RightStart™
PLASTICS TRAINING THAT’S IN A CLASS BY ITSELF

INJECTION MOLDING EDITION

Routsis Training
# Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Services</td>
<td>3</td>
</tr>
<tr>
<td>Routsis’s RightStart™ Process</td>
<td>3</td>
</tr>
<tr>
<td>Online Training Courses</td>
<td>6</td>
</tr>
<tr>
<td>Basic</td>
<td>6</td>
</tr>
<tr>
<td>Advanced</td>
<td>8</td>
</tr>
<tr>
<td>Production</td>
<td>14</td>
</tr>
<tr>
<td>Maintenance</td>
<td>21</td>
</tr>
<tr>
<td>Design</td>
<td>23</td>
</tr>
<tr>
<td>Technical Skills</td>
<td>26</td>
</tr>
<tr>
<td>Classroom &amp; On-site Training</td>
<td>28</td>
</tr>
<tr>
<td>Fundamental</td>
<td>28</td>
</tr>
<tr>
<td>Intermediate</td>
<td>30</td>
</tr>
<tr>
<td>Advanced</td>
<td>33</td>
</tr>
<tr>
<td>Workshop</td>
<td>36</td>
</tr>
<tr>
<td>Critical Success Factors for Training</td>
<td>37</td>
</tr>
<tr>
<td>Return on Investment</td>
<td>38</td>
</tr>
</tbody>
</table>
Routsis’s RightStart™ Process

Would you like on-site implementation of the easiest and fastest way to effectively train your entire workforce? Turn to Routsis for our RightStart™ system, and we’ll get you started right away with a complete, custom program that delivers uniquely relevant training for your company and employees.

Our Process for Tailoring and Launching Your Training Program

Here’s a quick look at how the RightStart™ Process works:

1. We actually visit your plant and create a custom training plan specifically designed for each employee at your workplace.
2. Based on your facility, we create job-specific tasks to develop and reinforce proper day-to-day work habits.
3. We show you how to implement, track, and customize your training – so you can launch your new training initiative.
4. Start training immediately with access to the world’s largest library of engaging, practical plastics training courses available.
5. We provide ongoing support to ensure you get the most from your program.

Benefits of RightStart™

- The absolute fastest, most effective way to train your production workforce
- Your company’s own secure online training portal
- Complete onsite setup and implementation – everything you need to get going and succeed
- A full 30-day money back guarantee
- Continuous collaboration with the knowledgeable, committed and service-driven Routsis team
- In-depth training specially developed by plastics industry experts – and customized for your shop floor

Best of all, it’s easy to get started with the Routsis RightStart™ process: Just contact us today.
Routsis is the only plastics training provider that will conduct an onsite visit to assist you in establishing a specific training plan for your entire workforce. During the RightStart™ process, we’ll help you list the respective job responsibilities of every position in your operation. We’ll develop a unique plan with established goals and a timetable for completing the outlined training.

By developing and enhancing the skills of each employee and job position at your facility, you’ll have a more versatile workforce and will never have to rely on one or two go-to production personnel.

While we’re onsite, we help establish critical metrics that include; scrap rate, set-up times, troubleshooting times, accidents, mold and machine damage, and more. Continuous improvement is the objective of any training initiative and these key metrics are monitored throughout the training initiative and reported in dollars on a monthly basis so that your operation continuously strives to achieve its goals and, more importantly, will not lose sight of the goal of keeping on top of everything within the training plan – which serves as a the blueprint.

You’ll receive all of the necessary tools to make your training initiative succeed and the net result is a lean, versatile, well-skilled workforce that will keep you profitable and competitive for years to come. Typical payback on your training investment averages a mere 3.4 months.

When we establish your company’s structured training plan, we integrate multiple forms of training designed to develop skills for your employees and include; computer-based interactive training (online), and plant-specific on the floor exercises created for each job position at your facility. The plan also includes training that we do not supply – such as machine-specific trade shows, outside seminars, and more.

4 Questions Our Competitors Hope You Never Ask

- Will your plastics professionals come to my plant and help devise a structured training plan?
- Do you supply the necessary tools to customize my interactive training?
- Do you provide plant specific on-the-job training tasks?
- Will you teach me how to use, track, monitor, and customize my training?
Routsis offers extensive implementation assistance and is second to none within the plastics industry. This includes facilitator instruction on how to use, customize, track and implement the online training.

We ensure that your training gets up and running quickly. We’ll configure your training station(s) and offer support via manuals, instructional DVDs, monthly ‘Train the Trainer’ webinars, phone and email – all at no additional charge.

All of our interactive training courses are accompanied by on-the-floor exercises and are provided in an electronic format so that you can fine tune them as needed. Our courses are also very easy to customize by adding videos, pictures, questions, or plant-specific work instructions and we’ll show you step-by-step how to do it. You can create your own new courses on subject matter and procedures that require emphasis – as this has become a very hot topic expressed by managers of our industry.

Training is an ongoing process, and while we are on site, we detail the entire process; from training room setup and the scheduling and reporting progress spreadsheets to the key metrics that should be closely monitored throughout the training initiative at your facility.

“Routsis didn’t just sell us a bunch of training courses. They worked with us to determine our needs and came to our plant and configured the training station the way we wanted. We also learned how to customize the courses - adding video, audio and pictures of our unique processes and equipment. After the visit, we were provided with specific training plans for each job position as well as Task Sheets to ensure everyone on the production floor receives the same training. I strongly urge anyone who is serious about training to consider what Routsis has to offer.”

Jerry Stare
Plastics Engineer
Ames True Temper (Camp Hill, PA)
An Introduction to Injection Molding

The fastest way to get new hires up-to-speed

This course provides participants with a general introduction to the plastics industry. The primary focus of this training program is the day-to-day operations of a typical injection molding facility.

An Introduction to Injection Molding was created for newcomers to the injection molding industry or anyone that would like to learn more about plastics. We recommend that new hires take this course before participating in our Injection Molding Basics series.

Topics covered include:

- An overview of plastics and the industry
- A typical molding facility
- General plant safety
- An introduction to the molding process
- Molding machine components
- Material handling
- Injection mold terminology
- Common part defects

An Introduction to Injection Molding
1 Interactive Training Program (1-2 hours)

PRODUCT ID:  wbt.im.bs.iim
               wbt.im.bs.iim.uk  (EU & UK version)
               wbt.im.bs.iim.sp  (Spanish Version)
               wbt.im.bs.iim.mc  (Mandarin Version)
Injection Molding Basics

*Here’s how you can get all your employees on the same page*

These courses teach employees the three major aspects of injection molding; the Machine, the Process, and the Mold. *Injection Molding Basics* gives new hires a good idea how injection molding works. These programs also serve as excellent refreshers for any employee; from operators and technicians to management and setup personnel.

**Program 1 | Machine**
- Cites important safety precautions for working around injection molding machines
- Gives an introduction to the injection molding process
- Introduces machine types and the different modes of operation
- Discusses the components of the injection molding machine and their respective functions
- General procedures for starting up and shutting down a molding machine

**Program 2 | Process**
- Discusses polymers and the three criteria used to classify them
- Covers some of the more common procedures for material preparation
- Introduces the three phases of the molding process; injection, cooling and ejection
- Explains the need for maintaining an accurate process log
- Defines common injection molded part defects and explains their causes

**Program 3 | Mold**
- Explains the specific functions that an injection mold must perform
- Introduces the various machining methods used to construct a mold
- Discusses the three mold configurations commonly used in the industry
- Covers common runner shapes and gate types
- Gives an overview of proper mold maintenance

---

**Injection Molding Basics**
3 Interactive Training Programs (3-6 hours)

**PRODUCT ID:**
- wbt.im.bs.imb
- wbt.im.bs.imb.uk (EU & UK version)
- wbt.im.bs.imb.sp (Spanish Version)
- wbt.im.bs.imb.mc (Mandarin Version)
**RJG’S DECOUPLED MOLDING℠**

Developed in collaboration with RJG’s corporate headquarters in Traverse City, Michigan, this four course series starts with the major components of the molding process, and progresses to systematic troubleshooting. The DECOUPLED MOLDING℠ system is an ideal processing method intended for anyone interested in optimizing an injection molding process.

**Program 1 | Introduction to DECOUPLED MOLDING℠**
- Discusses polymerization, crystallinity, additives, regrind and material degradation
- Lists necessary components of a proper part design
- Describes the injection molding process in depth
- Covers molding machine components and their functions

**Program 2 | DECOUPLED MOLDING℠ Techniques**
- Compares traditional and DECOUPLED MOLDING℠
- Defines the three DECOUPLED MOLDING℠ techniques
- Covers transducers and proper transducer placement
- Introduces signal conditioners and display devices

**Program 3 | Reading & Interpreting Data**
- Provides participants with an understanding of graphs & scaling
- Explains how to identify different types of graphical curves
- Introduces the integrals used in DECOUPLED MOLDING℠
- Compares ideal and inconsistent pressure curves

**Program 4 | Systematic Troubleshooting**
- Discusses the importance of proper process documentation
- Explains the appearance and symptoms of defects
- Introduces logical steps involved in troubleshooting defects
- Describes common processing defects, their causes and actions to correct them

**DECOUPLED MOLDING℠**
4 Interactive Training Programs (4-6 hours)

PRODUCT ID: wbt.im.as.dm
RJG’s eDART™

This course was created for production personnel that monitor and optimize injection molding processes equipped with RJG’s eDART™ process controllers.

This course will greatly benefit setup personnel, process engineers, machine operators, and managers that use (or plan on using) an RJG eDART™ system.

Participants will be better prepared to establish the following:

- Improved processing methods
- Increased operation efficiency
- Machine and process analysis
- Automated quality control
- Improved process stability

RJG’s eDART™

1 Interactive Training Program (1-2 hours)

PRODUCT ID: wbt.im.as.re
Intelligent Molder

*Teach your employees the proper way to evaluate any molding machine, injection mold, or molding process*

These courses were produced for technicians and process engineers that want to thoroughly evaluate both the capability and repeatability of a given injection molding machine, injection mold, or injection molding process.

Each course references three in-depth tests and will greatly benefit any participant of RJG’s classroom-based **Master MolderSM** Certification Series – either as a primer or as follow-up training.

**Program 1 | Machine Evaluation**
- Dynamic Check Ring Repeatability Test
- Load Sensitivity Test
- Platen Deflection Test

**Program 2 | Mold Evaluation**
- Dynamic Cavity Imbalance Test
- Mold Deflection Test
- Tonnage Calculation Worksheet

**Program 3 | Process Evaluation**
- In-Mold Rheology Test
- Gate Seal Worksheet
- DECOUPLED II^SM Process Sheet

Intelligent Molder

3 Interactive Training Programs (4-6 hours)

PRODUCT ID:  wbt.im.as.ims
Math for Molders

Any molder can benefit from these math-based programs

This two-part training program was created for all personnel within the injection molding industry who would like to expand or fine tune their math skills. These courses will greatly benefit any participant of RJG’s classroom-based, Master Molder\textsuperscript{SM} Certification Series either as a primer or as follow-up training.

Program 1
- Whole Numbers, Negative Numbers and Decimals
- Using a Calculator
- Addition, Subtraction, Multiplication and Division
- Rounding Numbers and Significant Figures
- Formulas, Equations and Order of Operations

Program 2
- Metric and Imperial Units
- Length and Distance
- Area, Volume & Flow
- Weight, Mass and Force
- Conversions
- Understanding Percentages
- Calculating Plastic Pressure and Part Shrinkage
- Calculating Tolerances

Math for Molders
2 Interactive Training Programs (2-4 hours)

PRODUCT ID: wbt.im.as.mfm
Processing Parameters for Scientific Molding

*Teach your employees the critical parameters that affect processing*

This 3-part training program will provide participants with a better understanding of the parameters involved with a scientific injection molding process and the control panels of injection molding machines.

This course is beneficial to die setters, process technicians, maintenance personnel, engineers, and anyone else using the control panel.

**Part 1 – Introduction**
- Scientific Molding Overview
- 5 General Rules for Scientific Molding
- Understanding the Process Controller
- Common Units for Process Parameters

**Part 2 – Process**
- Process Inputs versus Process Outputs
- 1st Stage Injection Inputs and Outputs
- 2nd Stage Packing Inputs and Outputs
- Cooling Inputs and Outputs
- Screw Recovery Inputs and Outputs
- Other Commonly Found Process Inputs

**Part 3 – Part Removal**
- Mold Open Settings
- Part Ejection Settings
- Core Pull Settings
- Mold Closing Settings

**Processing Parameters for Scientific Molding**
*3 Interactive Training Program (3-6 hours)*

PRODUCT ID: wbt.im.as.pp
Process Control Systems

*It is crucial for processing personnel to understand both open-loop and closed-loop process control*

This training program details process control systems and is designed to help molders make more educated choices. *Process Control Systems* is a must for any facility which employs (or plans to employ) closed loop process control.

- Open loop vs. closed loop process control
- How process control reduces variation
- Closed loop controllers
- Proper use of process control

**Process Control Systems**

*1 Interactive Training Program (2-3 hours)*

PRODUCT ID:  wbt.im.as.pc
Understanding Plastics

*Your employees need to know how and why plastic materials are different*

This program emphasizes material handling, processing, explains regrind and the effects of moisture on molded part properties. Different types of plastics and processing considerations are explained.

Topics include:

- The definition of plastics
- Polymer classification
- Material properties affected by processing
- Proper material handling techniques
- Processing characteristics of virgin and regrind

**Understanding Plastics**

1 Interactive Training Program (1-2 hours)

PRODUCT ID:  wbt.im.ps.up

  wbt.im.ps.up.uk  (EU & UK version)
  wbt.im.ps.up.sp  (Spanish Version)
  wbt.im.ps.up.mc  (Mandarin Version)
Scientific Troubleshooting for Injection Molders

This series consists of four in-depth training programs that will provide participants with the knowledge required to identify and troubleshoot 25 of the most common molded part defects.

Each of these defects will be defined and their respective causes and corrections will be explained in detail.

Part 1: Introduction

This training program focuses on the 7-step process to scientific troubleshooting. Participants are also presented with information and practices on how to best process, document and maintain a reliable injection molding process.

Part 2: Visual Defects

- Flash
- Sinks and Voids
- Short Shots
- Jetting
- Gate Blush
- Burning
- Flow Lines
- Weld and Melt Lines
- Poor Surface Finish

Part 3: Visual Defects

- Large Parts
- Small Parts
- Larger Parts at the Gate
- Smaller Parts at the Gate
- Warpage

Part 4: Material and Cycle-Related Defects

- Splay, Bubbles, and Blisters
- Brittleness, Cracking, and Crazing
- Delamination
- Contamination
- Poor Color Distribution
- Part Sticking and Ejector Pin Marks
- Occasional Part Hang-Up

Scientific Troubleshooting for Injection Molders
4 Interactive Training Program (6-10 hours)

PRODUCT ID: wbt.im.ps.st
Injection Mold Setup

Learn safe and efficient die-setting with this comprehensive program

This comprehensive 2-part program provides participants with a better understanding of die setting including safety preparation, documentation, mold removal & installation, and process startup.

This is an excellent course for anyone involved in die setting including process technicians and supervisors.

Injection Mold Setup, Program 1

- Safety Concerns and Considerations for Die Setters
- Injection Mold Setup Scheduling and Preparation
- Machine Dependent and Independent Documentation
- Proper Injection Mold Preparation and Examination
- Safe and Effective Mold Removal Techniques

Injection Mold Setup, Program 2

- Safe and Effective Mold Installation Techniques
- Setting Clamp Tonnage and Mold Protect
- Optimizing Clamp and Part Ejection Settings
- Establishing Consistent Screw Recovery
- Melt Temperature Matching Techniques
- Process Startup and Scientific Molding Principles
Electric Injection Molding

Our two Electric Injection Molding courses will provide participants with a better understanding of the benefits and capabilities of modern all-electric injection molding machines. Safety concerns particular to electric molding machines are also covered.

These programs identify critical differences between hydraulic and all-electric molding machines – and teach participants how to optimize a given process to take advantage of those differences.

**Understanding Electric Injection Molding Machines**
- General Injection Molding Safety
- Electric Molding Machine Safety
- Comparing Hydraulic and Electric Machines
- Basic Molding Machine Functions
- Efficiency, Accuracy and Repeatability
- Alternative Machine Designs
- Typical Uses for Electric Molding Machines

**Processing with Electric Injection Molding Machines**
- Closed-Loop Process Controls
- Hydraulic vs. Electric Machine Controls
- Process Optimization Strategies:
  - 1st Stage Filling
  - 1st Stage to 2nd Stage Transfer
  - 2nd Stage Pack
  - Screw Delay
  - Screw Recovery
  - Screw Decompression
  - Cooling Time
  - Mold Opening
  - Part Ejection
  - Mold Closing
  - Clamping
Material Drying Technology

Our two Material Drying Technology courses will provide participants with a better understanding of how different polymers are best dried and prepared for reliable processing. These courses show participants how proper material handling and drying is critical to produce a consistent product and process.

Material Drying Technology, Course 1
- Polymer Basics
- Hygroscopic vs. Non-Hygroscopic Polymers
- Hydrolysis
- Purposes of Drying
- Dewpoint
- Dewpoint Measurement
- Dewpoint Sensors
- Drying Procedures

Material Drying Technology, Course 2
- Hot Air Dryers
- Compressed Air Dryers
- Desiccant Dryers
- Vacuum Dryers
- Calculating Material Consumption
- Calculating Residence Time
- Calculating Dryer Capacity

Material Drying Technology
2 Interactive Training Programs (1-3 hours)

PRODUCT ID: wbt.im.ps.dt
Establishing a Scientific Molding Process

Ensure your employees know how to make appropriate and cost-effective decisions

- General Rules for Scientific Processing
- Process Optimization Strategies:
  - Filling / Transfer / Packing
  - Screw Recovery, Delay & Decompression
  - Cooling Time
  - Mold Opening, Mold Closing & Part Ejection
  - Clamping

Processing For Profit

Learn techniques to increase profitability while maintaining part quality

This course focuses on the relationship between the material, the mold and the molding machine.

Also included is practical, up-to-date information about process documentation procedures - as well as some great tips on process optimization.

- Material handling and preparation
- Process documentation and its importance
- Process optimization
- Energy conservation
The Effects of Shrinkage, Warpage & Part Ejection

Understand three of the most complicated aspects of injection molding

This course is designed to familiarize production personnel with complications that may arise during processing concerning shrinkage, warpage and ejection.

- How packing affects shrinkage and warpage
- Ejection systems for simple and complex geometry
- The effects of part geometry
- Amorphous vs. semi-crystalline polymer behavior

The Effects of Mold Filling, Gating & Weld Lines

What every technician needs to know about mold filling

This course outlines mold filling and how different gating configurations affect filling. Also discussed are weld and meld lines and their effects on molded parts.

- Weld line occurrence and strength determination
- Gate types, location, and importance
- Fatigue and cyclic stress
- Tooling considerations

PRODUCT ID:  wbt.im.ps.es

PRODUCT ID:  wbt.im.ps.em
Injection Mold Maintenance

Your employees should understand proper procedures for safety and mold care – before, during, and after a production run

From mold storage to part removal, this course provides participants with good mold maintenance habits and aims to extend tool life & increase productivity – while stressing important safety considerations.

· Proper mold maintenance
· Mold storage and preparation
· Water line maintenance
· Techniques for extending tool life

Injection Molding Machine Maintenance

Learn the standard maintenance considerations for an injection molding machine

Designed to introduce the many maintenance considerations for an injection molding machine. Participants are also shown newer technologies; such as laser leveling, ultrasonic tie bar stretch measuring, and portable machine process monitors.

· Basic machine maintenance & safety concerns
· Fluid and platen maintenance
· Screw and barrel maintenance
· Preventative maintenance & logging
Injection Molding Hydraulics

A must for any company utilizing hydraulically-powered injection molding machines

This course demonstrates the importance of hydraulics in the injection molding process.

Machine operators will learn ways to reduce wear on hydraulic components, while more advanced employees concentrate on hydraulic print reading and theory.

Topics include:

- Basic hydraulic theory
- The role of hydraulics in injection molding
- The function and purpose of hydraulic components
- Recognition of hydraulic symbols
- Directional valves and flow controls
- Hydraulic pumps and motors
- Proportional valves and servo valves
- Hydraulic fluid management

Injection Molding Hydraulics

2 Interactive Training Programs (3-4 hours)

PRODUCT ID:  wbt.im.ms.hs
Plastic Part Design Series

Our Plastic Part Design Series provides part designers with an understanding of the plastic part design process. This extensive interactive training course also addresses many of the factors and concerns associated with part design. Dr. Robert Malloy, a respected author and professor at the University of Massachusetts, Lowell, developed these comprehensive interactive training programs.

Program 1 | Product Development & the Prototype Process
- Product development steps & concurrent engineering
- Computer simulations for design
- Rapid prototyping and tooling processes

Program 2 | Mechanical Behavior of Polymers
- The mechanical behavior of polymers
- Stress/strain curves and visco-elastic behavior of polymers
- Creep and stress relaxation

Program 3 | Mold Filling, Gating & Weld Lines
- Fatigue and cyclic stress
- Mold filling processes
- Gate types, location, and importance
- Weld line occurrence and strength determination

Program 4 | Shrinkage, Warpage, & Part Ejection
- How packing affects shrinkage and warpage
- The effects of part geometry
- Amorphous vs. semi-crystalline behavior
- Ejection systems for simple and complex geometry

Program 5 | Mechanical Fasteners, Press & Snap Fits
- Assembly techniques
- Snap fit design and considerations
- Design for assembly and disassembly
- Boss and screw design / press fit design and strength equations

Program 6 | Welding & Adhesives Bonding Technology
- Various part welding processes
- Joint design for injection molded parts
- Adhesive bonding applications & techniques
- Wetting, surface attraction and curing of adhesives
Mold Design & Moldmaking Series

This comprehensive 9-part course was created with help from many of the world’s leading tool manufacturers and suppliers and is intended for tool designers, mold makers, engineers, part designers, and anyone involved in the tool procurement process.

The *Mold Design and Moldmaking Series* familiarizes participants with the different types of injection molds, contemporary machining methods, and many of the available mold components.

This course also provides the participant with a tool design methodology and a sample mold specification guide for reference.

**Program 1 | Injection Mold Fundamentals**
- The four basic functions of an injection mold
- Part design considerations
- Material considerations
- Molding machine considerations
- Initial mold design

**Program 2 | Mold Machining Methods, Part 1**
- Conventional and CNC milling
- Conventional and CNC lathe
- Conventional and CNC surface grinding
- The advantages and disadvantages to each machining method
- Finishes and stresses with each process

**Program 3 | Mold Machining Methods, Part 2**
- Conventional and CNC die sinking EDM
- CNC wire EDM
- Polishing
- Inspection equipment
- Seal-offs

**Program 4 | 2-Plate, 3-Plate, and Hot Runner Molds**
- Explains the three basic mold designs and their construction
- Advantage and disadvantage to each design
- Common uses for each design
- Explains different hot runner systems
- Parting line locks
- Specialty molds
Mold Design & Moldmaking Series

**Program 5 | Mold Bases, Tool Steels & Heat Treating**
- Tooling materials and their properties
- Various heat treating methods
- Introduces alternative materials, such as Beryllium-copper
- Features DME standardized mold bases

**Program 6 | External & Internal Actions**
- Slides, core pins, & lifters
- Unscrewing & expandable cores
- Inserts
- Dissolvable cores
- Preload and seal-offs

**Program 7 | Part Ejection, Venting & Cooling**
- Ejector pins, sleeves, blades and lifters
- Stripper plates and pneumatic ejection
- Water lines, bubblers, baffles and conductive cooling rods
- Multi-stage ejection and ejection return
- Covers different forms of part venting

**Program 8 | Gating Methods**
- Commonly used Gates and their characteristics
- Introduction to hot runner gate design
- Introduction to cold runner gate design
- Explains manual and automatic gate removal
- Discusses gate location determination

**Program 9 | Runners, Filling Software & the Mold Design Process**
- Parting line determination and considerations
- Core and cavity block configuration
- Cooling line and ejection layout
- Additional mold components
- Mold filling analysis capabilities

Mold Design & Moldmaking Series
9 Interactive Training Programs (9-16 hours)

PRODUCT ID: wbt.ds.md
Blueprint Reading

Your employees should know how to accurately locate and interpret dimensions on engineering drawings

The six programs in our blueprint reading training course develop workers’ abilities to accurately locate and interpret dimensions on engineering drawings. These training programs are based on ANSI standards and incorporate input from a broad industrial cross-section.

Program 1 | Introduction to Engineering Drawings
- The six principal views of a third-angle projection
- Identify the ISO symbols for third-angle and first-angle projections
- Auxiliary views, partial views, and enlarged views
- Determine which line takes precedence over another

Program 2 | Multiview Drawings
- Outside, inside, vernier and electronic micrometers
- Types of dial indicators
- Dial indicating gauges; snap gauges, calipers, depth gauges

Program 3 | Sectional Views
- Determine which portion of the part is shown in section
- Explain the purpose of section lines and identify the ways they’re used
- Identify and interpret the common drafting conventions applied to sectional views

Program 4 | Dimensions and Tolerances, Part 1
- Identify the size and/or location for a given part feature
- Correctly calculate the tolerance specified for a given part feature

Program 5 | Dimensions and Tolerances, Part 2
- Locate and interpret dimensions specified by chain, baseline and direct dimensioning methods
- Identify a datum feature and explain its purpose
- Explain how MMC and LMC apply to internal and external features
- Calculate allowance
- Identify a surface finish specification

Program 6 | Part Feature Specifications
- Identifies twelve of the most common part features on a drawing
- How to correctly interpret part specifications
Geometric Dimensioning & Tolerancing

These courses are a must for any company manufacturing to GD&T requirements

This four-disc series builds the ability to read and interpret GD&T symbols. Understanding the international engineering language of Geometric Dimensioning & Tolerancing is essential for communicating in the global marketplace.

Program 1 | Basic Principles
- Definition and benefits of GD&T
- Basic Terminologies
- Maximum and Least material condition
- Clearance, interference and transition fits

Program 2 | Interpreting GD&T Symbols
- Diameter symbol
- Coordinate vs. position system tolerance zones
- Effect of material condition on size of geometric tolerance

Program 3 | Form and Orientation Tolerances
- Flatness, straightness, circulatory, and cylindricity
- Orientation tolerances; perpendicularity, angularity, and parallelism
- Application of maximum material condition principle and inspection procedures

Program 4 | Profile, Runout & Location Tolerances
- Profile tolerances
- Runout tolerances; position, concentricity, and symmetry

Geometric Dimensioning & Tolerancing
4 Interactive Training Programs (4-8 hours)

PRODUCT ID:  wbt.ts.gdt
2-Day Fundamental Scientific Molder Training

This package is intended to provide the participant with an extended well-rounded understanding of injection molding with a knowledge-based certification once all the training is complete. This process is a proven and effective system designed to combine a variety of learning techniques into an effective learning experience.

Prerequisite Online Training
- Injection Molding Basics

Prerequisite Learning Objectives
- Understand safety precautions around the molding machine
- Introduces the molding machine, process, mold, & material
- Identify machine components and understand their functions
- General injection molding machine startup and shutdown
- Common polymers types and their general classifications
- Understand the purpose and importance of a process log
- Visual injection molding defects and their typical causes
- Identifying basic injection mold components and functions
- Hot and cold runners systems and common gating methods
- Basic injection mold maintenance during production

Day 1 : Classroom Instruction
- Safety
- Rules of Processing
- First Stage Injection
- Second Stage Packing

Day 1 : Hands-On Lab Exercises
- Setting Injection Speed
- Establishing 1st Stage Fill
- Establishing 2nd Stage Pressure
- Determining Gate Seal Time
- Setting Final Cushion

Day 1 : Scientific Learning & Skills Objectives
- The importance of good housekeeping and machine safety
- Machine guarding and personal protective equipment
- Industry best practices for processing and troubleshooting
- 5 rules of effective and efficient scientific processing
- Understanding process parameters for 1st stage injection
- Basic optimization of 1st stage injection and transfer
- Fundamental scientific (DII or short shot molding) methodology
- Proper setting of maximum 1st stage injection pressure
- Correct and incorrect uses of injection velocity profiling
- Transferring 1st stage injection to 2nd stage pressure by weight
- Understanding process parameters for 2nd stage packing
- Properly compensating for material shrinkage with pressure
- Effective 2nd stage packing pressure establishment techniques
- 2nd stage packing time determination using part weight
- Proper cushion sizing techniques to compensate for variation
- Establishing a 90 to 95% 1st stage fill based on part weight
- Determination of upper and lower acceptable packing pressures
- Optimization of final packing pressure to compensate for variation
- Practical gate seal time determine techniques
- Manual graphing of part weight vs. 2nd stage packing time
- Selection of optimal 2nd stage packing time for variation compensation
- Techniques for obtaining the optimal final cushion sizing
- Adjustments to shot size and transfer position for proper cushion sizing

Day 2 : Classroom Instruction
- Screw Recovery
- Part Cooling
- Process Documentation
- Intro to Troubleshooting

Day 2 : Hands-On Lab Exercises
- Establishing Cooling Time
- Setting Screw Speed
- Process Documentation

Day 2 : Scientific Learning and Skills Objectives
- Understanding process parameters for screw recovery
- Screw decompression both before & after screw recovery
2-Day Fundamental Scientific Molder Training

- Minimizing the stresses imposed on the material
- How to reduce screw flex and breakage during recovery
- Reduction of energy consumption during shot generation
- Proper uses for back pressure during screw recovery
- Melt and mold temperature measurement technique review
- Proper melt temperature matching troubleshooting techniques
- Difference between mold, coolant, and controller temperatures
- Optimal mold temperature determination techniques
- Review of the steps to determine the most efficient cooling time
- Proper machine independent process documentation techniques
- Effective machine independent process documentation techniques for:
  - 1st Stage Injection
  - 2nd Stage Packing
  - Part Cooling
  - Material Recovery
  - Mold Clamping
- The definition and role of a scientific troubleshooter
- Scientific vs. non-scientific process documentation techniques
- The difference between conventional and scientific troubleshooting

- An introduction to proper scientific troubleshooting techniques
- The 7 steps to the effective scientific troubleshooting
- The role of scientific documentation in proper documentation
- Performing a cooling time study to determine minimal cooling time
- Calculating the optimal cooling time which compensates for variation
- Practice setting of screw recovery to minimize material degradation
- Performing effective machine independent process documentation
- Uses for material drying including effective pre-heating techniques
- Basic operation of hot air, compressed air, desiccant, and vacuum dryer systems
- Different methods for removing both absorbed and surface moisture
- Explanation of drying concepts including relative humidity and dewpoint
- Effective and reliable portable dewpoint measurement techniques
- Establishing an efficient scientific molding process
- Scientific process optimization strategies for:
  - 1st Stage Filling
  - 1st to 2nd Stage Transfer
  - 2nd Stage Pack
  - Screw Delay
  - Screw Recovery
  - Screw Decompression
  - Cooling Time
  - Mold Opening
  - Part Ejection
  - Mold Closing
  - Clamping

Post-Requisite Online Training
- Understanding Plastics Materials
- Material Drying Technology
- Establishing a Scientific Molding Process

Post-Requisite Learning Objectives
- Material properties which are affected by processing
- Basic material handling and drying techniques
- How hydrolysis causes increased polymer chain degradation

Fundamental Scientific Molder Training
2 Days of Classroom & Hands-On Instruction + Pre and Post Training Online
PRODUCT ID: crt.im2
3-Day Intermediate Scientific Molder Technician Training

This package is intended to provide the participant with an extended well-rounded understanding of injection molding with a knowledge-based certification once all the training is complete. This process is a proven and effective system designed to combine a variety of learning techniques into an effective learning experience.

Prerequisite Online Training
- Injection Molding Basics
- Understanding Plastics Materials
- Establishing a Scientific Molding Process

Prerequisite Learning Objectives
- Understand safety precautions around the molding machine
- Introduces the molding machine, process, mold, and material
- Identify machine components and understand their functions
- General injection molding machine startup and shutdown
- Common polymers types and their general classifications
- Understand the purpose and importance of a process log
- Visual injection molding defects and their typical causes
- Identifying basic injection mold components and functions
- Hot and cold runners systems and common gating methods
- Basic injection mold maintenance during production
- Material properties which are affected by processing
- Basic material handling and drying techniques
- Establishing an efficient scientific molding process
- Basic scientific process optimization strategies

Day 1 : Classroom Instruction
- Safety
- Rules of Processing
- 1st Stage Injection
- 2nd Stage Packing

Day 1 : Hands-On Lab Exercises
- Melt Temperature Measurement
- Mold Temperature Measurement
- Short Shot Progression
- Setting Injection Speed
- Establishing 1st Stage Fill

Day 1 : Scientific Learning and Skills Objectives
- The importance of good housekeeping and machine safety
- Machine guarding and personal protective equipment
- Industry best practices for processing and troubleshooting
- 5 rules of effective and efficient scientific processing
- Understanding process parameters for 1st stage injection
- Basic optimization of 1st stage injection and transfer
- Fundamental scientific (DII or short shot molding) methodology
- Proper setting of maximum 1st stage injection pressure
- Correct and incorrect uses of injection velocity profiling
- Transferring 1st stage injection to 2nd stage pressure by weight
- Understanding process parameters for 2nd stage packing
- Properly compensating for material shrinkage with pressure
- Effective 2nd stage packing pressure establishment techniques
- 2nd stage packing time determination using part weight
- Proper cushion sizing techniques to compensate for variation
- Difference between melt temperature and barrel temperature
- Proper material temperature measurement techniques
- Proper melt temperature and mold temperature documentation
- Demonstrating the mold gating and filling patterns
- Establishing a 90 to 95% 1st stage fill based on part weight
Day 2: Classroom Instruction
- Screw Recovery
- Part Cooling
- Material Drying Technology

Day 2: Hands-On Lab Exercises
- Establishing 2nd Stage Pressure
- Determining Gate Seal Time
- Setting Final Cushion

Day 2: Scientific Learning and Skills Objectives
- Understanding process parameters for screw recovery
- Screw decompression both before & after screw recovery
- Minimizing the stresses imposed on the material
- How to reduce screw flex and breakage during recovery
- Reduction of energy consumption during shot generation
- Proper uses for back pressure during screw recovery
- Melt and mold temperature measurement technique review
- Proper melt temperature matching troubleshooting techniques
- Difference between mold, coolant, and controller temperatures
- Optimal mold temperature determination techniques
- Review of the steps to determine the most efficient cooling time
- How hydrolysis causes increased polymer chain degradation
- Uses for material drying including effective pre-heating techniques
- Basic operation of hot air, compressed air, desiccant, and vacuum dryer systems
- Different methods for removing both absorbed and surface moisture
- Explanation of drying concepts including relative humidity and dewpoint
- Effective and reliable portable dewpoint measurement techniques
- Determination of upper and lower acceptable packing pressures
- Optimization of final packing pressure to compensate for variation
- Practical gate seal time determine techniques
- Manual graphing of part weight vs. 2nd stage packing time
- Selection of optimal 2nd stage packing time for variation compensation
- Techniques for obtaining the optimal final cushion sizing
- Adjustments to shot size and transfer position for proper cushion sizing

Day 3: Classroom Instruction
- Hydraulic vs. Plastic Pressure
- Electric Molding Machines
- Process Documentation

Day 3: Hands-On Lab Exercises
- Establishing Cooling Time
- Setting Screw Speed
- Process Documentation

Day 3: Scientific Learning and Skills Objectives
- Understanding the difference between hydraulic and plastic pressure
- Common hydraulic to plastic pressure conversion techniques
- Understanding all-electric molding machine control systems
- Review of the difference between electric and hydraulic machine controls
- Proper machine independent process documentation techniques
- Effective machine independent process documentation techniques for:
  - 1st Stage Injection
  - 2nd Stage Packing
  - Part Cooling
  - Material Recovery
  - Mold Clamping
- The definition and role of a scientific troubleshooter
- Scientific vs. non-scientific process documentation techniques
3-Day Intermediate Scientific Molder Technician Training

- The difference between conventional and scientific troubleshooting
- An introduction to proper scientific troubleshooting techniques
- The 7 steps to the effective scientific troubleshooting
- The role of scientific documentation in proper documentation
- Performing a cooling time study to determine minimal cooling time
- Calculating the optimal cooling time which compensates for variation
- Practice setting of screw recovery to minimize material degradation
- Performing effective machine independent process documentation

**Post-Requisite Online Training**

- Scientific Troubleshooting for Injection Molders

**Post-Requisite Learning Objectives**

- The 7 steps to the effective scientific troubleshooting in detail
- Using proper process documentation to your advantage

- Identification, causes, and effective troubleshooting techniques for fixing:
  - Flash
  - Sinks & Voids
  - Short Shots
  - Jetting
  - Gate Blush
  - Burning
  - Flow Lines
  - Weld & Meld Lines
  - Poor Surface Finish
  - Large Parts
  - Differential Part Dimensions
  - Part Warpage
  - Splay, Bubbles, & Blisters
  - Brittleness, Cracking, & Crazing
  - Delamination
  - Contamination
  - Poor Color Distribution
  - Part Sticking & Ejector Pin Marks
  - Occasional Part Hang-Up
4-Day Advanced Scientific Molder Professional Certification

This package is intended to provide the participant with an extended, well-rounded understanding of injection molding with a knowledge-based certification once all the training is complete. This process is a proven and effective system designed to combine a variety of learning techniques into an effective learning experience.

Prerequisite Online Training
- Injection Molding Basics
- Understanding Plastics Materials
- Establishing a Scientific Molding Process
- Electric Injection Molding

Prerequisite Learning Objectives
- Understand safety precautions around the molding machine
- Introduces the molding machine, process, mold, & material
- Identify machine components and understand their functions
- General injection molding machine startup and shutdown
- Common polymers types and their general classifications
- Understand the purpose and importance of a process log
- Visual injection molding defects and their typical causes
- Identifying basic injection mold components and functions
- Hot and cold runners systems and common gating methods
- Basic injection mold maintenance during production
- Material properties which are affected by processing
- Basic material handling and drying techniques
- Electric injection molding machine specific safety

Day 1 : Classroom Instruction
- Safety
- Rules of Processing
- 1st Stage Injection
- 2nd Stage Packing

Day 1 : Hands-On Lab Exercises
- Melt Temperature Measurement
- Mold Temperature Measurement
- Short Shot Progression
- Setting Injection Speed
- Establishing 1st Stage Fill

Day 1 : Scientific Learning and Skills Objectives
- The importance of good housekeeping and machine safety
- Machine guarding and personal protective equipment
- Industry best practices for processing and troubleshooting
- 5 rules of effective and efficient scientific processing
- Understanding process parameters for 1st stage injection

Day 1 : Scientific Learning and Skills Objectives
- Basic optimization of 1st stage injection and transfer
- Fundamental scientific (DI or short shot molding) methodology
- Proper setting of maximum 1st stage injection pressure
- Correct and incorrect uses of injection velocity profiling
- Transferring 1st stage injection to 2nd stage pressure by weight
- Understanding process parameters for 2nd stage packing
- Properly compensating for material shrinkage with pressure
- Effective 2nd stage packing pressure establishment techniques
- 2nd stage packing time determination using part weight
- Proper cushion sizing techniques to compensate for variation
- Difference between melt temperature and barrel temperature
- Proper material temperature measurement techniques
- Proper melt temperature and mold temperature documentation
- Demonstrating the mold gating and filling patterns
- Establishing a 90 to 95% 1st stage fill based on part weight
Day 2 : Classroom Instruction
- Screw Recovery
- Part Cooling
- Closed Loop Control

Day 2 : Hands-On Lab Exercises
- Establishing Second Stage Pressure
- Determining Gate Seal Time
- Setting Final Cushion

Day 2 : Scientific Learning and Skills Objectives
- Understanding process parameters for screw recovery
- Screw decompression both before & after screw recovery
- Minimizing the stresses imposed on the material
- How to reduce screw flex and breakage during recovery
- Reduction of energy consumption during shot generation
- Proper uses for back pressure during screw recovery
- Melt and mold temperature measurement technique review
- Proper melt temperature matching troubleshooting techniques
- Difference between mold, coolant, and controller temperatures
- Optimal mold temperature determination techniques
- Review of the steps to determine the most efficient cooling time
- Understanding closed loop process control systems
- Determination of upper and lower acceptable packing pressures
- Optimization of final packing pressure to compensate for variation
- Practical gate seal time determine techniques
- Manual graphing of part weight vs. 2nd stage packing time
- Selection of optimal 2nd stage packing time for variation compensation
- Techniques for obtaining the optimal final cushion sizing
- Adjustments to shot size and transfer position for proper cushion sizing

Day 3 : Classroom Instruction
- Electric Molding Machines
- Understanding Polymer Strength
- Material Drying Technology

Day 3 : Hands-On Lab Exercises
- Determining Mold Temperature
- Establishing Cooling Time

Day 3 : Scientific Learning and Skills Objectives
- Understanding all-electric molding machine control systems
- Review of the difference between electric and hydraulic machine controls
- Presentation on how polymers get their strength and how it can be compromised
- The effects of semi-crystallinity on shrinkage and part performance
- Minimizing material degradation ad polymer chain breakdown
- The effects of polymer chain orientation on performance and shrinkage
- How hydrolysis causes increased polymer chain degradation
- Uses for material drying including effective pre-heating techniques
- Basic operation of hot air, compressed air, desiccant, and vacuum dryer systems
- Different methods for removing both absorbed and surface moisture
- Explanation of drying concepts including relative humidity and dewpoint
- Effective and reliable portable dewpoint measurement techniques
- Practicing proper techniques for determining optimal mold temperature
- Machine independent coolant temperature measurement techniques
- Performing a cooling time study to determine minimal cooling time
- Calculating the optimal cooling time which compensates for variation
4-Day Advanced Scientific Molder Professional Certification

Day 4: Classroom Instruction
- Hydraulic vs. Plastic Pressure
- Process Documentation
- Intro to Troubleshooting

Day 4: Hands-On Lab Exercises
- Rear Zone Temperature Study
- Setting Screw Speed
- Process Documentation

Day 4: Scientific Learning and Skills Objectives
- Understanding the difference between hydraulic and plastic pressure
- Common hydraulic to plastic pressure conversion techniques
- Proper machine independent process documentation techniques
- Effective machine independent process documentation techniques for:
  - 1st stage injection
  - 2nd stage packing
  - Part cooling
  - Material recovery
  - Mold clamping
- The definition and role of a scientific troubleshooter
- Scientific vs. non-scientific process documentation techniques
- The difference between conventional and scientific troubleshooting
- An introduction to proper scientific troubleshooting techniques
- The 7 steps to the effective scientific troubleshooting
- The role of scientific documentation in proper documentation
- Optimization of screw recovery efficiency through rear zone temperature
- Practice setting of screw recovery to minimize material degradation
- Performing effective machine independent process documentation

Post-Requisite Online Training
- Math for Scientific Molders
- Scientific Troubleshooting for Injection Molders

Post-Requisite Learning Objectives
- Review of applicable mathematics for the production floor
- Understanding of formulas, decimals, and negative numbers
- Proper use of a calculator to perform daily calculations
- Understanding of common metric and imperial units
- Calculating percentages, tolerances, and common equations
- Understanding number rounding, significant figures, and fractions
- The 7 steps to the effective scientific troubleshooting in detail
- Using proper process documentation to your advantage
- Identification, causes, and effective troubleshooting techniques for fixing:
  - Flash
  - Sinks & Voids
  - Short Shots
  - Jetting
  - Gate Blush
  - Burning
  - Flow Lines
  - Weld & Meld Lines
  - Poor Surface Finish
  - Large Parts
  - Differential Part Dimensions
  - Part Warpage
  - Splay, Bubbles, & Blisters
  - Brittleness, Cracking, & Crazing
  - Delamination
  - Contamination
  - Poor Color Distribution
  - Part Sticking & Ejector Pin Marks
  - Occasional Part Hang-Up

Advanced Scientific Molder Professional Certification
4 Days of Classroom & Hands-On Instruction + Pre and Post Training Online

PRODUCT ID: crt.im4

Routsis Training tel: (978) 957-0700 fax: (978) 957-1860 www.traininteractive.com
Additional 1-Day Scientific Process Builder/Improver Workshop

This optional package is an excellent way to provide your employees more experience using the tools they learned during the classroom training. As a group, the instructor and students will spend the day on one or two processes at your facility.

Based on the intent of management, the focus will be to develop and/or improve an existing process. The current process will be reviewed and then the participants, under instructor direction, will utilize a variety of processing tools to improve and develop a robust and reliable process.

At the end of the day, a short report will be generated indicating the improvements obtained, steps taken, and machine independent process documentation to ensure that the process can be repeated in the future.

Scientific Process Builder/Improver Workshop
1 Day of Interactive Hands-On Instruction on Production Equipment

PRODUCT ID:  crt.imx
CRITICAL SUCCESS FACTORS FOR TRAINING

With over 25 years of training experience in the plastics industry, A. Routsis Associates knows the six critical factors that can make or break your company’s in-house training program. Let’s examine these success factors and see how other industry training methods stack up against interactive training.

Relevant
The information being presented must be relevant to the workplace. A comprehensive in-house training plan incorporates all of the training necessary to instill a good base of fundamental knowledge.

Captivating
Training must be captivating in order to keep the participants’ attention. Everyone knows that in order to learn, you must pay attention – yet companies often rely on boring lectures and literature to train.

Interactive
Employees retain significantly more information in an interactive environment. Research has shown a 38% increase in retention when using interactive training compared to other methods.

Customizable
Curriculum must be tailored to meet the specific needs of your plant. Training media, such as interactive training, can be easily customized to your business at no additional cost.

Skill Development
Trainees often learn a wealth of theoretical information yet do not understand how to apply it to the workplace. The participant needs to develop skills so the knowledge can actually be used.

Progress Monitoring
Tracking the results proves the effectiveness of the training. Facilitators need to use a training method that makes it easy to track and monitor each employee’s progress.
RETURN ON INVESTMENT (ROI)

At Routsis Training, we are constantly asked “I know we need training, but how do I justify it?” Since poorly skilled employees are the root cause of most production losses, the highest return on investment comes from improving on three categories: scrap, downtime, and equipment damage.

In a recent industry survey, we found that most companies lose over a quarter of a million dollars annually in scrap and reworked parts, yet are not willing to invest even a fraction of this to remedy the problem. As the company expands and grows, the financial losses increase exponentially. Our customers typically realize reductions of over 60% in scrap and rework while also eliminating customer returns – all as a direct result of improving the skills and confidence of their workforce.

Competent Workers Provide Immediate Payback Through:

- Lower scrap rates
- Reduced mold damage
- Decreased machine downtime
- Improved troubleshooting time
- Faster machine startup
- Fewer defects
- Consistent part quality
- Highly repeatable processes
- Shorter cycle times
- Less accidents
- Process optimization
- Increased customer satisfaction
- Quicker changeovers
- Extended tool and machine life
- More energy-efficient processes

“We have seen a 65% reduction in scrap and a 30% cycle time improvement – resulting in a 66% increase in production capacity.”

Justin Reid
Harrington Corp.

“In our first month of training, our scrap dropped 35%, our employees felt more empowered, and they were eagerly anticipating the next step.”

Mark Rhoads
B & M Plastics