

# 10 Procedures To Fine-Tune Any Molding Process

*presented by:*



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# **Best Molding Practices**

April 29, 2009

# 10 Procedures To Fine-Tune Any Process

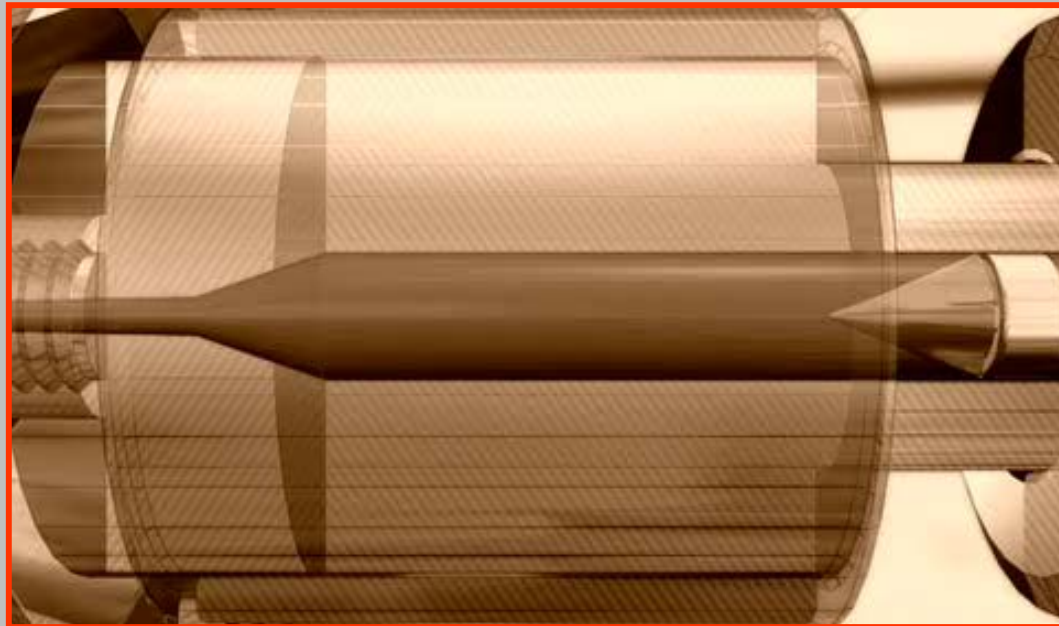
- Establish Fill
- Establish Gate Seal
- Establish Cushion
- Melt Temperature
- Temperature Profiling
- Tacking Temperature
- Heater Band Monitoring
- Nozzle Sizing
- Material Preparation
- Housekeeping
- Special Offer
- Questions & Answers



# Establish Fill

Always Use:

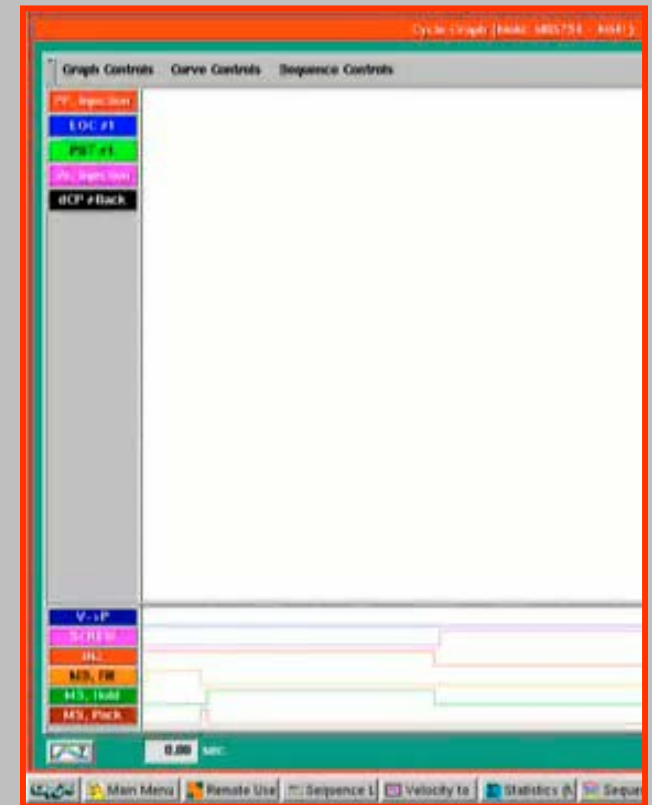
- Velocity Controlled Injection
- Transfer Via Screw Position
- Fill Ends At 95% Full



# Establish Fill

## Velocity Controlled Injection:

- Screw Velocity Is Entered
- Hydraulic Pressure Varies
- Velocity Is Maintained



# Establish Fill

## Transfer Via Screw Position:

- Screw Position Is Entered
- Velocity Control Ends At Setpoint



# Establish Fill

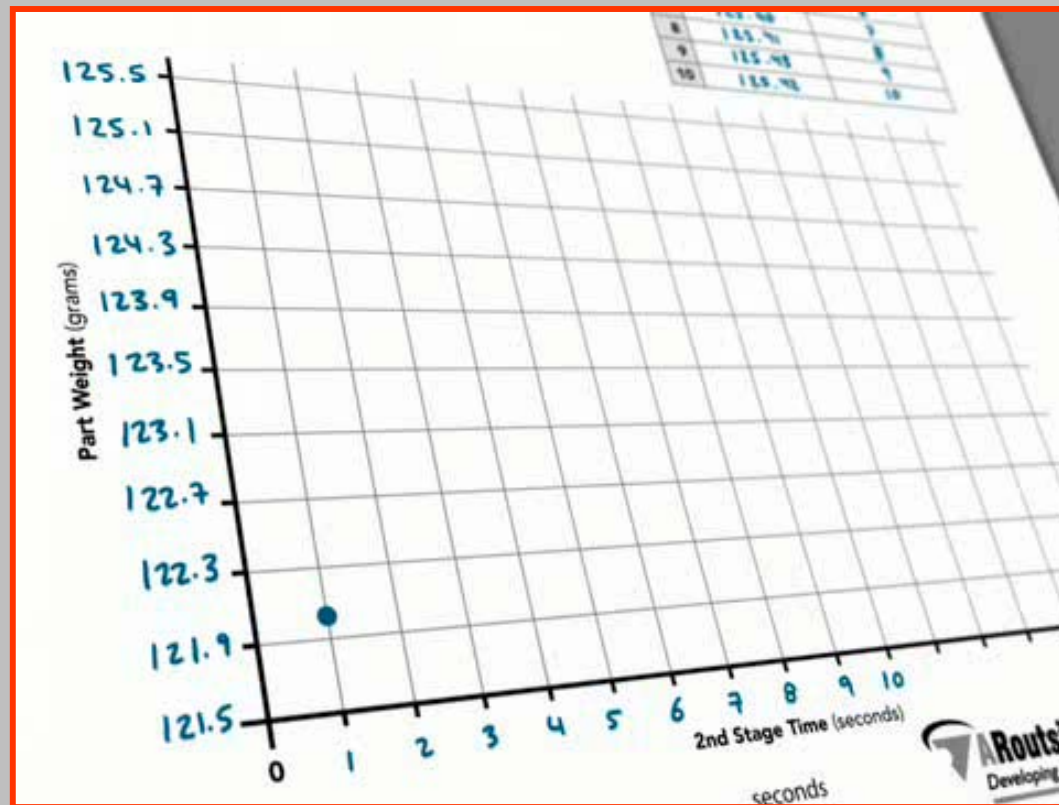
## Fill Ends At 95% Full:

- Determined By Part Weight
- Compared To Full Part
- Compensates For Variability
- Ensures Part Is Not Full Before Packing
- Scale Accurate To At Least 0.5%



# Establish Gate Seal

## Part Weight Vs. 2nd Stage Time



# Establish Gate Seal

## Procedures:

- Establish Proper Fill
- Minimal 2<sup>nd</sup> Stage Time
- Mold & Record
  - Part Weight
  - 2<sup>nd</sup> Stage Time
- Increase 2<sup>nd</sup> Stage Time And Repeat

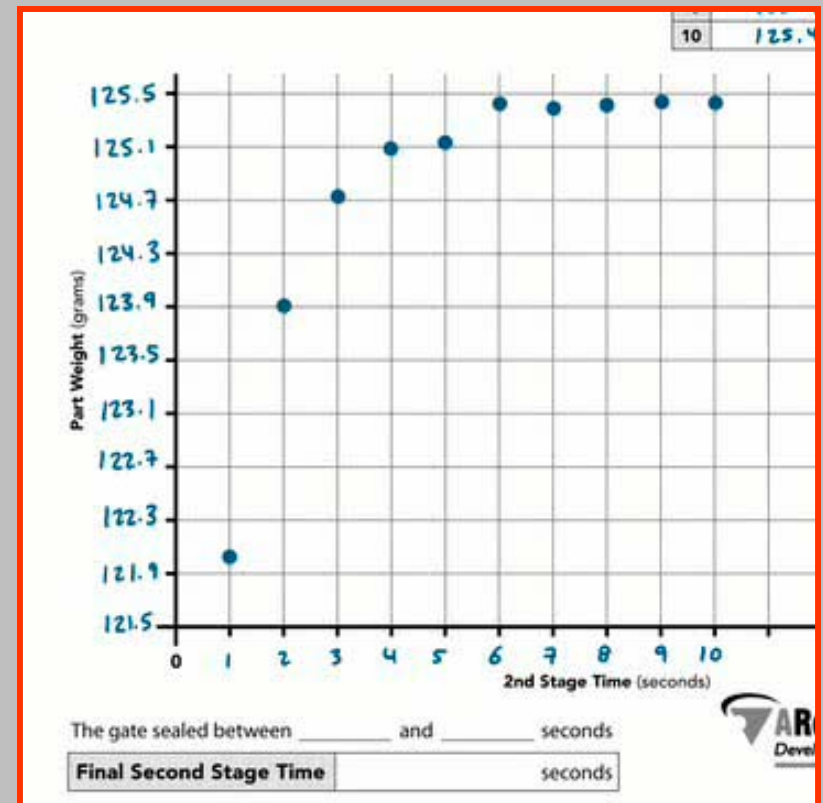


|    | Part Weight | 2nd Stage Time |
|----|-------------|----------------|
| 1  | 121.98      | 1              |
| 2  | 123.40      | 2              |
| 3  | 124.75      | 3              |
| 4  |             |                |
| 5  |             |                |
| 6  |             |                |
| 7  |             |                |
| 8  |             |                |
| 9  |             |                |
| 10 |             |                |

# Establish Gate Seal

## Plotting:

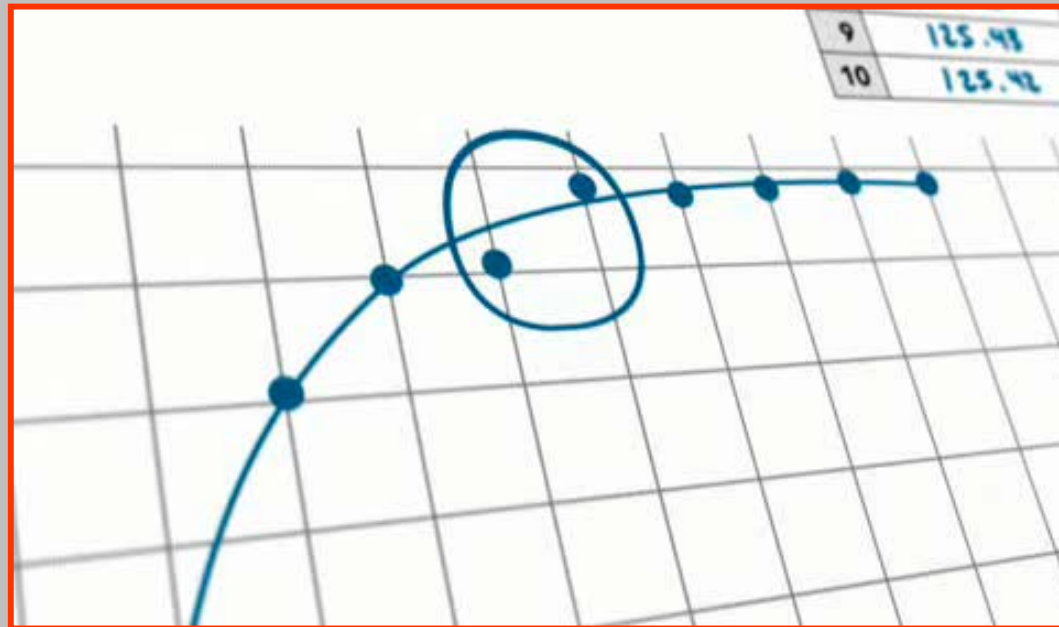
- Plot Data
- Draw Trend Line



# Establish Gate Seal

## Graph Interpretation:

- Gate Seals At Stabilization Point
- Optimal 2<sup>nd</sup> Stage Time Is Next Point
  - Allows For Variation



# Establish Cushion

## Understanding Cushion:

- Forward-Most Point Of Screw Travel
  - Fill
  - Pack
- Reading Not Always Accurate
  - Based On Bottom Out Point



# Establish Cushion

## Common Cushion Setting:

- 5% Or 10% Of Overall Shot Size
- Depends On:
  - Mold
  - Material
  - Machine

|            |           |           |           |
|------------|-----------|-----------|-----------|
| Cycle      | 2.89 s    | Screw     | 3.872 in  |
| INJ time   | 0.13 s    | Platen    | 0.00 in   |
| RCU time   | 10.48 s   | Ejector   | 0.000 in  |
| INJ peak P | 11480 psi | Cushion   | 3.837 in  |
| BP peak P  | 1060 psi  | HP end    | 0.000 in  |
| RCU torq   | 0.0%      | Barrel Pr | 0 psi     |
|            |           | Screw Spd | 0.0 rpm   |
|            |           | Trans Pos | 0.000 in  |
|            |           | Trans Prs | 11040 psi |
|            |           | Trans Spd | 0.00 in/s |

# Establish Cushion

## Commodity Molding ~10%:

- Provides Accommodation For
  - Material Variance
  - Machine Variability
  - Multi-Cavity Mold Fill Imbalance
  - Regrind Variation



# Establish Cushion

## High Precision Molding ~5%:

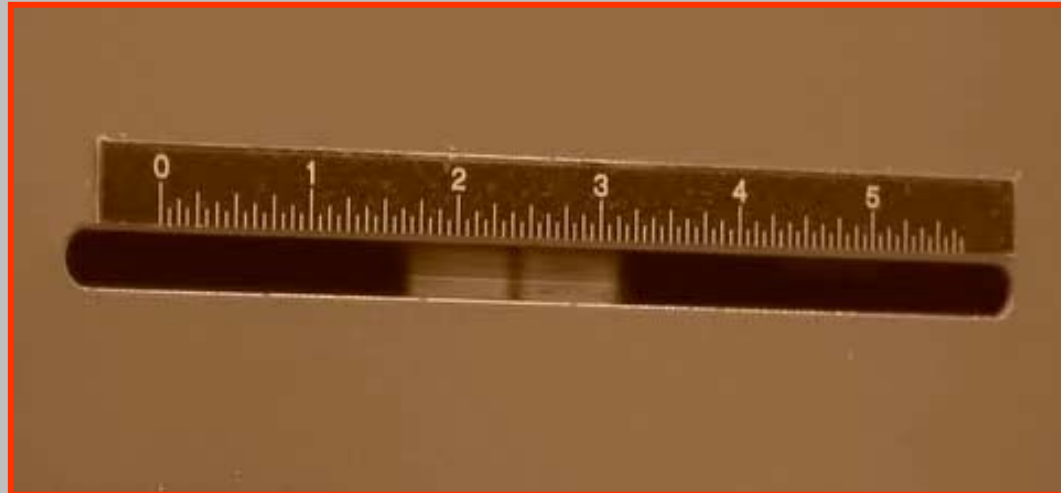
- Prevents Issues From:
  - Melt Compression In Barrel
  - High Barrel Residence



# Establish Cushion

## Determine Screw Bottom-Out Point:

- Zero Out If Possible
- Document On Machine Exterior
- Test During Machine Maintenance



# Melt Temperature

Always Measure Actual Melt Temperature:

- Melt Pyrometer
- 30/30 Method
- Follow Safe Procedures



# Melt Temperature

## Melt Pyrometer Probes:

- Accurate To 1°C Or 1°F
- Preferred: Thin Probe (quick response)
- Avoid: Wire Probe (very delicate)
- OK: Thick Probe (require pre-heating)



# Melt Temperature

## 30/30 Method:

- Set Barrel To Desired Temperature
- If Thick Probe - Preheat Temperature Probe
  - 30° Above Barrel Setting
- Purge And Insert Probe
  - Wait 30 Seconds Before Reading



# Melt Temperature

## Follow Safe Procedures:

- Use Proper PPE
  - Safety Shield
  - Heat Resistant Gloves
  - Long Sleeves
  - Any Plant Specific PPE
- Do Not Place Purge On Floor
  - Place In Purge Receptacle
  - Usually Filled With Water



# Temperature Profiling

## Barrel Temperature Settings:

- Based On Melt Temperature
- Not On Generic Recommendations
- 70-90% Energy Provided By Shear Heating



# Temperature Profiling

## 4 Easy Steps:

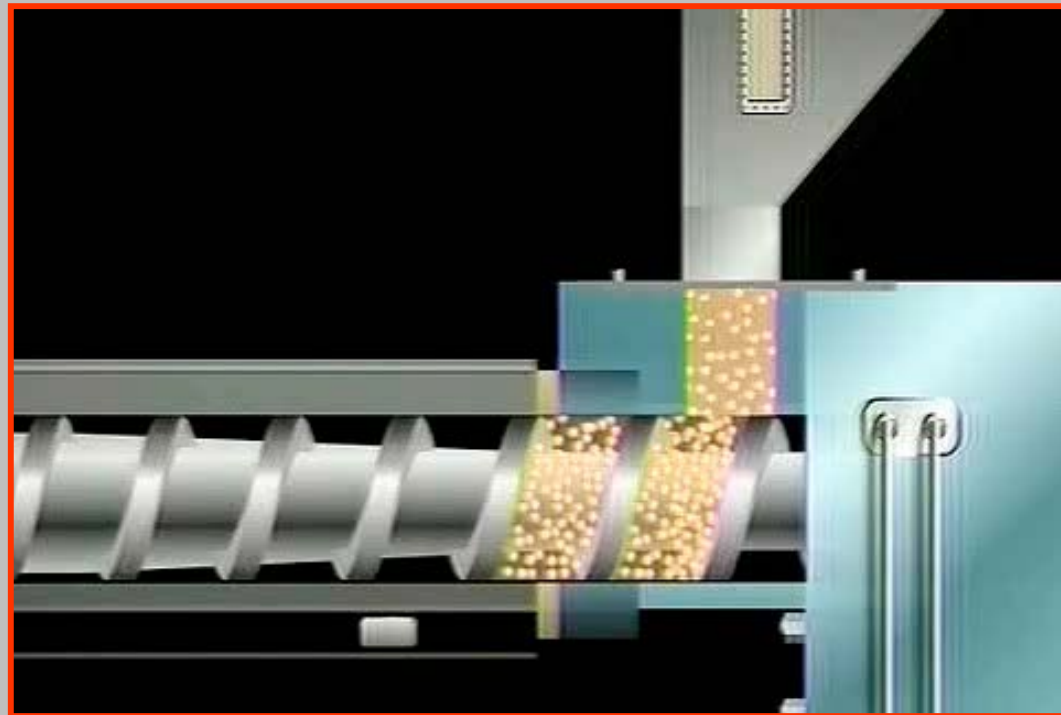
1. Set All Zones To Desired Temperature
2. Run Machine Until Stabilization
3. Measure Actual Melt Temperature
4. Adjust Center And Rear Temperatures



# Tacking Temperature

In Feed Zone:

- Polymer Sticks To Barrel
- Screw Conveys Material



# Tacking Temperature

## Optimal Feed Zone Temperature:

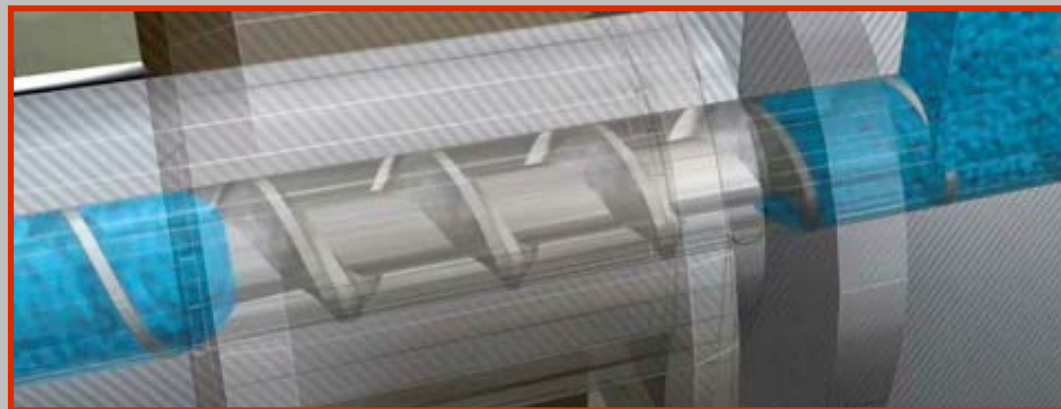
- Provides Highest Friction
  - Between Barrel And Material
- If Temperature Is Too Low
  - Pellets Stay Rigid
- If Temperature Is Too High
  - Polymer Melt Sticks To Screw



# Tacking Temperature

To Determine:

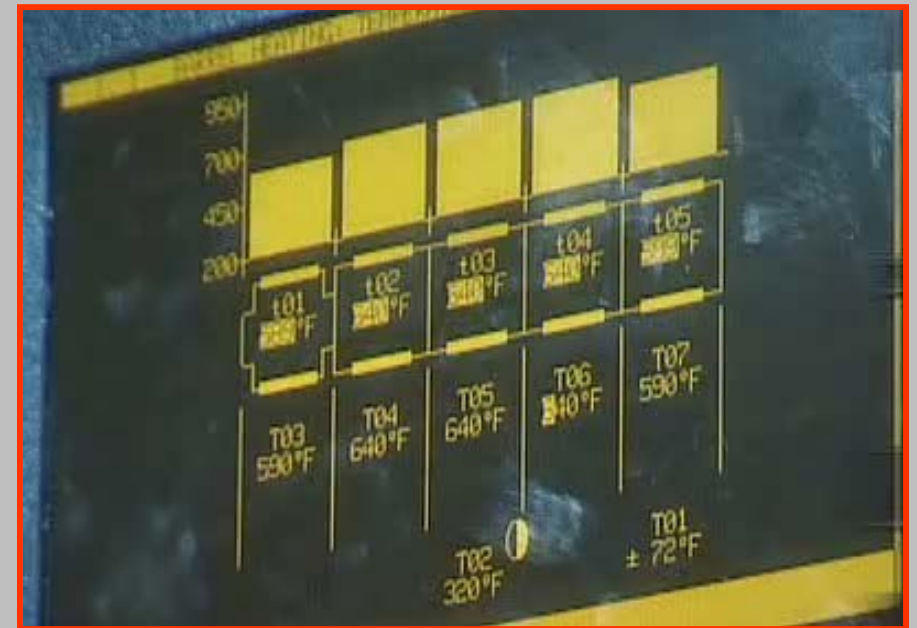
1. Set Feed Zone To A Low Temperature
2. Measure Screw Recovery Time
3. Increase Feed Zone Temperature
4. Repeat Until Recovery Time Drops & Rises



# Tacking Temperature

## Set Rear Temperature:

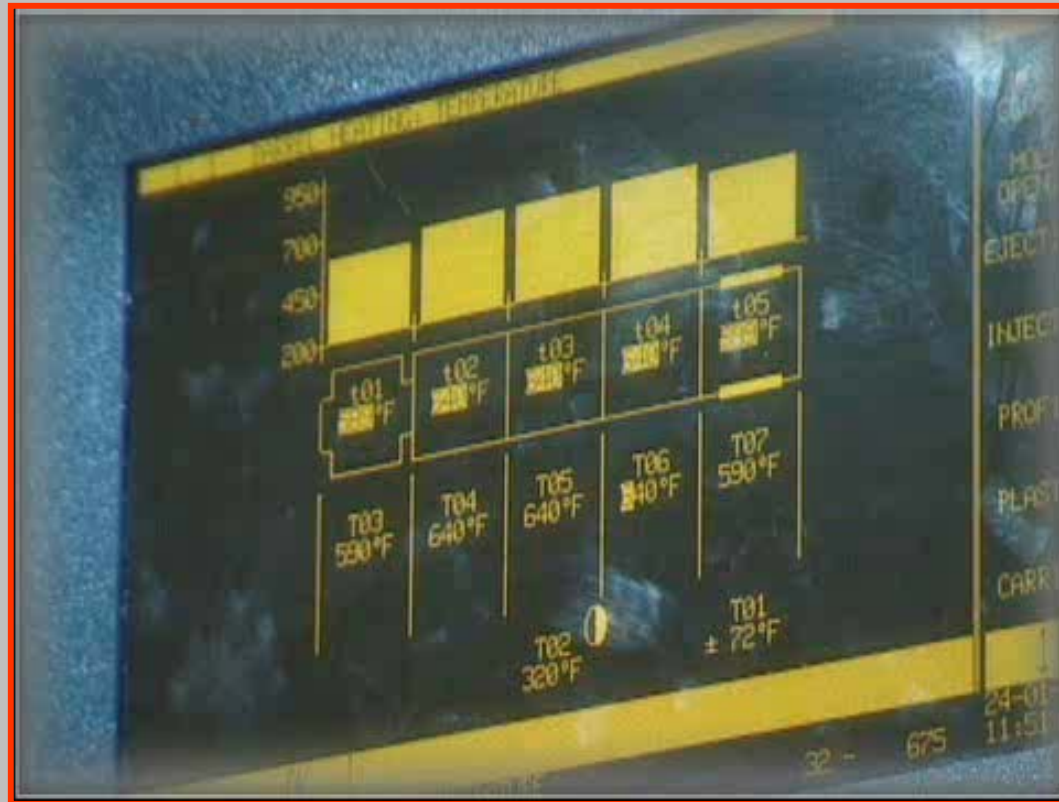
- Within Optimum Recovery Time Range
- Document Temperature Range
  - Specific Machine
  - Material Grade



# Heater Band Monitoring

Used To Regulate Temperature

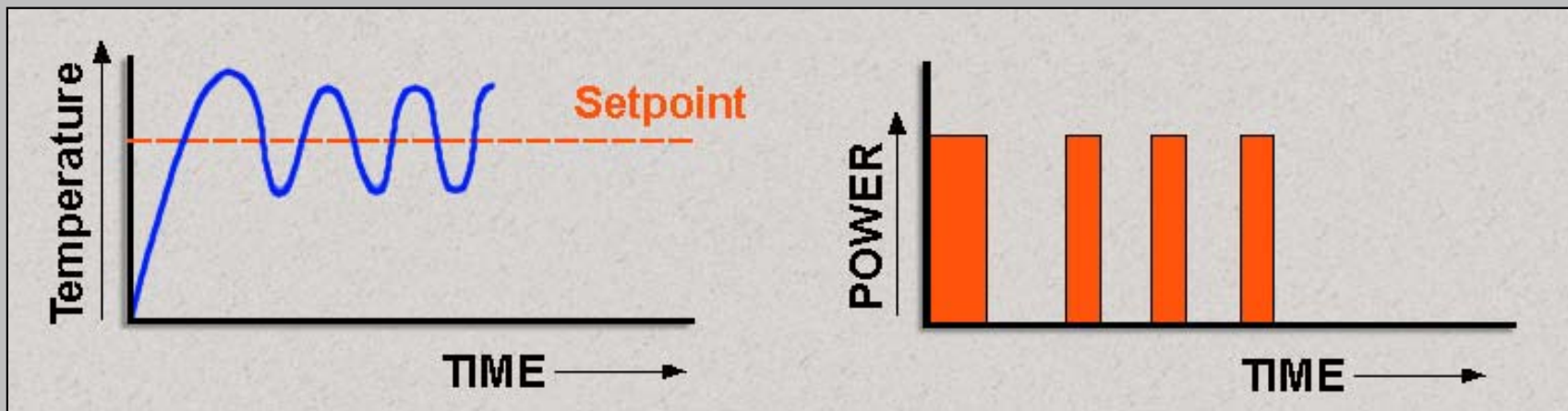
- Provides Only 10-30% Of Melt Energy



# Heater Band Monitoring

## On-Off Temperature Controllers:

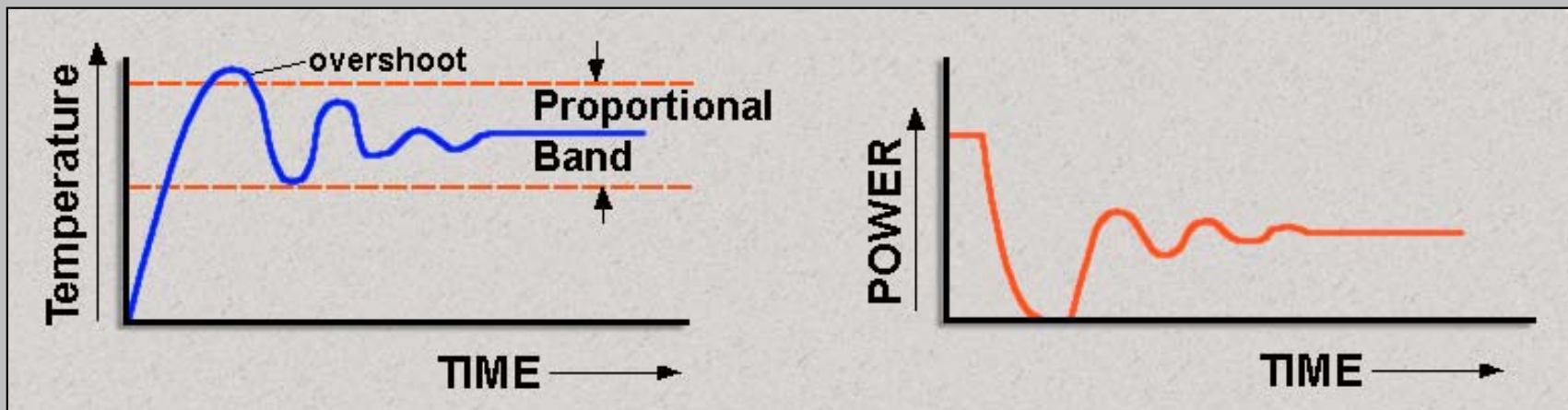
- Determine Typical % Of On-Time
- Look For Significant Variances



# Heater Band Monitoring

## Proportional Heater Bands:

- Determine The Typical Power Consumption
- Look For Significant Variances



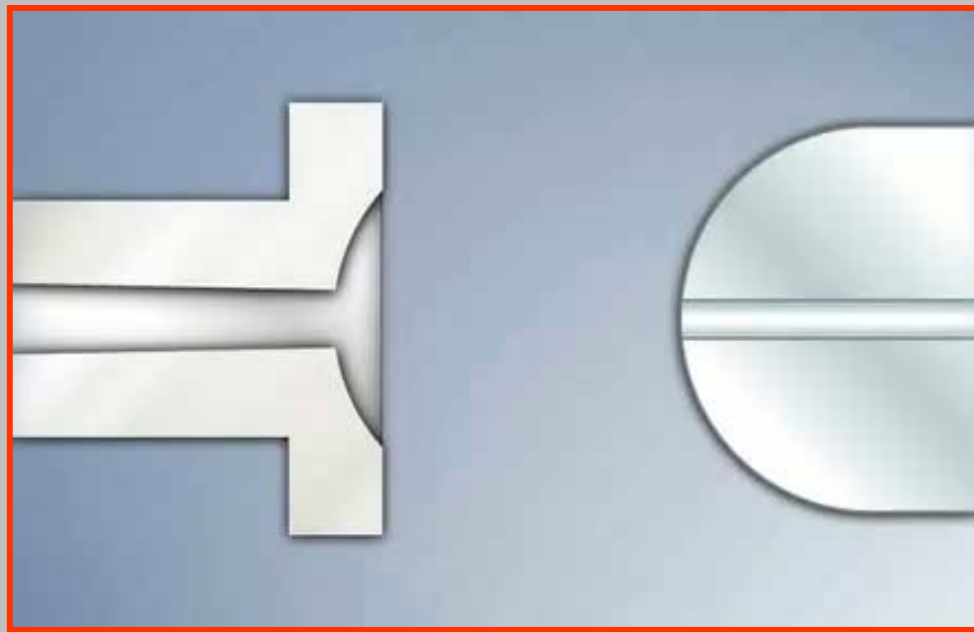
# Heater Band Monitoring

Since Machines Function Differently...  
You Must Get To Know The Regular  
Function Of Your Heater Band  
Controllers

# Nozzle Sizing

Inappropriate Nozzle Diameter Causes:

- Filling Complications
- Ejection Complications



# Nozzle Sizing

Nozzle Should Have Slightly Smaller  
Diameter Than Sprue Bushing

# Nozzle Sizing

Larger Nozzle Diameters  
Make Sprue Removal More Difficult

# Nozzle Sizing

Excessively Small Nozzle Diameters  
Increase Injection Pressure Losses

# Material Preparation

Involves Material...

- Storage
- Transport
- Mixing
- Drying



# Material Preparation

## Storage:

- Climate Controlled
- Container Properly Labeled
- Keep Covered & Sealed
- Low Humidity



# Material Preparation

## Transport:

- Keep Material Covered & Sealed
- Move Label With Container
- Open Container Only When Needed



# Material Preparation

## Mixing:

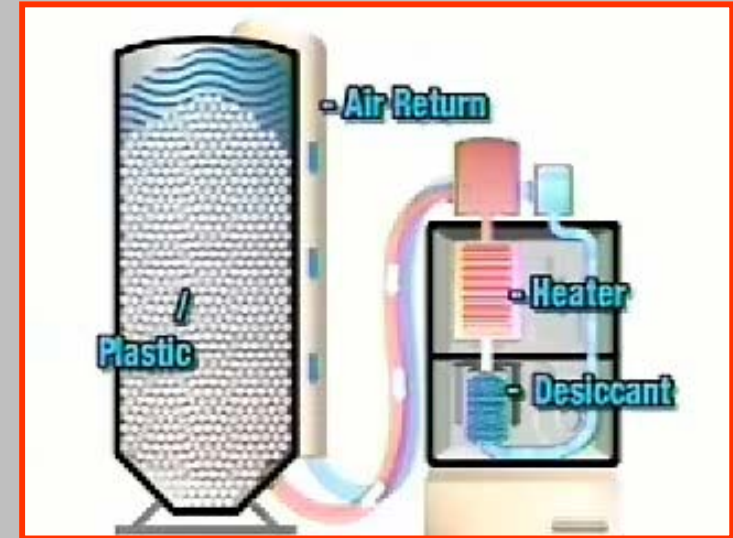
- Avoid Batch Methods
- Gravimetric Blending Preferential
- Closest To Hopper Is Best



# Material Preparation

## Drying:

- In-Line Is Preferred
- Desiccant Drier Is Best
- Consider Hopper Dryer
  - When Dryness Is Critical
  - When Interruptions Are Common



# Housekeeping

## Poor Housekeeping:

- Introduces Contamination
- Increases Complications
- Reduces Morale
- Causes Complacency



# Housekeeping

## Contamination Sources:

- Dirt
- Dust
- Material
- Transfer



# Housekeeping

## Good Housekeeping:

- Decreases Time To Find Things
- Everything Stays Cleaner
- Fewer Safety Risks
- Less Frustrating



# Housekeeping

## Reduced Morale:

- Careless About Material Handling
- Careless About Personal Appearance
- Careless About Quality
- Careless About Safety



# Special Offer – 20% discount

## Scientific Troubleshooter Package

- DECOUPLED MOLDING<sup>SM</sup> Series
- Intelligent Molder Series
  - Machine Evaluation
  - Mold Evaluation
  - Process Evaluation



# 10 Procedures To Fine-Tune Any Process

Q & A Session

Please Ask Via Chat Feature

