PTech course, but the 6-month time limit has elapsed will be expected to re-sit the theory test and the Practical End Test to achieve the full TSett or PTech accreditation demonstrating theoretical and practical competence.

N.B. It is strongly recommended the delegate has attended the Mould Mounting (MMount), or a relevant formal Mould Mounting course, to gain a thorough understanding of the mould mounting process before attending the TSett Practical End Test.

Toolsetting (TSett) Practical End Test

- Complete a mould change.
- Enter settings from a given setting sheet.
- Optimise clamp unit parameters.
- Demonstrate safe purging and use of PPE.
- Start-up the machine safely and produce components.
- Optimise injection unit parameters.
- Achieve the given quality specification.
- Safely and efficiently shut down the machine.
- Complete criteria, in the time set, under exam conditions.
- Demonstrate health and safety requirements during the exam.

Process Technician (PTech) Practical End Test

- Set-up and optimise the clamp unit parameters.
- Set-up the injection unit with initial parameters.
- Demonstrate safe purging and use of PPE.
- Start-up the machine safely and produce components.
- Optimise injection unit parameters.
- Achieve the given quality specification.
- Safely and efficiently shut down the machine.
- Complete criteria, in the time set, under exam conditions.
- Demonstrate health and safety requirements during the exam.

Trouble Shooting (TShoot)

A course designed to give delegates in-depth knowledge and understanding regarding the five variables that are required to control the injection moulding process and how they interact with each other. The PTech course covers Part 1 of Faults, Causes and Remedies in relation to process trouble shooting. For a thorough understanding of Faults, Causes and Remedies and the interaction of the process parameters, attending Part 2 on the Trouble Shooting (TShoot) course is thoroughly recommended. The combined Part 1 (PTech) and Part 2 (TShoot) gives the delegate the complete theoretical tuition, but in modular form to allow full learning of this complex subject.

Ideal delegates for attendance

- Technical staff responsible for trouble shooting process related issues within the injection moulding environment.
- Apprentice (who has recently passed the PTech course).
- Process technician (who has recently passed the PTech course).

Course duration: 3 days

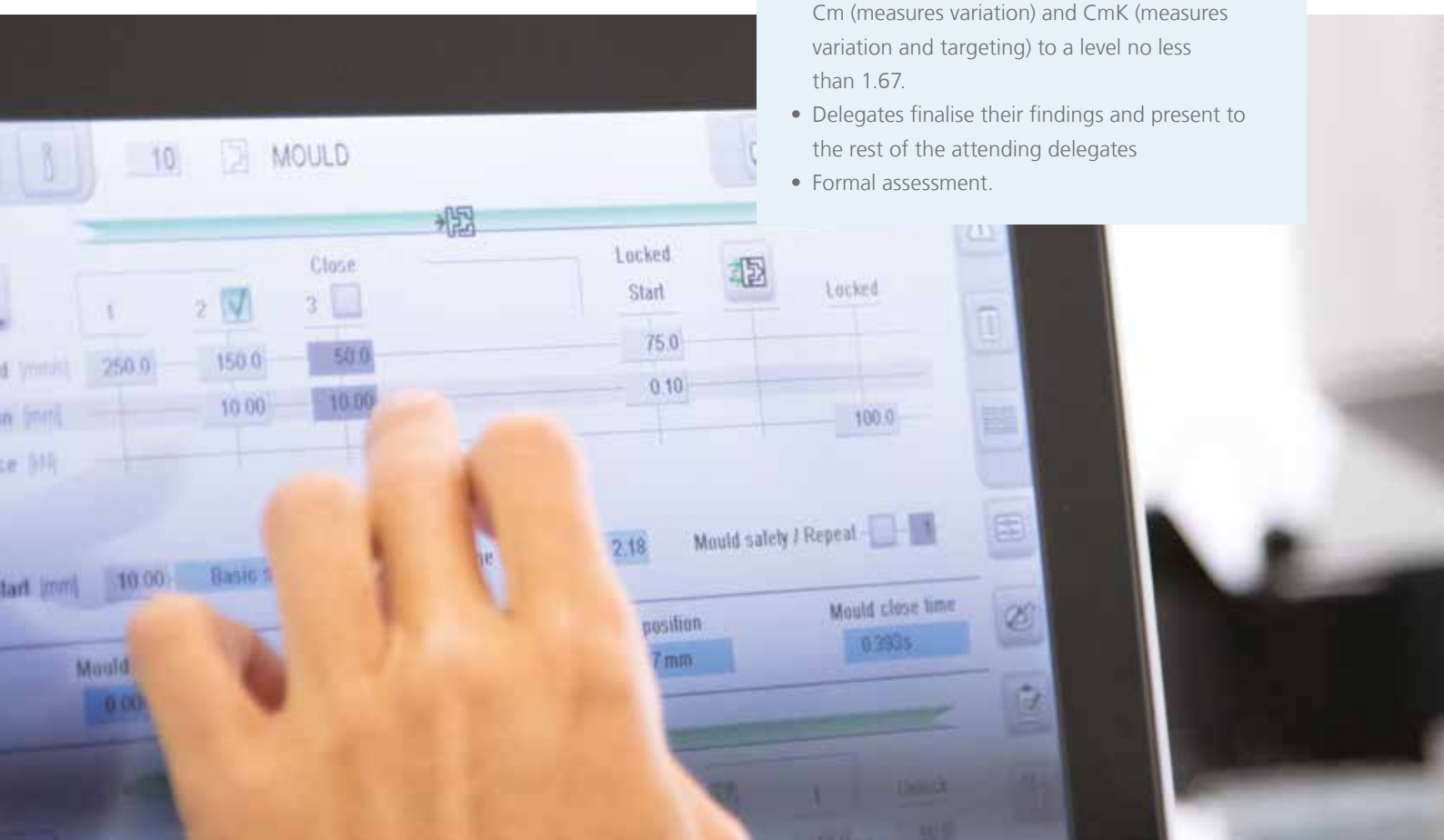
Blend of theoretical and practical tuition
09:30 to 16:00hrs

Day 1 Theory & Practical

- Day 1 (am) practical exercise to assess the delegates current knowledge.
- The five variables controlling the process and how they interact with each other.
- Initial setting of process parameters.
- Deductive reasoning with a systematic approach to rectifying injection moulded process faults.
- Injection moulding process related faults resulting from; material, mould and machine.
- Options available to reduce injection moulding process faults before the cutting of mould steel.

Day 2 & 3 Theory and Practical

- Optimise the clamp and injection unit from initial poorly set parameters.
- Calculate clamp force.
- Trouble shoot processing faults; identifying their cause, which phase of the cycle, and suggest in a logical order their remedies.
- Components must achieve a given specification to include cycle time, weight, and quality criteria.
- Verify optimisation by conducting a statistical process control (SPC) capability study using Cm (measures variation) and CmK (measures variation and targeting) to a level no less than 1.67.
- Delegates finalise their findings and present to the rest of the attending delegates
- Formal assessment.



Advanced Injection Moulding (AIM)

The AIM course uses scientific injection moulding and mathematical principles to fully optimise the injection moulding process. The delegate will also gain valuable knowledge in injection moulding machine selection.

Ideal delegates for attendance

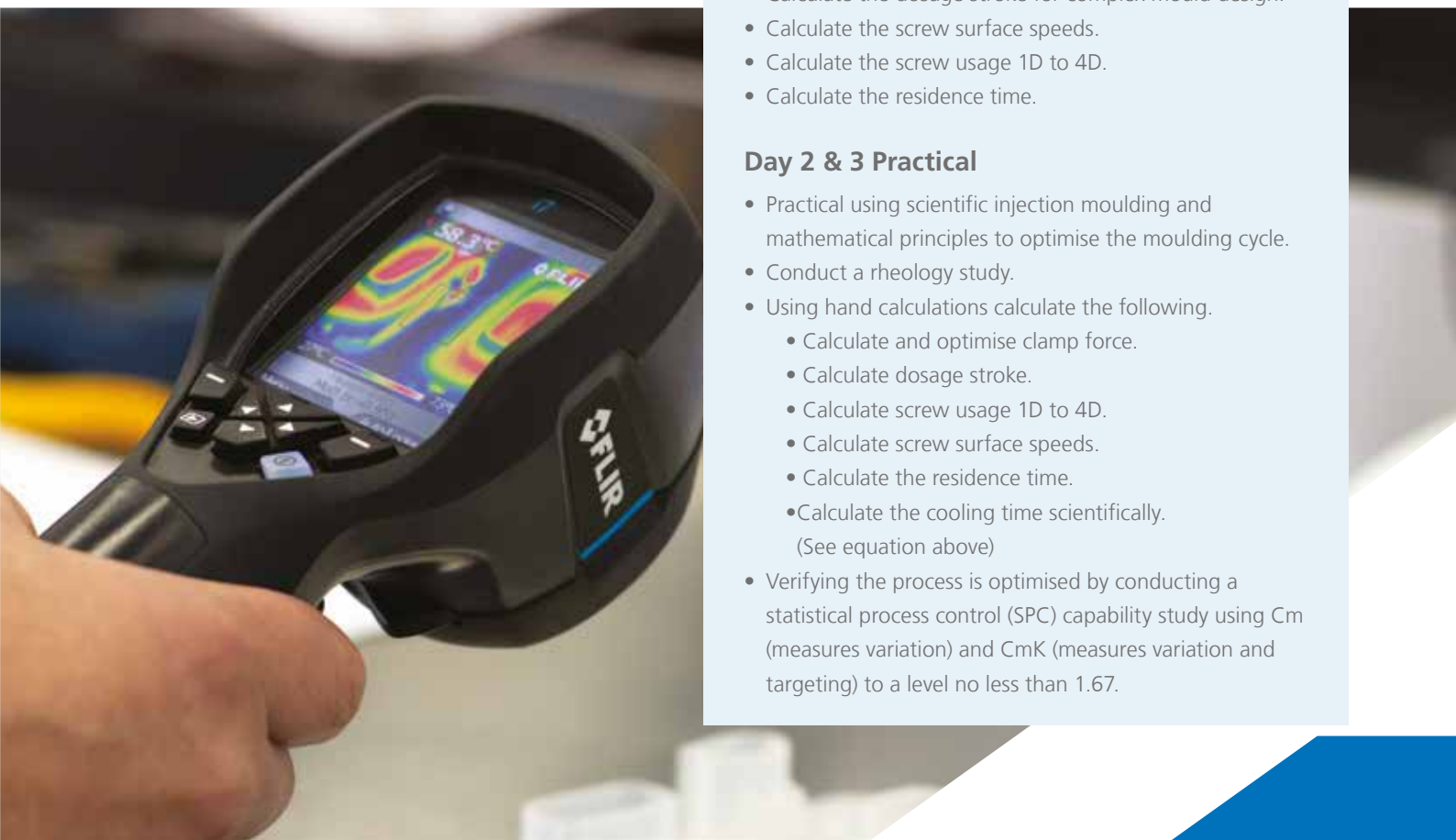
- Technical staff responsible for process optimisation scientifically and injection moulding machine selection
- Process technicians (who have attended PTech and TShoot).
- Process engineers.

Course duration: 3 days

1 day theory, 2 days practical
09:30 to 16:00hrs

N.B. The AIM multiple-choice question paper has been designed with questions that require more than one answer. By passing the course, it demonstrates the delegate has a higher level of understanding.

$$C_t = \frac{s^2}{\pi^2 \alpha} \; x \; In \left(\frac{4}{\pi} x \frac{T_m - T_w}{T_e - T_w}\right)$$



Day 1 Theory

- Theory of polymer materials.
- Theoretical and practical clamp force studies
- Scientific Injection Moulding to optimise: -

Injection phase optimisation.

- The benefits of a rheology study.
- Calculate gate shear rates from known data.
- The effects of residual stresses in an application.
- Injection velocity profiles and when to use them.

Holding phase optimisation.

- Ensuring adequate holding pressure to achieve conclusive gate solidification.
- Applying the right amount of holding pressure.
- The effective use of holding pressure profiles and selecting the right profile based on the application.

Cooling phase optimisation.

- The theory of Reynolds number.
- The effects of laminar and turbulent flow.
- The use of monitoring water flow (Δt) as an indication of effective mould cooling.
- The effects associated with cooling rate, shrinkage, and distortion.
- Calculate scientifically the cooling time.

Metering phase optimisation.

- Calculate the dosage stroke for complex mould design.
- Calculate the screw surface speeds.
- Calculate the screw usage 1D to 4D.
- Calculate the residence time.

Day 2 & 3 Practical

- Practical using scientific injection moulding and mathematical principles to optimise the moulding cycle.
- Conduct a rheology study.
- Using hand calculations calculate the following.
  - Calculate and optimise clamp force.
  - Calculate dosage stroke.
  - Calculate screw usage 1D to 4D.
  - Calculate screw surface speeds.
  - Calculate the residence time.
  - Calculate the cooling time scientifically. (See equation above)
- Verifying the process is optimised by conducting a statistical process control (SPC) capability study using Cm (measures variation) and CmK (measures variation and targeting) to a level no less than 1.67.

Beginner to Advanced Training Programme (BATP)

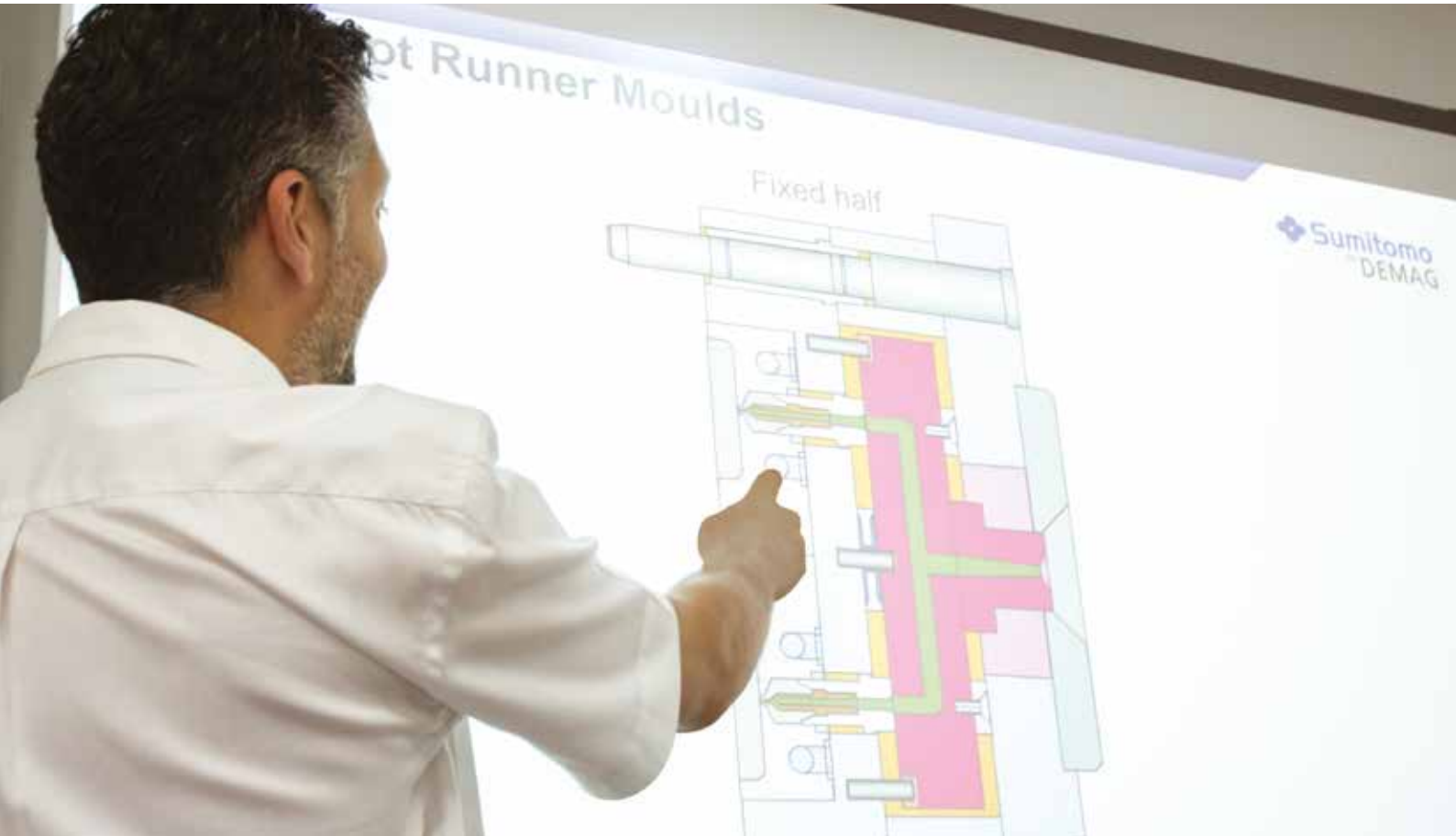
The aim of the Beginner to Advance Level Training Programme is to take an Injection Moulding Trainee/ Apprentice with zero knowledge to an advanced level of understanding of the injection moulding process and the health and safety requirements over a 42-month period.

Sumitomo Demag Training Academy have designed a modular set of six injection moulding training courses, which are delivered over a period of 3 days (apart from the End Test Practical exams), with a blend of theoretical tuition, classroom exercises, handouts, and machine practicals to maximise the learning outcome for every course.

The delegate over a 42-month period will sit six knowledge assessments, 2 practical End Tests and one End of Programme Exam. This means the delegate will attend all SDUK bespoke courses, as highlighted, in a conducive learning environment with constant testing throughout the 42 months. A discount is available for booking all courses upfront.

All the course lectures cover Machine Design Technology, Mould Design Technology and Polymer Material Technology, but with increasing levels of complexity and difficulty, as the delegate progresses through the programme. The AIM course focuses on Advanced Machine Parameters, Polymer Material Technology and Process Optimisation, which uses injection moulding and mathematical principles.

Beginner to Advanced Level Training Programme	
1	Introduction to Injection Moulding (IIM)
2	Mould Mounting (MMount)
3	Tool Setter (TSett)
3a	Tool Setter (TSett) Practical End Test
4	Process Technician (PTech)
4a	Process Technician (PTech) Practical End Test
5	Troubleshooting (TShoot)
6	Advanced Injection Moulding (AIM)



Plastic Materials Appreciation (PMApp)

The PMapp course has been developed to gain an appreciation of the nature of thermoplastic materials, and how their properties can be affected. Any individual who wishes to improve their knowledge of plastics materials may attend the PMapp course.

Ideal delegates for attendance

No formal assessment on this course.

Course duration: 2 days

2 days theory
09:30 to 16:00hrs

Day 1 and 2 Theory:
Why use plastics?

- Advantages and disadvantages.

Elements, atoms, and molecules

Polymer synthesis

- How to make a plasti.c
- Blends and alloys.

Classifying plastics

- The plastics family tree.
- Thermosetting, thermoplastic and elastomers.
- Amorphous and semi crystalline.
- Degree of crystallinity.
- Homopolymer.
- Copolymer.

Glass transition temperature (Tg) and melting temperature (Tm)

Molecular weight, orientation, and composition

- Viscosit.y.
- Residual stress.
- Crystalline morphology.
- Tacticity of polypropylenes (isotactic, atactic, syndiotactic).

Properties of polymers when injection moulded

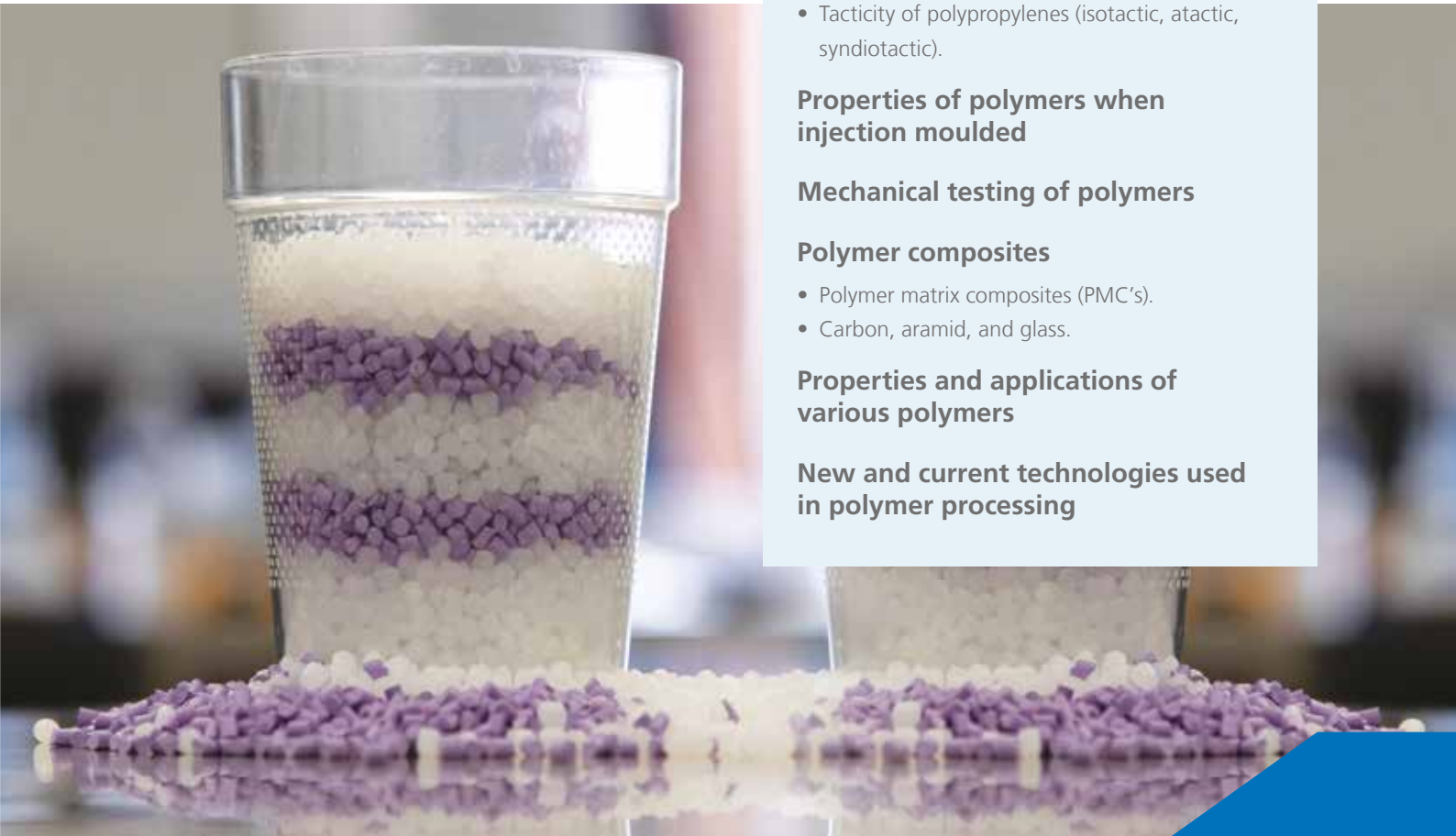
Mechanical testing of polymers

Polymer composites

- Polymer matrix composites (PMC's).
- Carbon, aramid, and glass.

Properties and applications of various polymers

New and current technologies used in polymer processing



Injection Moulding Refresher (IMR)

The Injection Moulding refresher course is aimed at experienced technical staff who have been working in injection moulding for several years and would like to refresh their skills, as well as part of their Continual Professional Development (CPD).

No formal assessment on this course.

Course duration: 2 days

1 day theory, 1 day practical
09:30 to 16:00hrs

$$C_t = \frac{s^2}{\pi^2 \alpha} \; x \; In \left(\frac{4}{\pi} x \frac{T_m - T_w}{T_e - T_w}\right)$$

Day 1 Theory

- Theory of polymer materials.
- Theoretical and practical clamp force studies
- Scientific Injection Moulding to optimise: -

Injection phase optimisation.

- The benefits of a rheology study.
- Calculate gate shear rates from known data.
- The effects of residual stresses in an application.
- Injection velocity profiles and when to use them.

Holding phase optimisation.

- Ensuring adequate holding pressure to achieve conclusive gate solidification.
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Cooling phase optimisation.

- The theory of Reynolds number.
- The effects of laminar and turbulent flow.
- The use of monitoring water flow (Δt) as an indication of effective mould cooling.
- The effects associated with cooling rate, shrinkage, and distortion.
- Calculate scientifically the cooling time.

Metering phase optimisation.

- Calculate the dosage stroke for complex mould design.
- Calculate the screw surface speeds.
- Calculate the screw usage 1D to 4D.
- Calculate the residence time.

Day 2 Practical

- Practical using scientific injection moulding and mathematical principles to optimise the moulding cycle.
- Conduct a rheology study.
- Using hand calculations calculate the following.
  - Calculate and optimise clamp force.
  - Calculate dosage stroke.
  - Calculate screw usage 1D to 4D.
  - Calculate screw surface speeds.
  - Calculate the residence time.
  - Calculate the cooling time scientifically. (See equation above)
- Verifying the process is optimised by conducting a statistical process control (SPC) capability study using Cm (measures variation) and CmK (measures variation and targeting) to a level no less than 1.67.

Maintenance and Fault Finding (Maint NC5)

A course designed to give delegates theoretical and practical fault finding experience on NC5. This course covers hydraulic, electric control and mechanical systems of both the direct and toggle lock machines.

Training on IntElect machines to be held at our Daventry Training Academy

For all other machines, training is available onsite at the customer's premises.

Ideal delegates for attendance

- Maintenance Engineers and Maintenance Technicians with basic maintenance knowledge

Course duration: 2 days

09.30 – 16.00hrs (practical)

Day 1 & 2 Practical

- Differences in direct and toggle lock machines.
- Sumitomo Demag numbering code and function chart.
- Types and control system.
- Basic hydraulic.s
- Familiarisation and theoretical operation of hydraulic circuitry including symbols.
- Further setting of NC5 controls and use of dry cycle as a means of fault finding.
- Introduction to Sigmatek processor (types and layout).
- Use of IBED as a maintenance aid.
- Hardware layout.
- Finding essential voltage.
- Fault finding tasks.
- Lubrication and general maintenance task.s
- Navigation of electrical diagrams.

Course Lecturers

Darren Vater-Hutchison
Process Engineering and Training

Darren's career in plastics started at Link Plastics as a trainee toolsetter, finally progressing to senior technician. From Link Plastics he moved to Plastics Omnium as a technician in the technical department. He then moved to the British Polymer Training Association (BPTA) where he spent 11 years as a technical consultant. Following the close of BPTA he joined Epson, taking a senior position within the injection moulding department. During a period of three years he achieved a high accolade, a 'silver award' in the 37th global Epson injection moulding competition in Japan. Darren was the first British person to enter such competition for Epson since manufacturing began in May 1999.

He then rejoined the Polymer Training Innovation Centre (PTIC, formerly BPTA) in 2012 and completed his Masters in 'Polymer Engineering Design' at the University of Wolverhampton.

Darren has worked within the injection moulding industry for over 30 years with exposure to trade moulding, automotive and IT consumables.

Rob Keers
Maintenance and Fault Finding

Rob has been with Sumitomo (SHI) Demag UK Ltd for over 30 years. During that time he has built up a wealth of practical maintenance experience, covering NCII, NCIII, NC4 as well as our current NC5 product range; Systec, EL-EXIS and IntElect machines.

Before joining the company, he studied engineering then electronics, after which he worked on sound and stage equipment, which took him around the UK and abroad.

Rob visits our factories in Germany on a regular basis to ensure he is fully aware of the latest developments, enabling him to deliver the most up to date training available.

As well as being a Technical Service Engineer, Rob also delivers bespoke training for customers on-site and at our training facility.

Bespoke Courses and Other Services

Sumitomo (SHI) Demag UK is also able to offer bespoke training courses, either at our training centre or on-site. Please call with your requirements and we can tailor a package to suit you.

Other Services

- Mould Trials
- Pre-course analysis to evaluate the delegates current knowledge ensuring the best course is undertaken

Contact

Email: sduk.training@shi-g.com
Tel: 01296 739500

Sumitomo (SHI) Demag Moulding Academy

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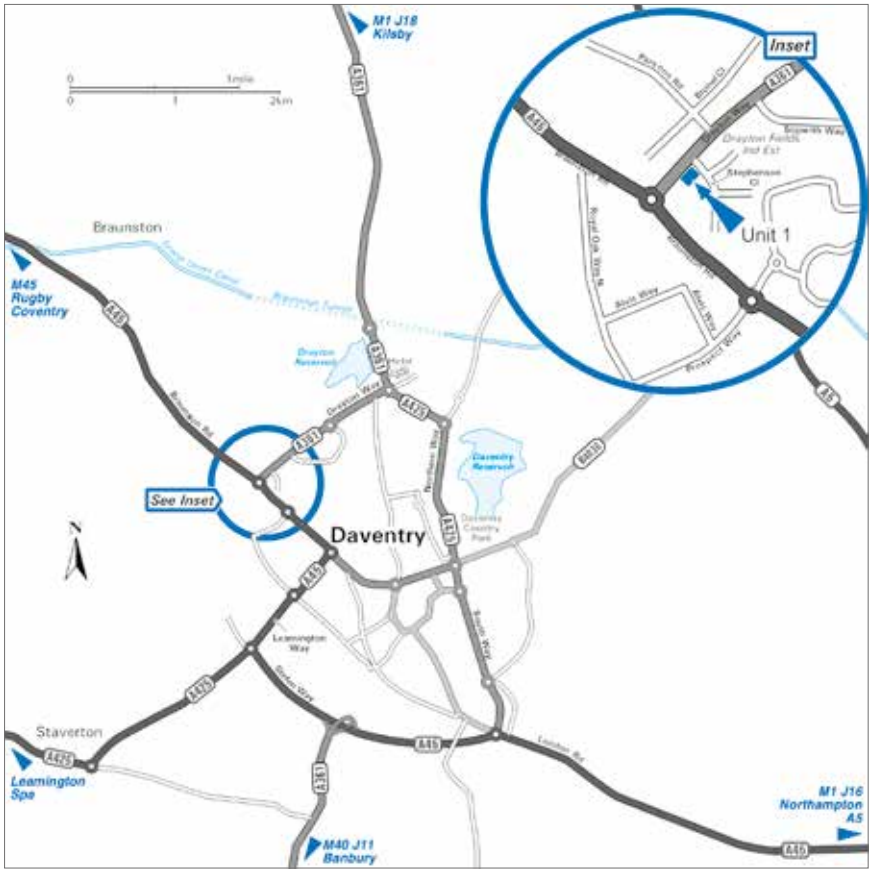

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