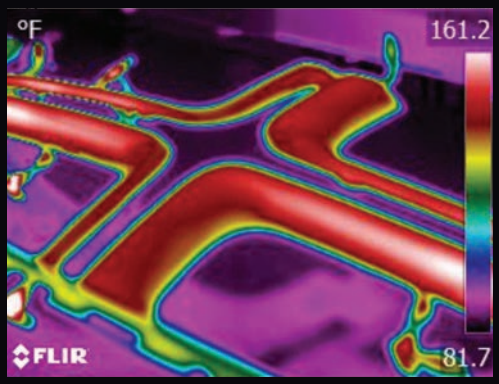
EMITTED ENERGY

Infrared Thermal Technologies



Here are the four major factors that affect the overall quality of the part.

Melt Temp	Plastic Flow Rate	Shrink Rate	Plastic Pressure Gradient
Heater Barrel Temperatures	Injection Speed	Mold Temp Change	Primary Pressure Change
Screw Speed	Material Viscosity Change	Cooling Time	Secondary Pressure Change
Back Pressure	Regrind percentage Change		Transfer Change from Primary to Secondary
Nozzle Temperature			
Manifold Temperature			

What are the Common problems for Injection Molding that relates to your scrap?

INITIAL PART PROCESS SET-UP: Set-up was not optimized to allow the product to have the largest PROCESS WINDOW to compensate for variation (Drifting).

MATERIAL PATH and gating scheme designed in mold or machine, can create excessive shearing in heat signature.

COOLING RATE STRATEGY designed in, and or applied is insignificant for normalizing thermal signature.

PART DESIGN includes areas of concern that create quality concerns when variation occurs.

All of these common problems can result in multiple quality issues such as:

- Warp and Dimensional problems
- Knit Lines
- Non-Fills (short shots)
- Flashing
- Sinks
- Gate Shear
- Yellowing (Discoloration in plastic)

Don't be left behind...

Industry 4.0 is the current trend of automation and data exchange in manufacturing technologies.

Why do I have variance in my process?

1). Unvalidated process settings adjustments

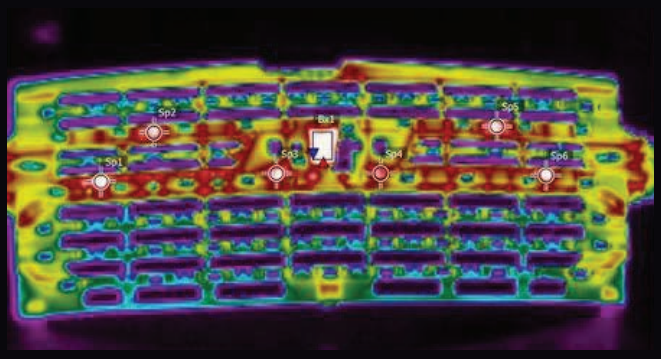
2). In-coming material from supplier carries variation.

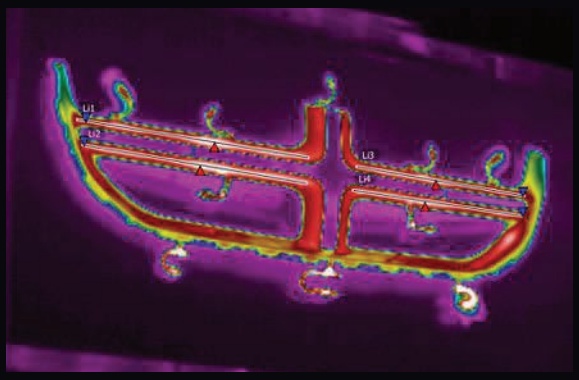
3). Machine functionality

4). Component failure or variation

5). Environment changes
(seasonal changes in humidity)

HOW DO WE DETECT AND GUIDE YOU THROUGH YOUR COMMON INJECTION MOLDING PROBLEMS?			
Everyday issues we are faced with	What is changing causing these quality issues we are faced with?	How does Thermal imaging detect and guide you in resolving these quality concerns?	Thermal image captured
Process Window (Initial Part Set Up)	Improper valve gate sequencing (timing) or process setting has been changed	AOI (area of influence) will pick up this localized heat signature variation or change pointing the technician to the appropriate area needing attention	Thermal imaging readings are key programmed areas that have given values and tolerances that will alert you when a drift is starting or a change has occurred via the control panel, and email, or a text message
Material Path	Material viscosity drifitng changing thermal signature estabished in the original set up	Assigned AOI's are picked and programmed to detect these viscosity changes.	The AOI's pre-programmed settings are based off the initial scientific molding physics principles, and the data calculated from the Design of Experiment (DOE)
Process Window (Initial Part Set Up)	Mold temperature increasing/-decreasing/uneven (cooling rate strategy incorrect)	AOI will pick up this Mold Surface variation/change pointing the technician to the appropriate area that is not working properly.	The AOI is programmed with values for heat signature that determines when a quality concern is occurring based off the calculated data from the DOE
Material Path	Heat source is out of control (not allowing enough heat for plastic to flow or over heating the material to a point of degradation)	AOI will pick up isolated heat signature that is suspect. These AOI points are picked during the Scientific set up using a short shot progression	AOI are picked across your part surfaces to monitor areas in the material path from start to finish as it relates to your part surface.
Part / Mold / Screw Design Problems	Designed wall stock variation, or rib to wall ratio improper, or design in obstructions (openings) are sensitive areas for AOI's because they are more readily affected by heat	Key AOI's in these known areas are picked because of the increased sensitivity	These areas are ALWAYS going to be of concern, because the customer or part design is dicating it. Our system will establish a process window that can accommodate these design issues
Part / Mold Venting Problems	Venting in end of fill area preventing plastic to fill, plastic to over heat (burn)	Key AOI's in these known areas are picked because of the increased sensitivity due to the ongoing physics. (Heat in by exterior sources, or mechanical)	AOI's in these key areas can also detect a closed or blocked vent due to ga residue because of increased heat signature in that area





Injection Molding is a HEAT IN, HEAT OUT process.

What better way is there to analyze and control your process then by using THERMAL IMAGING!!!

Infrared images can deliver meaningful temperature data to tool & process engineers so they can diagnose problems in the operation or design of an injection molding machine.

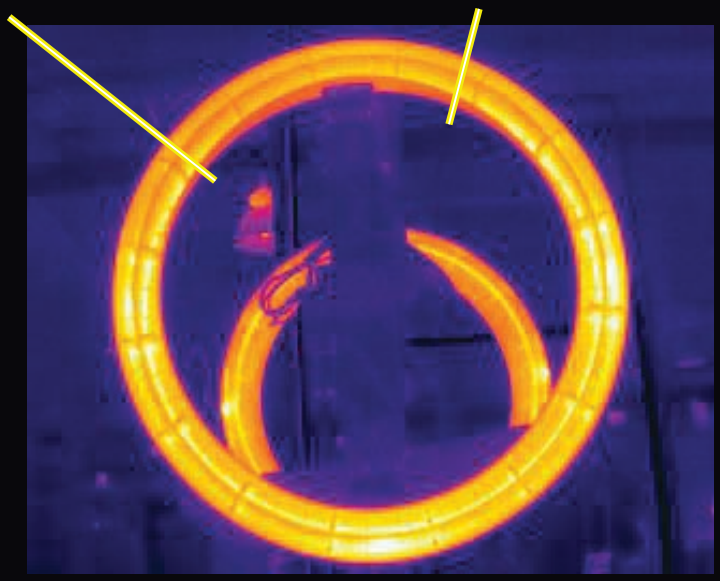
Does your injection molding process continually cost your company money, time, and its reputation?

Do you know if your machine is operating at its peak performance?

Do you know if the process is correct… or is it drifting?

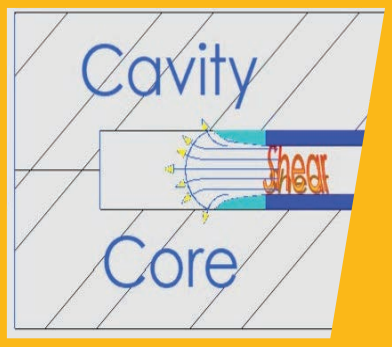
It is this drifting from caused from your Incoming Material, Machine operation, and Mold functioning, that causes a high percentage of your scrap.

Notice the thermal gradient difference in the upper left corner



Before: Thermal image clearly identifies a frozen drop

After: Frozen drop resolved.



Fountain Flow
(Laminar Flow)

How Plasitc “acts” in the process

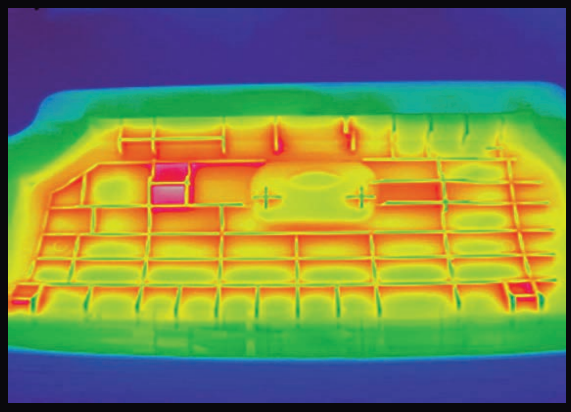
The injection speed, and melt temp make the skin thickness

A large portion of the heat being induced into the plastic product is a result of the dynamics occurring during Laminar Flow.

Laminar Flow is the dynamic of the plastic flowing between itself the material flow creating an inner and outer skin (cavity and core). As the flow continues, the skin cools and gets thicker, which continually reduces the channel the farther it flows. This process flow creates frictional heat as the new plastic continues to fill through the skins.

This frictional heat can be detected using our Thermal imaging system. Any variation in the frictional heat (Laminar flow) could result in dimensional and visual defects.

Without our system, these defects may otherwise go undetected until dimensional analysis or visual inspection occurs.



Injection Molding Solution Package Includes:

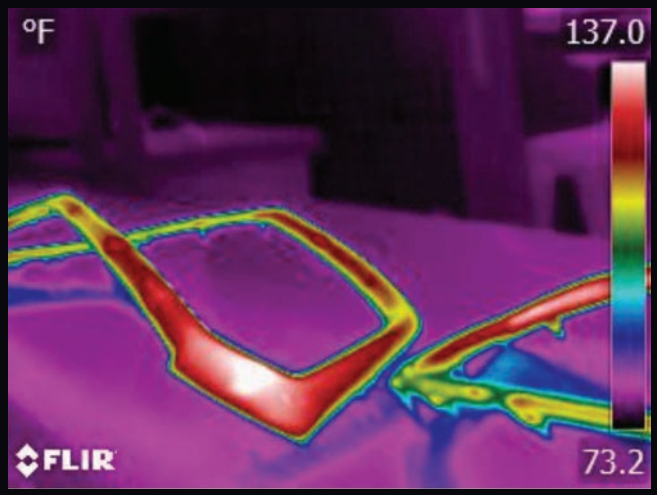
Thermal Process Monitoring System (TPMS)

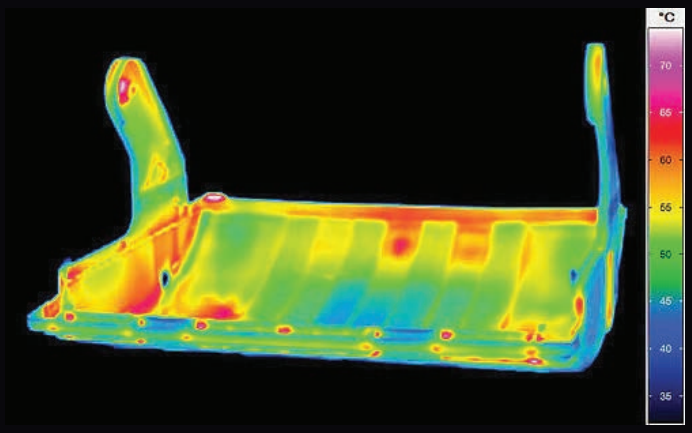
The thermal process monitoring system (TPMS) package designed for Injection Molding Equipment includes the required engineering and programming necessary for injection molding machinery.

This is a thermal machine vision solution integrated with the equipment to actively monitor the thermal profile of the product related to the plastic flow rate, temperature, cooling and pressure gradient. Monitoring of mold machine functionality such as manifold, thermo-couple placement, heater bands and nozzle drops.

The process monitoring package provides capability for part reject with a pass/fail inspection trigger to the end-of-arm (EOA) or diverter system.

- Data is recorded and retained for later analysis.
- Machine Thermal-Vision Software with 1-camera license
- Required programming and setup
- Machine PLC integration
- Digital I/O communication programming
- High Performance i7-based PC
- Touchscreen Monitor and user interface





Process Optimization

Process optimization includes a complete engineering services on your molding process. Our mission is to reduce your molding scrap, increase your first-time quality, avoid costly warranty issues and improve your cycle time. Emitted Energy support will include a Master Molder, a Quality Engineer, and a Level 1 Thermographer on site. Activities included in the Process Optimization:

1. Full review of the current defects occurring to determine the responses for the Design of Experiment (DOE).
2. Run a Scientific Molding Master Set up (approximately 4 hours of product run required to establish the DOE factors).
3. Complete an extensive Statistical DOE run (approximately 6 hours of product run required).
4. Emitted Energy's Quality Engineer will gage and make a visual evaluation of the product responses in the DOE and record the results.
5. Master Molder will evaluate the DOE data (inputs and outputs) to determine the optimized process and identify the factors that affect the responses.
6. Master Molder will create a report of the findings of the DOE. Report includes:
    i. Excel file containing the discoveries found during the Master Set up.
    ii. WISDOM DOE file (WISDOM software required)

Design of Experiment (DOE) Injection Molding Coarse

Course description:

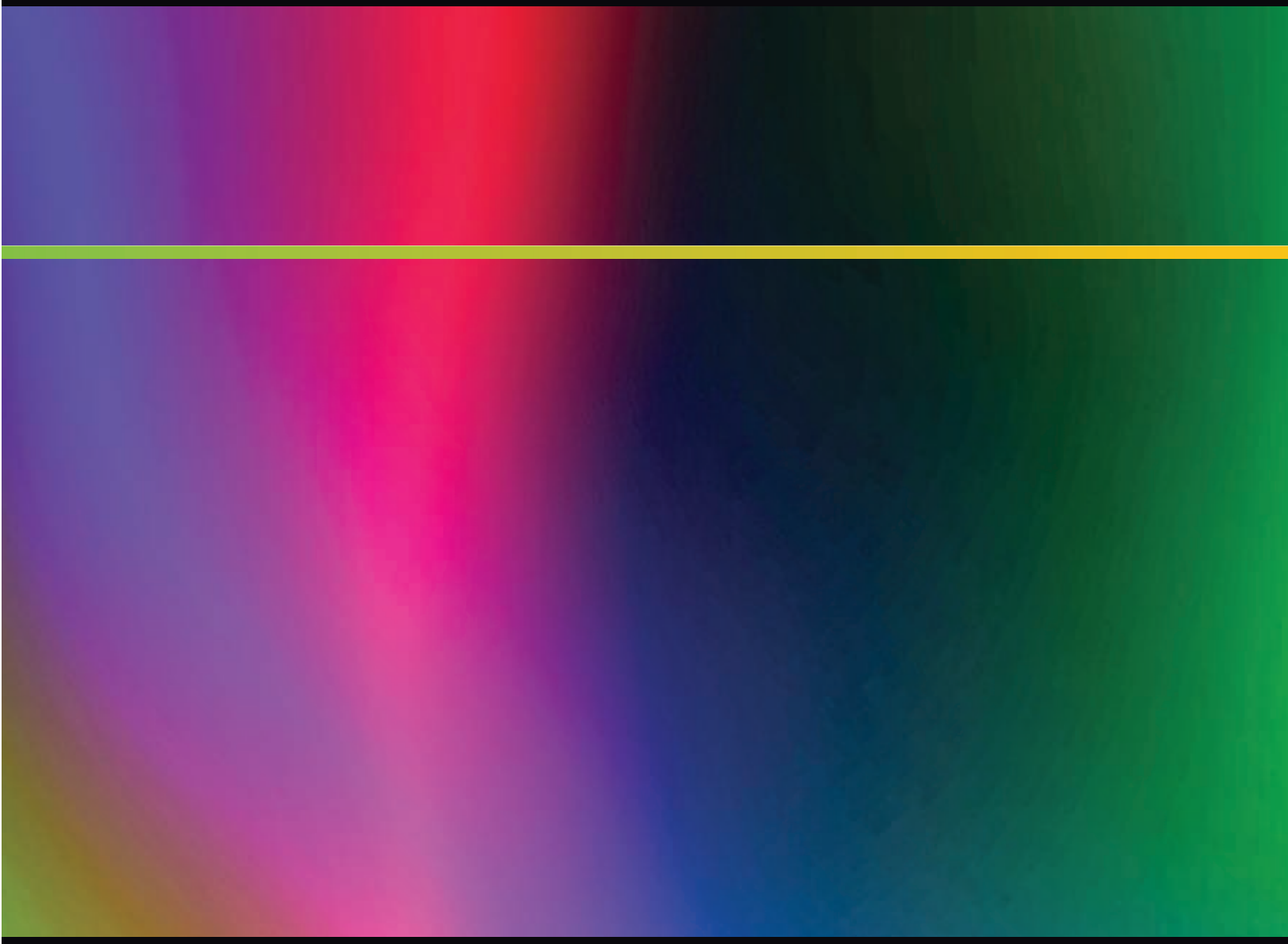
Design Of Experiments (DoE) for injection molding was produced in cooperation with leading DoE experts and provides an overview on how to design an experiment by explaining common terminology and teaching DoE techniques, all in an injection molding environment.

This comprehensive course provides everything needed to improve your molding processes with DoE technique. Taught by a Master Molder with over 35 year of experience.

Our course:

- Provides an overview of how to design an experiment
- Explores various DoE techniques
- Explains how to collect and analyze the data using real-world molding examples
- Analyzes how data is used to characterize, optimize and troubleshoot an injection molding process.
- Explains common DoE terminology

This is a 4-hour course at your facility with unlimited attendance.



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