AUTODESK UNIVERSITY

Optimize Plastic Part Designs: Injection Molding Simulation in Autodesk Fusion 360

CP500672

Mason Myers & Tim VanAst
Autodesk: Principal Implementation Consultants

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Optimize Plastic Part Designs: Injection Molding Simulation in Autodesk Fusion 360

- Class ID: CP500672
- Product(s): Fusion 360
- Topics: Automotive and Industrial Design, Injection Molding, Product Design, Simulation and Analysis, Software Training
- Session Description
- Just because you designed a plastic part, doesn’t mean it can be manufactured at scale. Product design has a significant impact on the cost and timing to manufacture your parts. You will learn how to identify and address costly manufacturing issues with Injection Molding Simulation in Fusion 360.

- Learning Objectives
- Simulate the injection molding process to improve manufacturability
- Learn the potential manufacturing issues your plastic part design may have
- Use the guides to help you understand the changes that you should make to reduce cost and time to market
- Validate that your design is ready to be injection molded

Tim VanAst

AUTODESK Moldflow Insight

CERTIFIED EXPERT

Mason Myers

Beaumont

LORD

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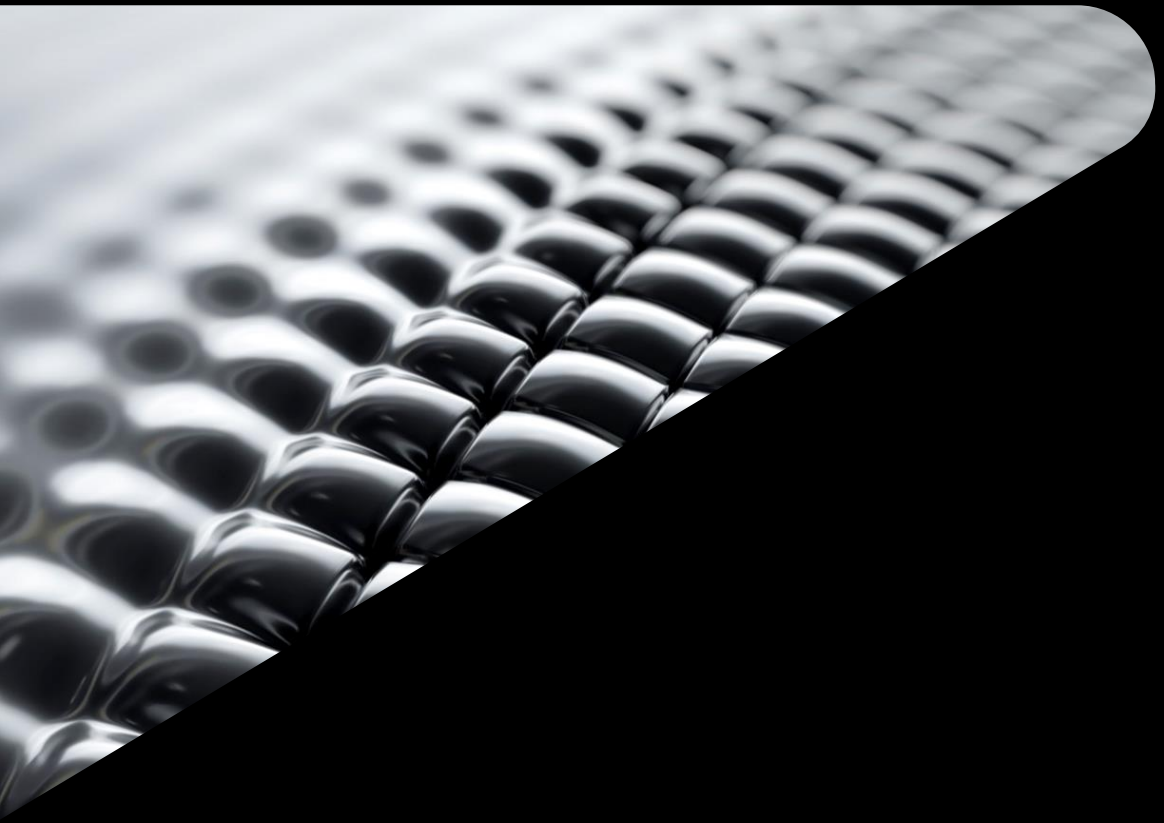
Moldflow Insight
CERTIFIED EXPERT



Fusion 360


Increase size of wheel. Please design a new fender for the larger wheel
Fusion 360

Analyze product performance

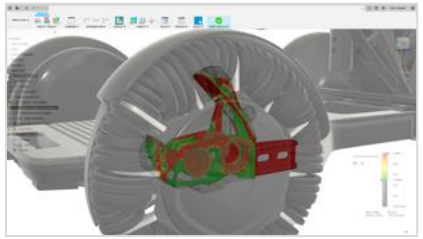
Simulation

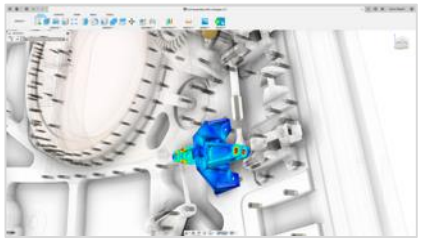
Benefits

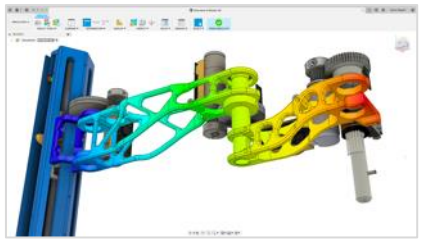
- Reduce cost of physical prototyping
- Early detection of design flaws
- Avoid product performance issues
- Compare benefits of design changes
- Simulate real world condition

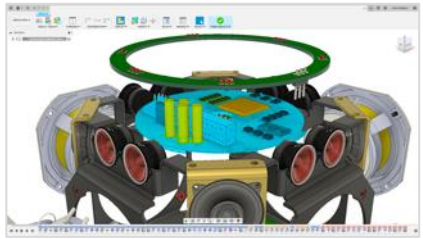
Capabilities

- Static & non-linear stresses
- Modal frequency
- Thermal & thermal stress
- Buckling & Event
- **Plastic Injection Molding**



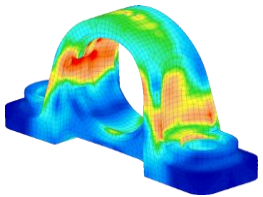
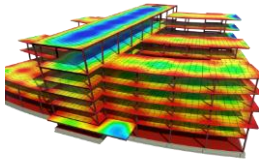
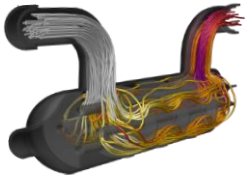
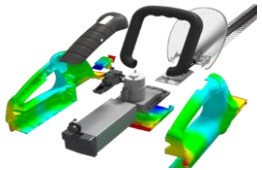
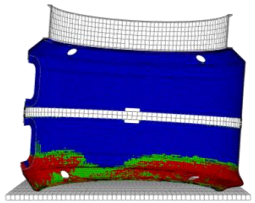
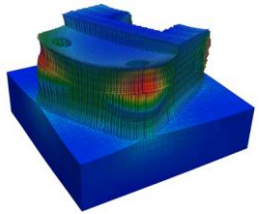


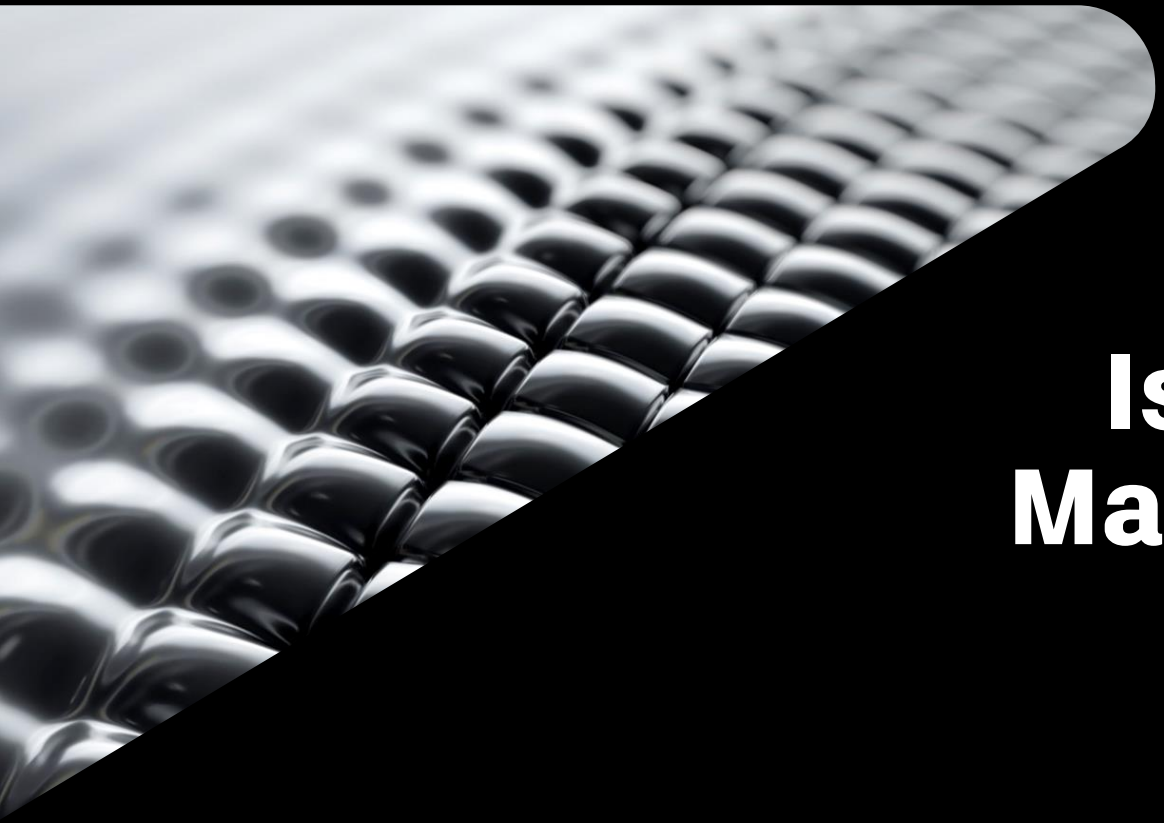




Fusion 360

Autodesk Simulation Portfolio

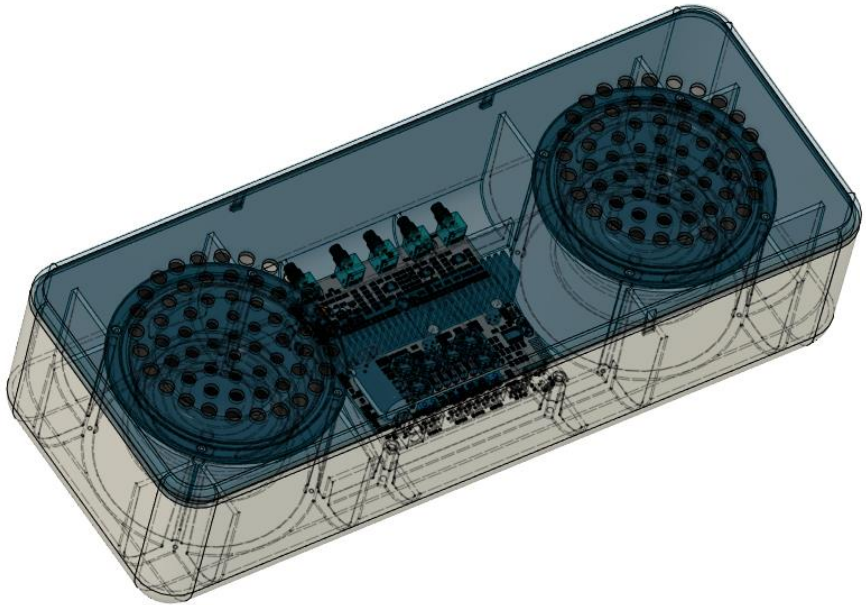
Structural Mechanics	Structural Architecture	Flow & Thermal Analysis	Molding Processes	Composite Materials	Additive MFG Optimization
					
Inventor NASTRAN, Fusion 360	Robot Structural Analysis PRO	CFD	Moldflow ADVISER, Moldflow INSIGHT	Inventor NASTRAN, Moldflow INSIGHT	Netfabb



Is Your Design Manufacturable

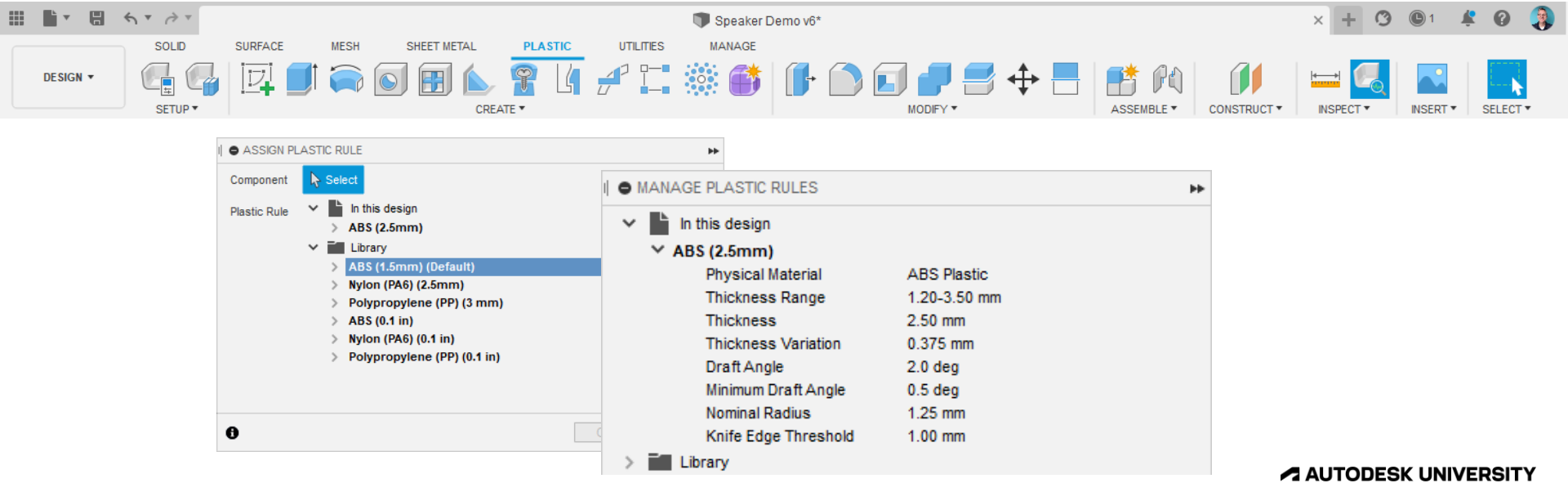
Congratulations! You've Designed a Part

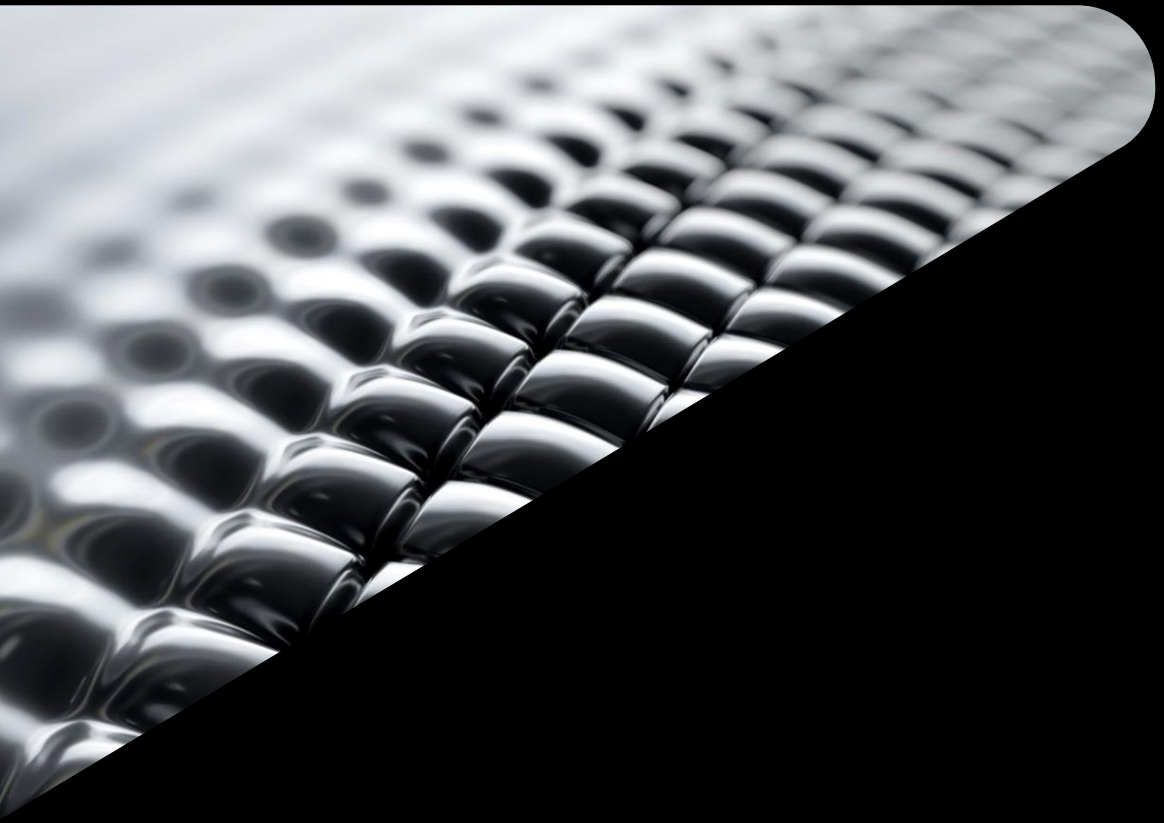
…but is it manufacturable?



Fusion : Product Design Extensions

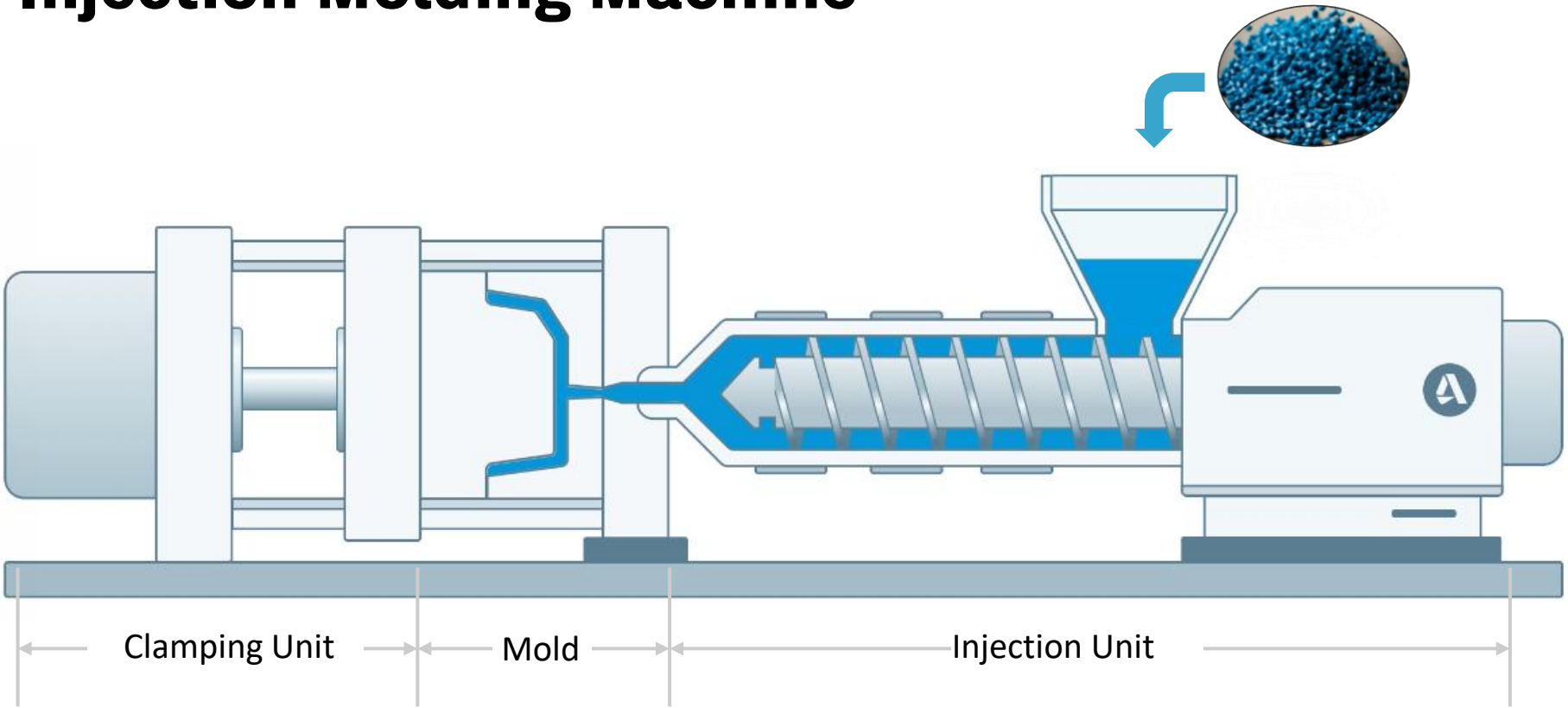
- CP500808 | Creating the Autodesk University Factory Name Badge with the New Product Design Extension
  - Thursday at 1:30 PM – don't miss it



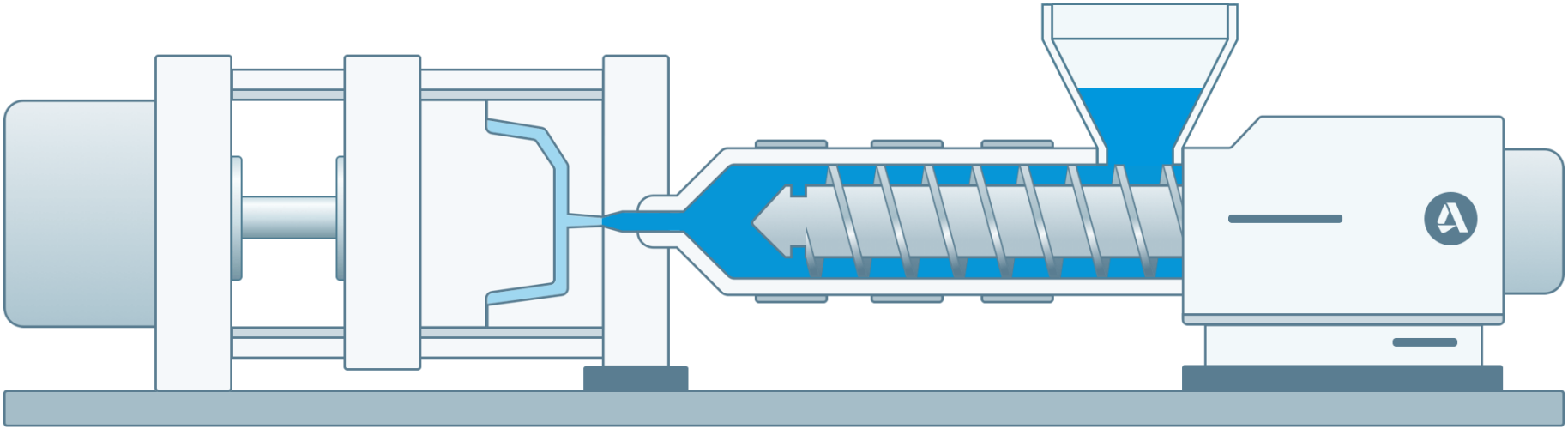


Review of Injection Molding Process

Injection Molding Machine

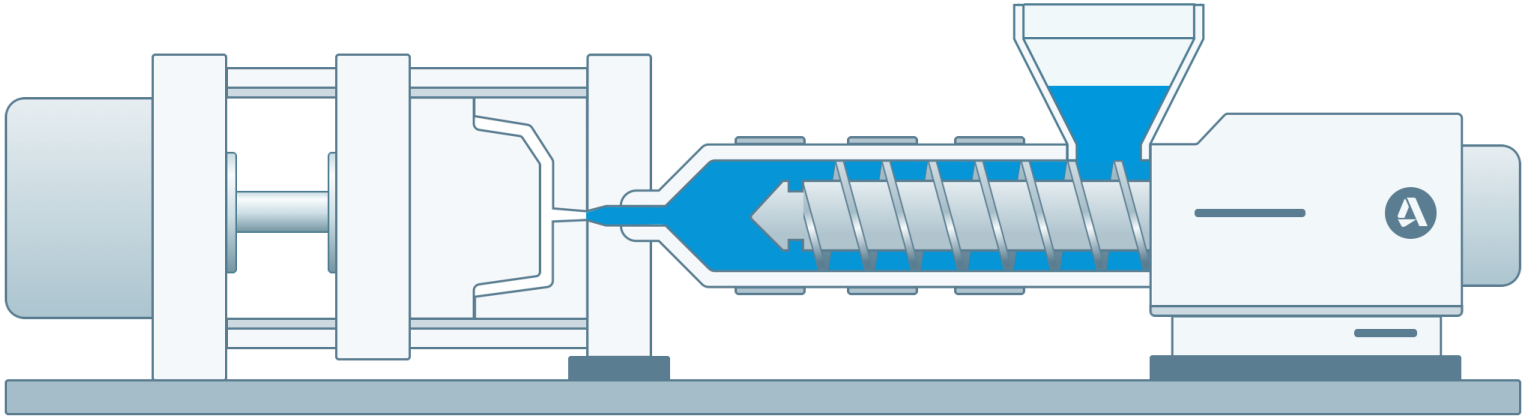


Injection Molding Cycle



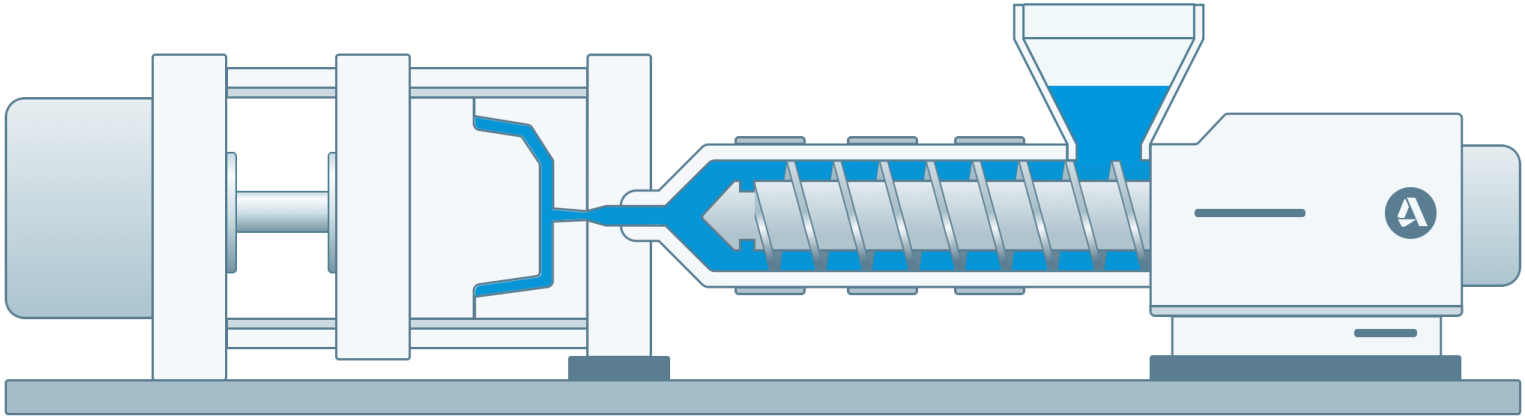
Filling Phase

- Mold Closes
- Screw moves forward
- Frozen polymer skin forms as cavity is filled



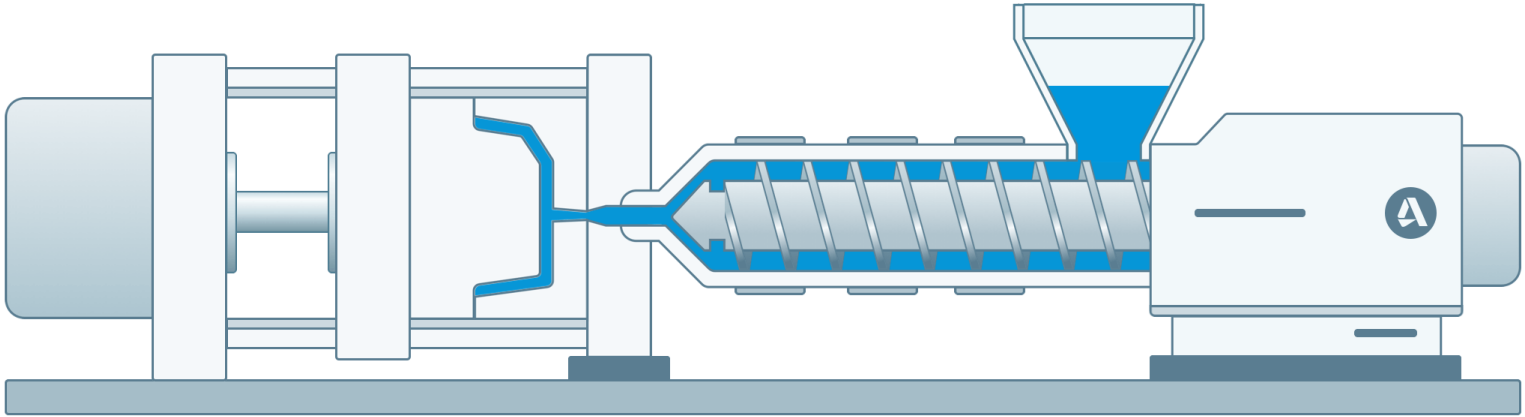
Packing Phase

- Cavity filled
- Additional pressure applied
- Gate freezes



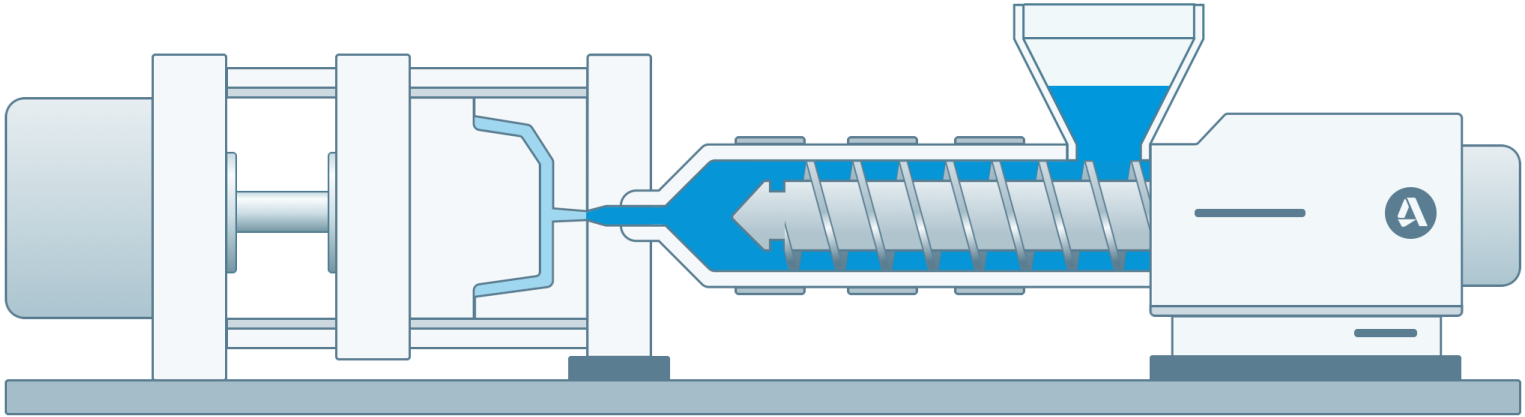
Cooling Phase

- Part cools to ejection temperature
- Screw rotates back

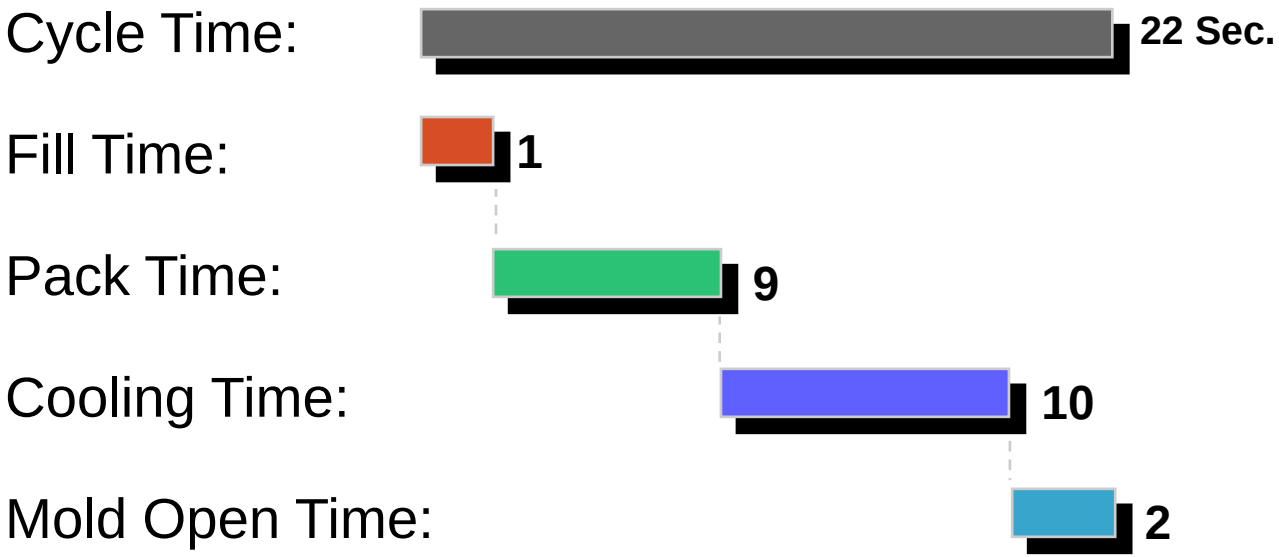


Mold Open Phase

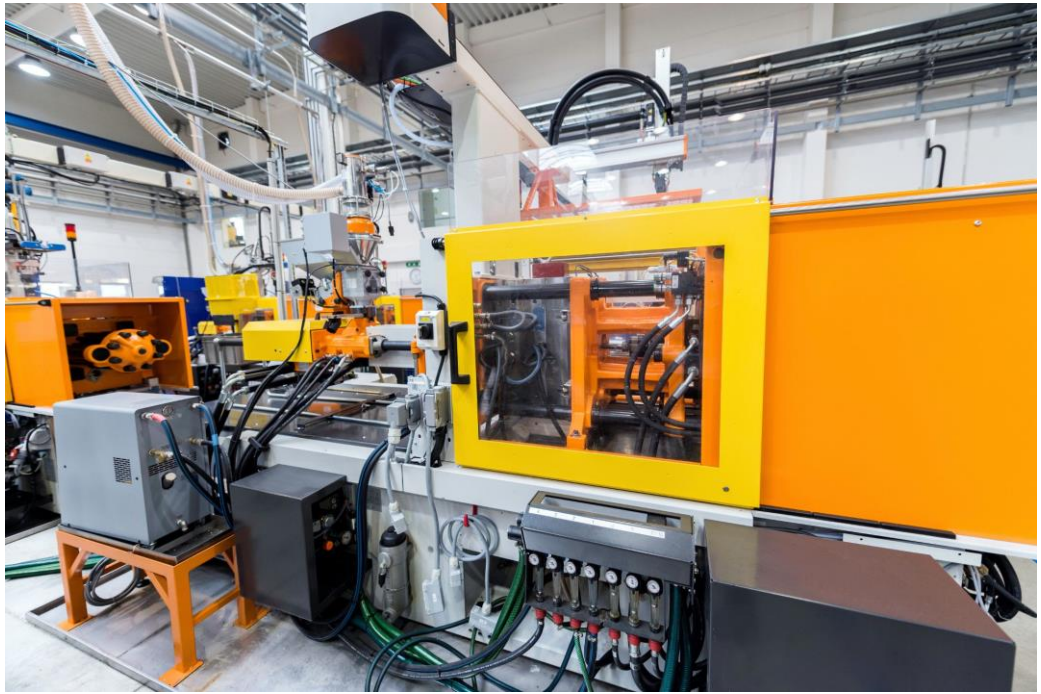
- Mold opens
- Part is ejected from the mold
- Mold closes and process is repeated



Injection Molding Cycle – Linear Timeline



Injection Molding Process Control



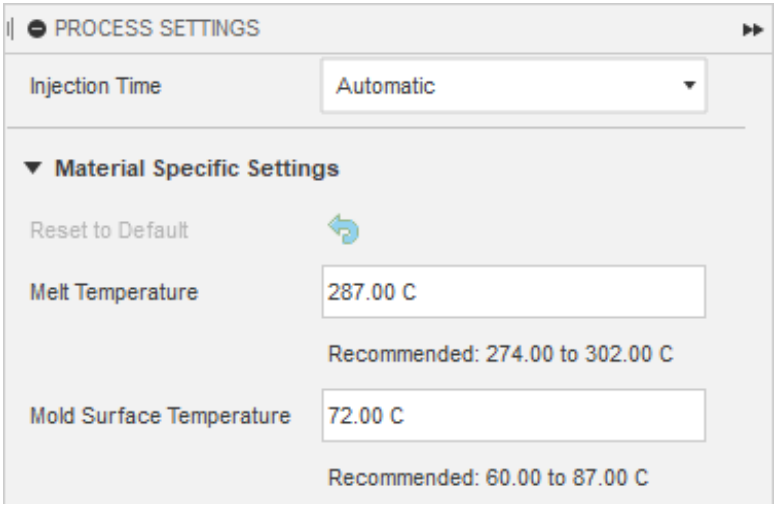
Mold Temperature

Melt Temperature

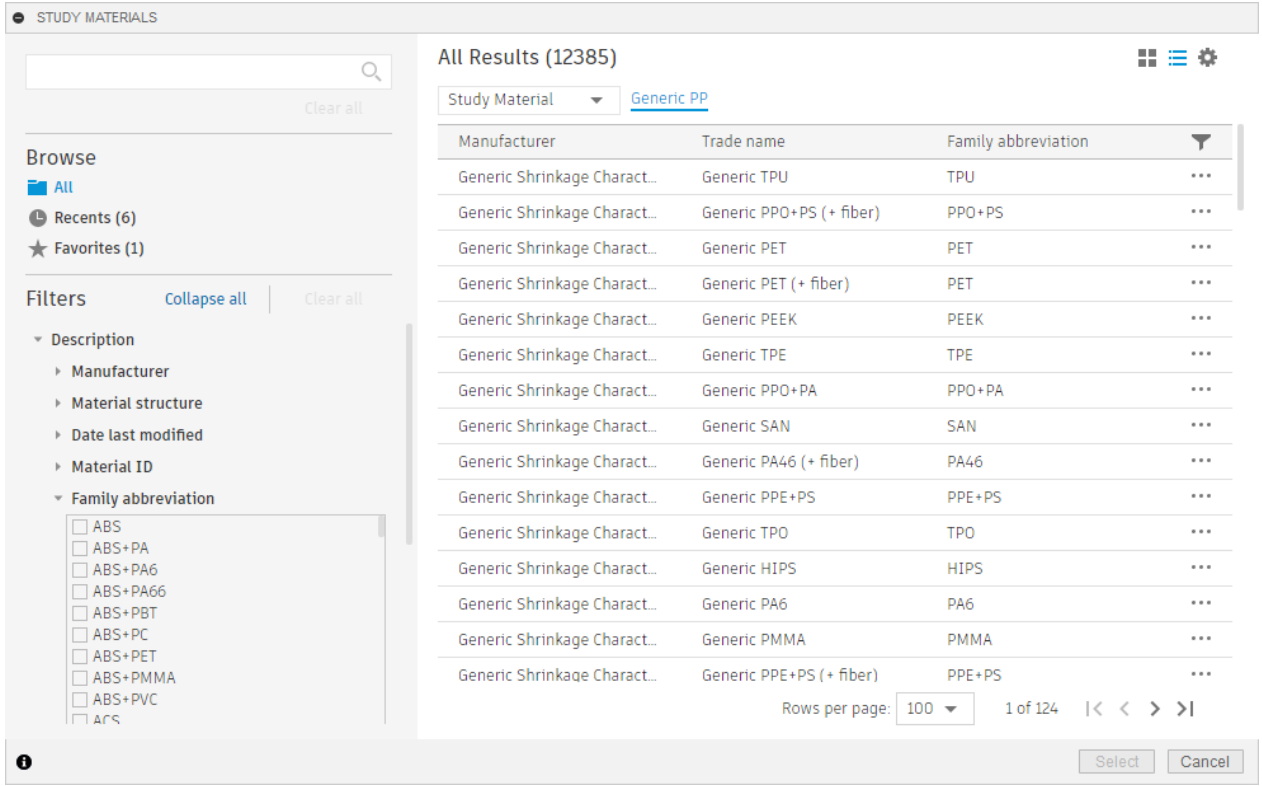
Injection Control

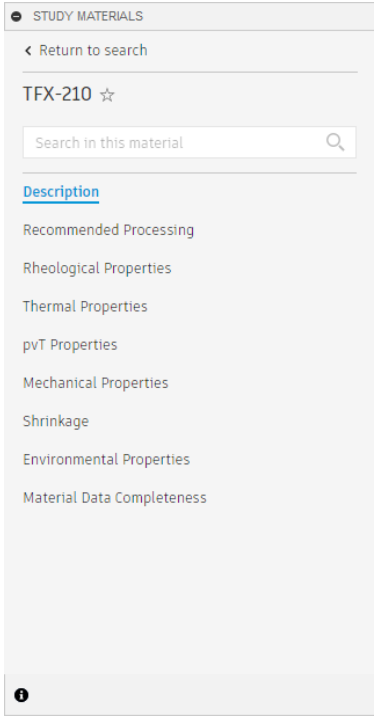
Injection Molding Process Settings

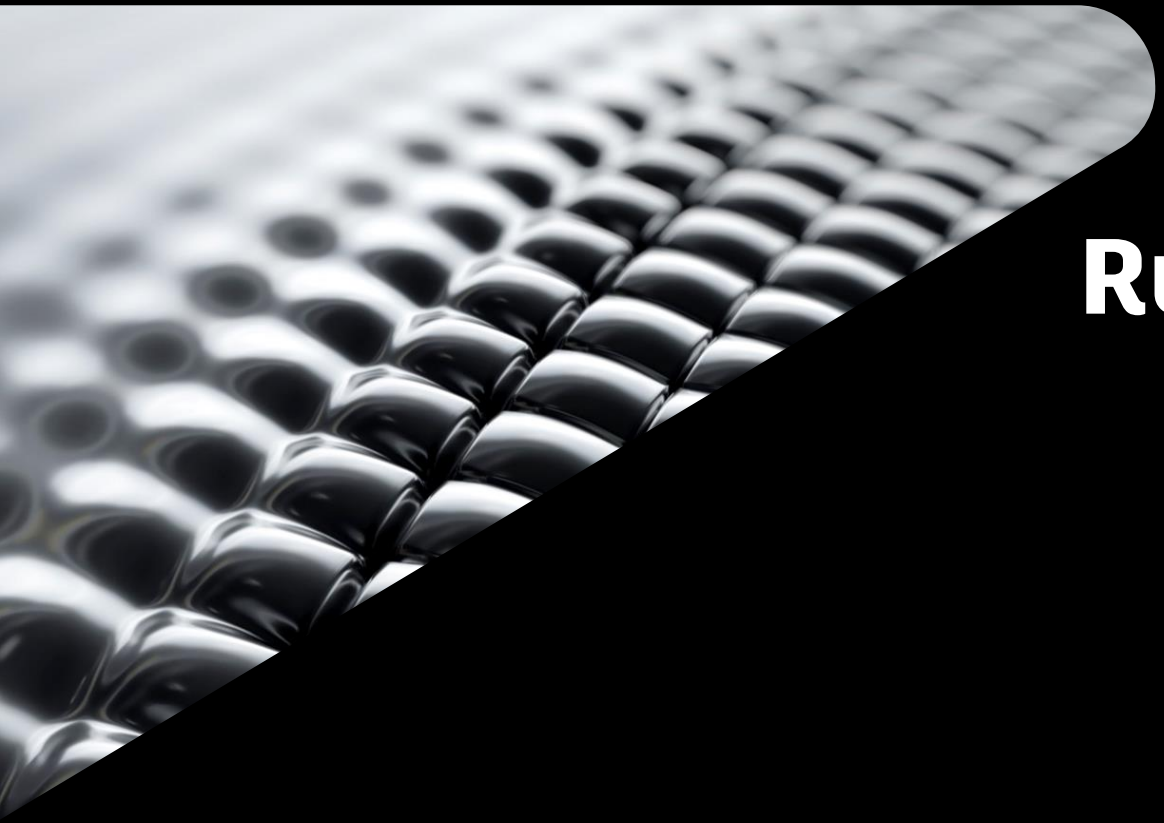
- Injection Time
- Resin Melt Temperature
- Mold Surface Temperature
  - Default values per material selected



Material Choice







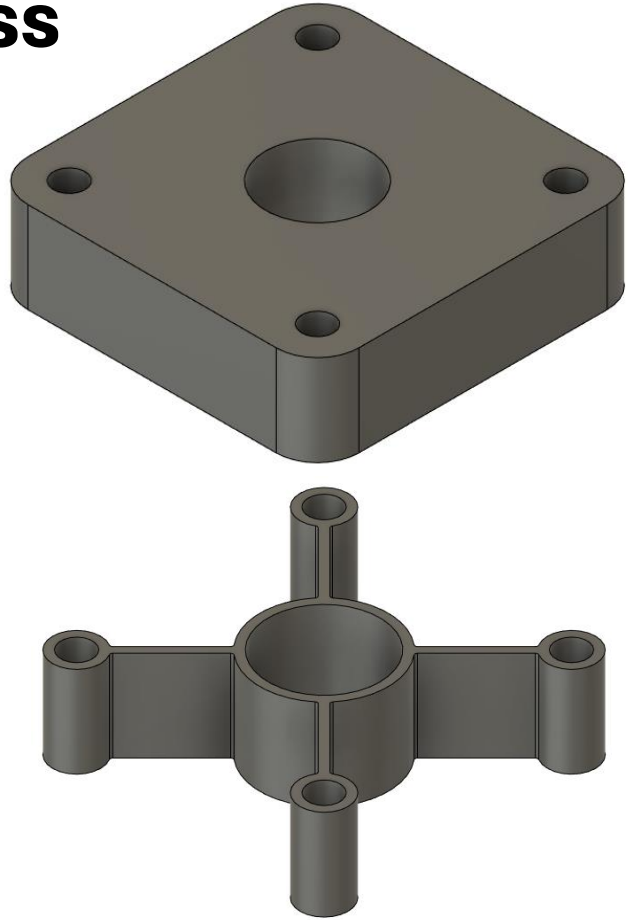
Rules for Good Plastic Part Design

Rules for good plastic design

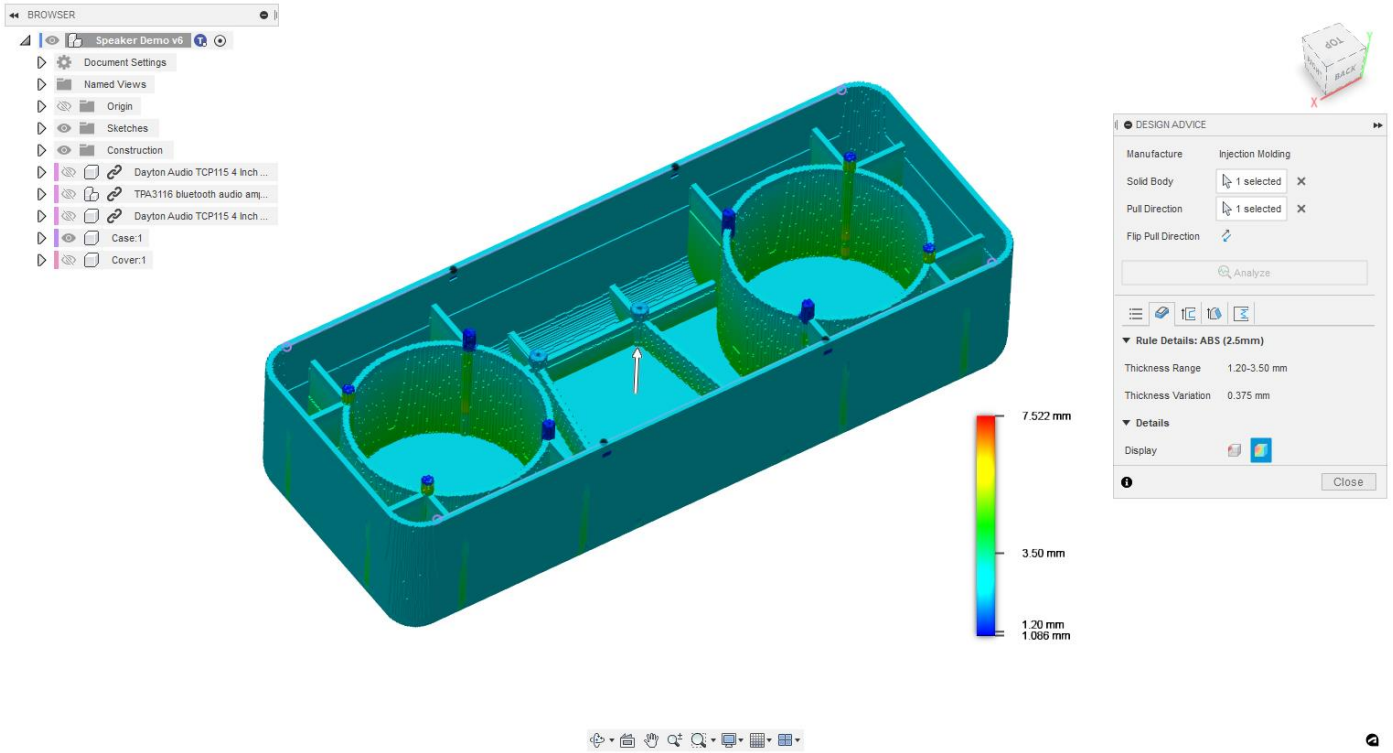
1. **Uniform wall thickness**
2. Uniform wall thickness
3. Radii
4. Draft
5. Undercuts

Rule #1 : Uniform Wall Thickness

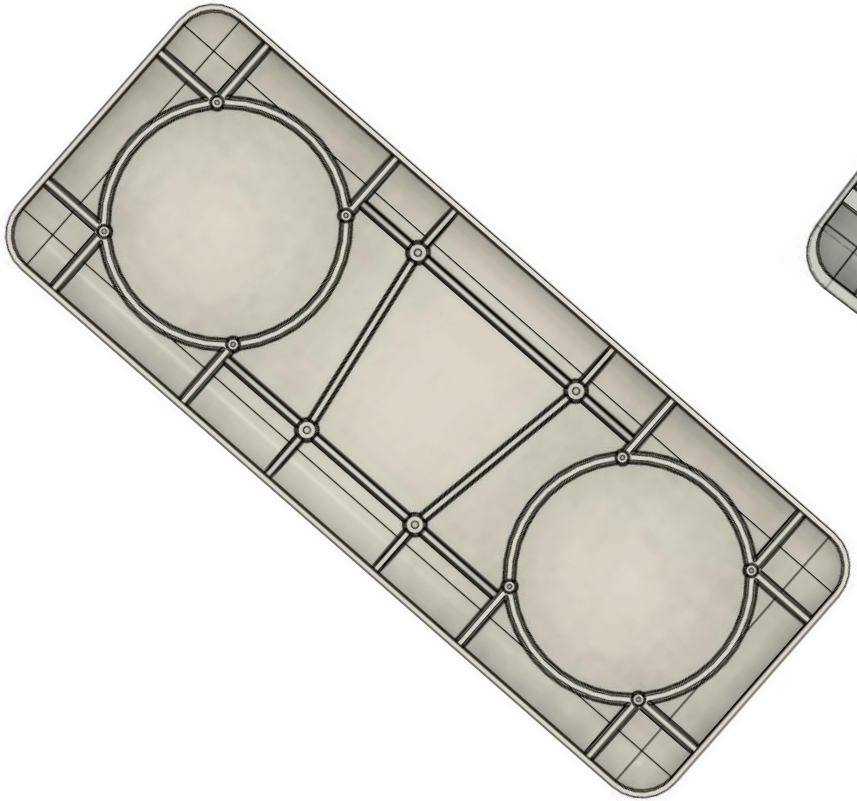
- First rule of plastic part design typically broken
  - Uniform wall thickness
- Uniform wall thickness help produce
  - Even filling patterns
  - Uniform temperatures and pressures
  - Uniform cooling
  - Uniform shrink & warp

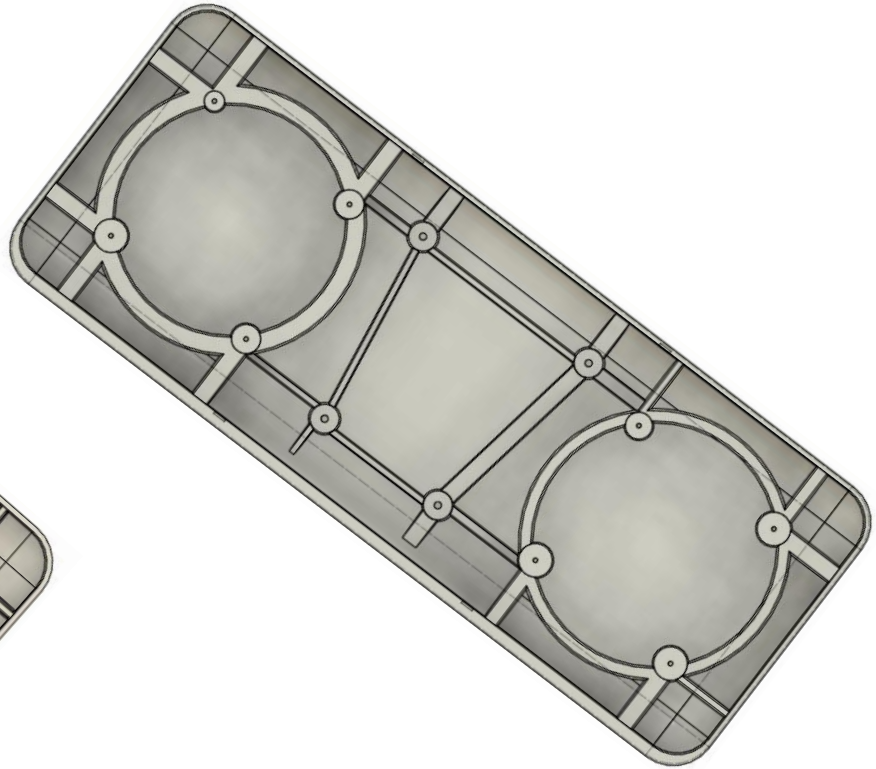


Rule #1 : Uniform Wall Thickness



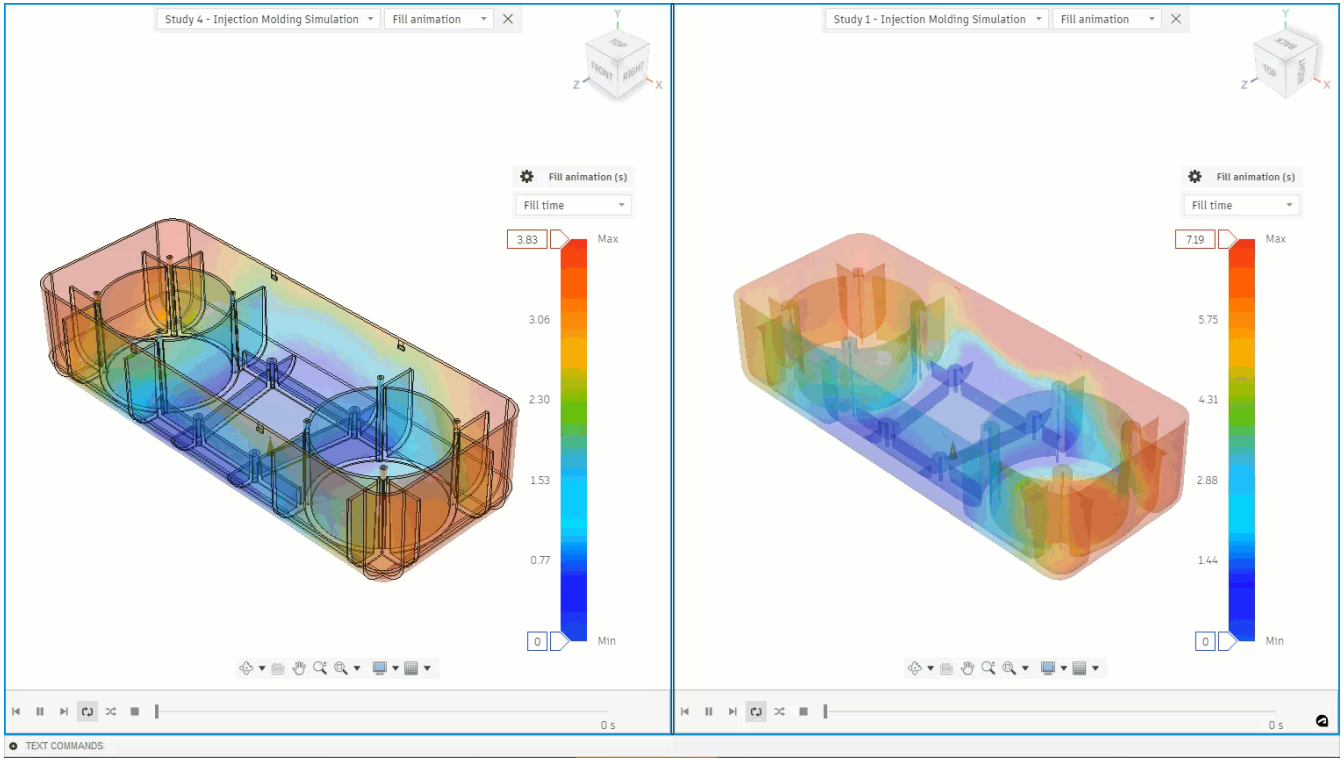
Rule #1 : Uniform Wall Thickness





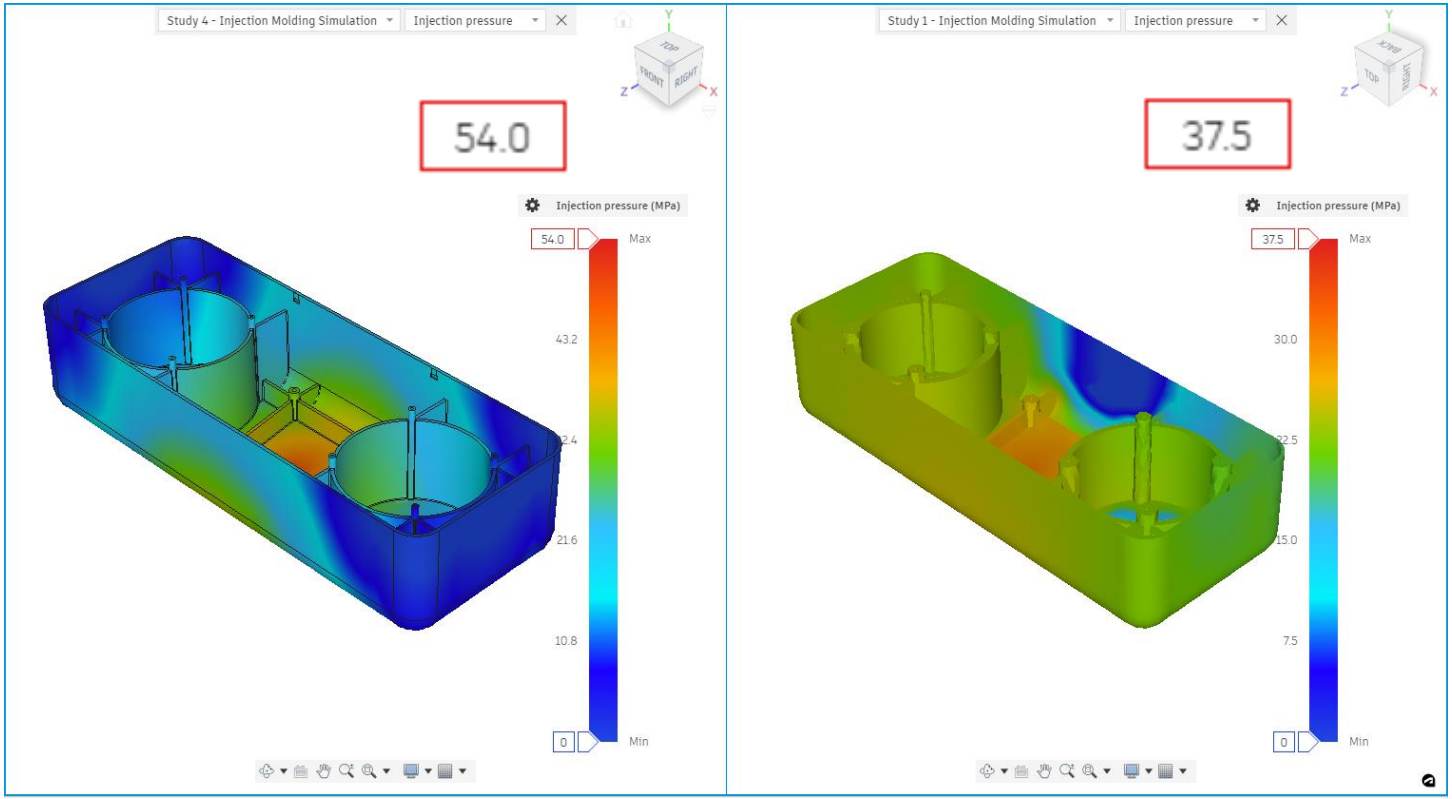
Rule #1 : Uniform Wall Thickness

Fill Time



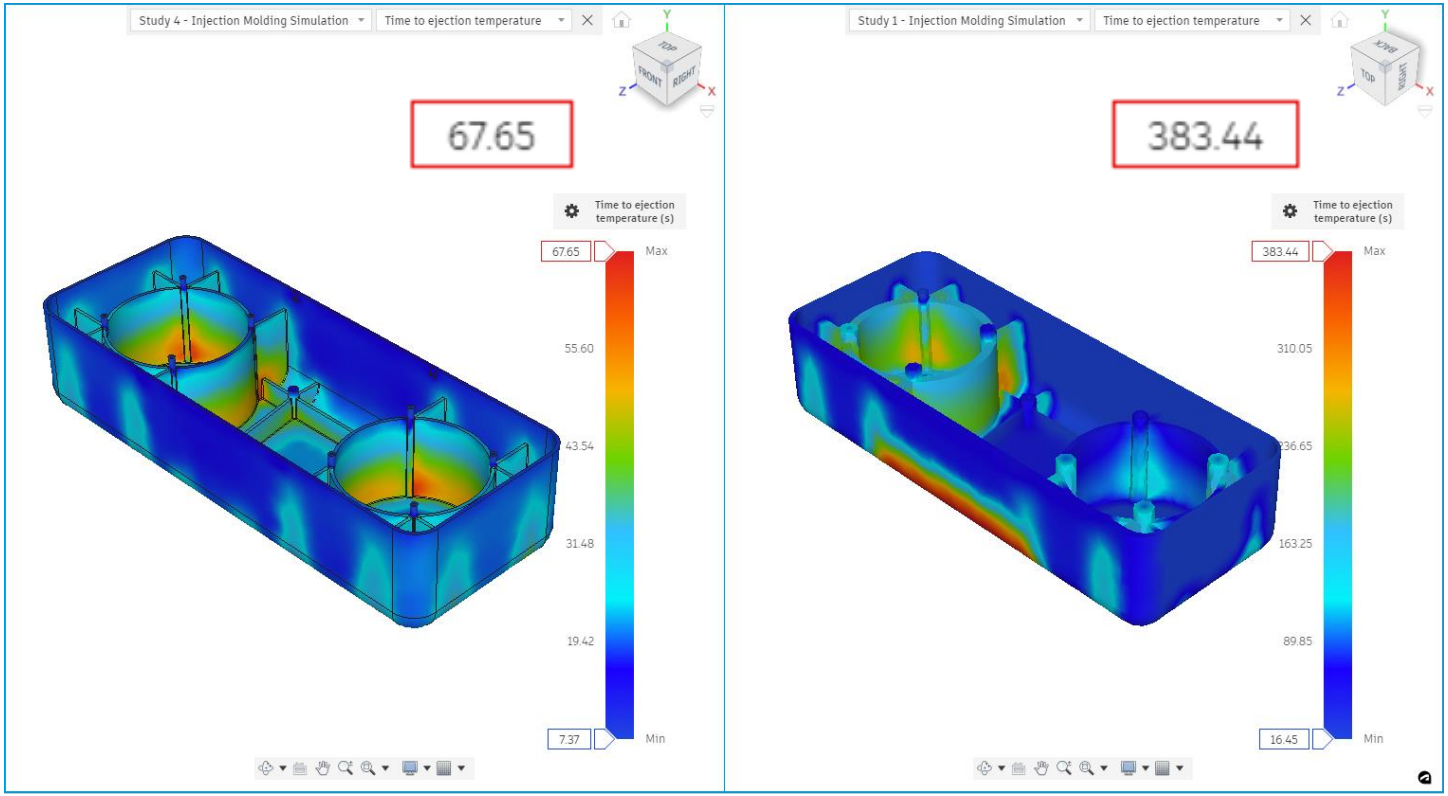
Rule #1 : Uniform Wall Thickness

Injection Pressure



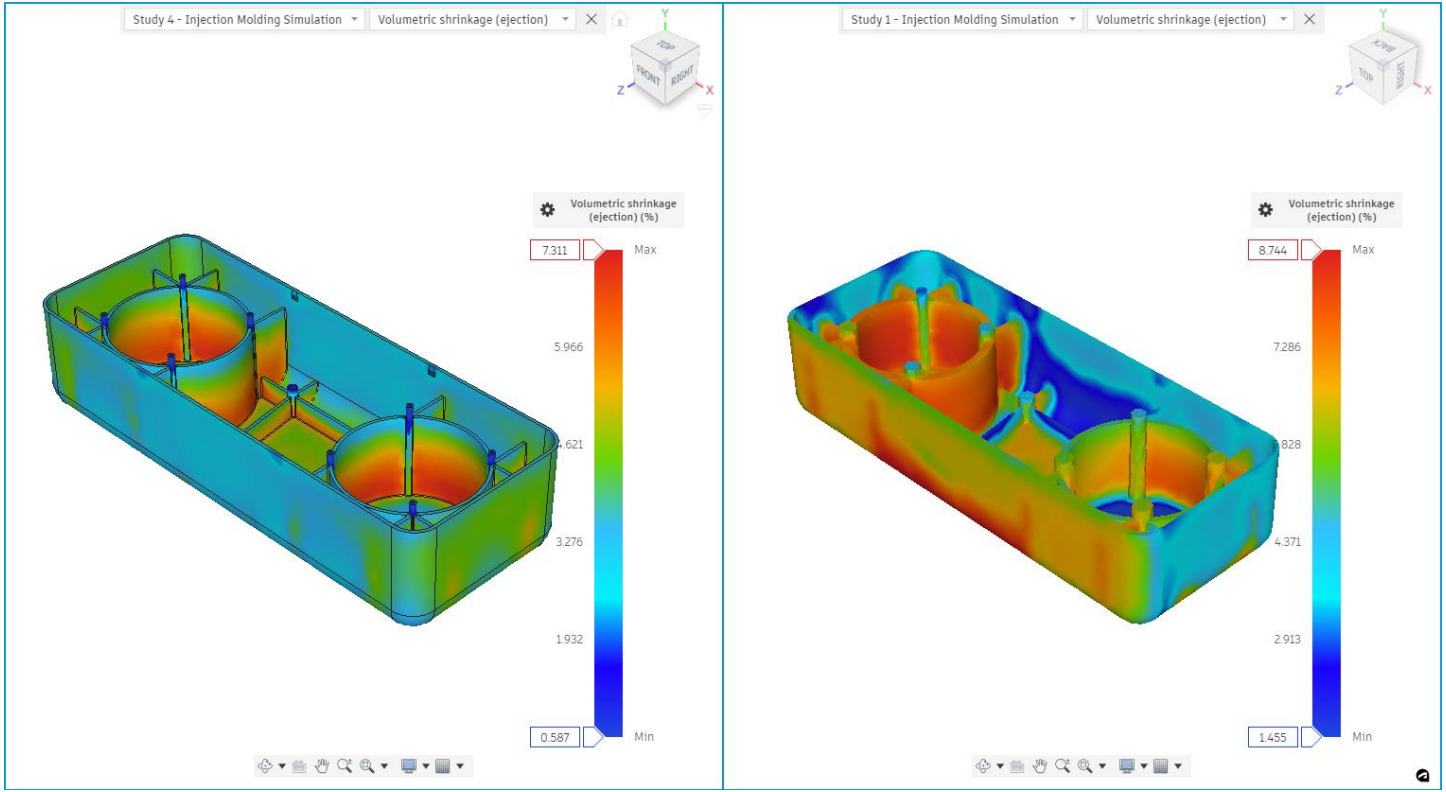
Rule #1 : Uniform Wall Thickness

Time to Reach Ejection Temperature



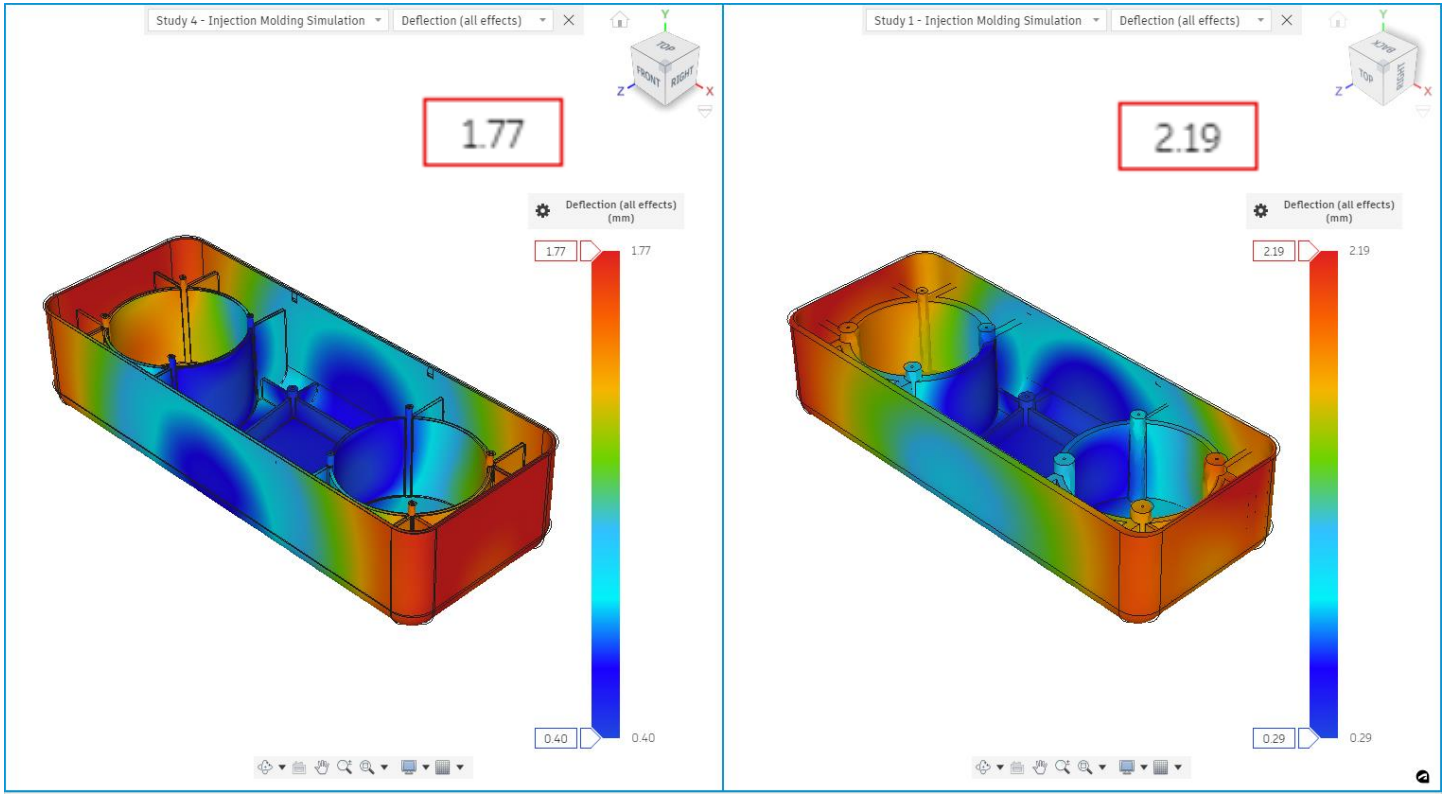
Rule #1 : Uniform Wall Thickness

Volumetric Shrinkage



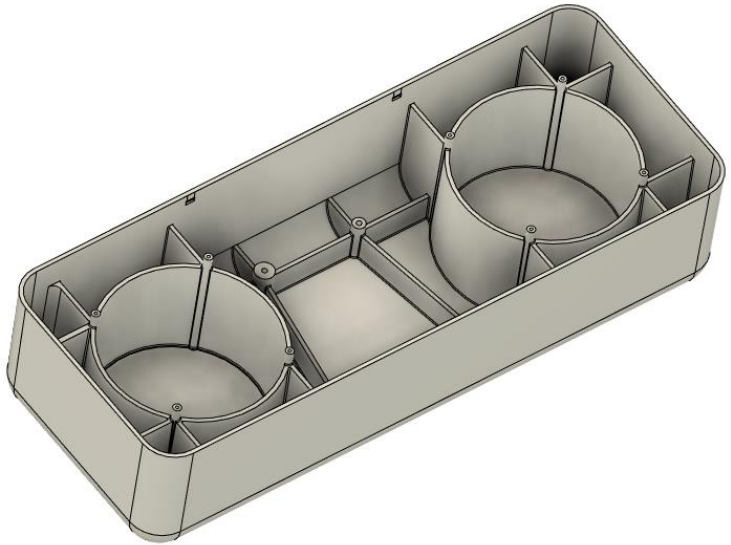
Rule #1 : Uniform Wall Thickness

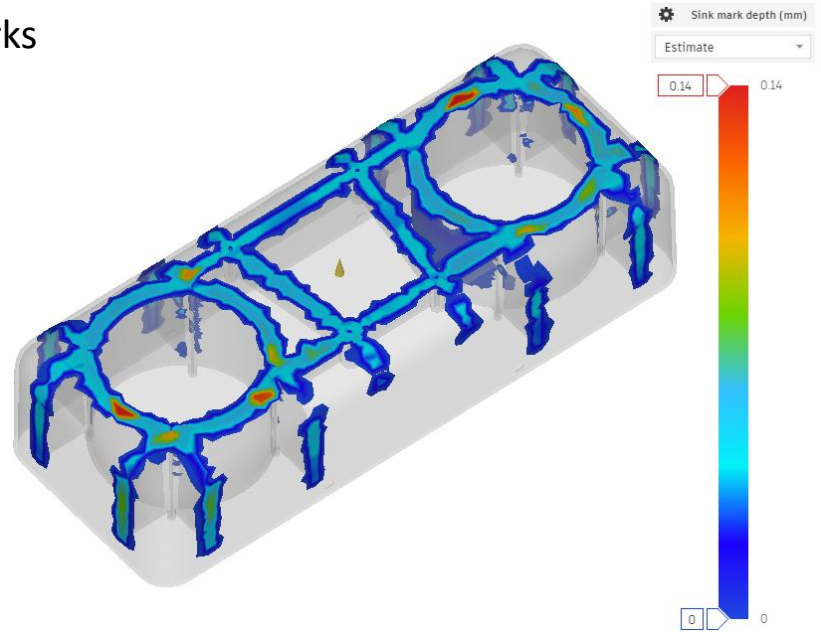
Deflection



Rule #1 : Uniform Wall Thickness - Ribs

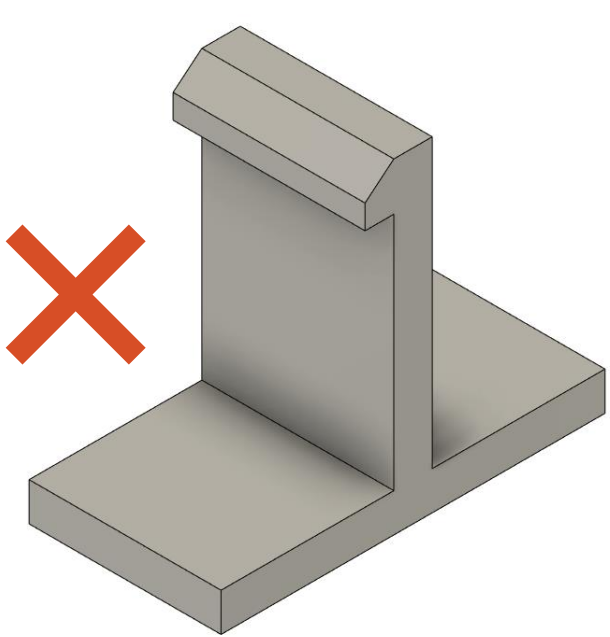
- Normally 50-75% of part wall thickness
- Thicker ribs may create visual defects like sink marks

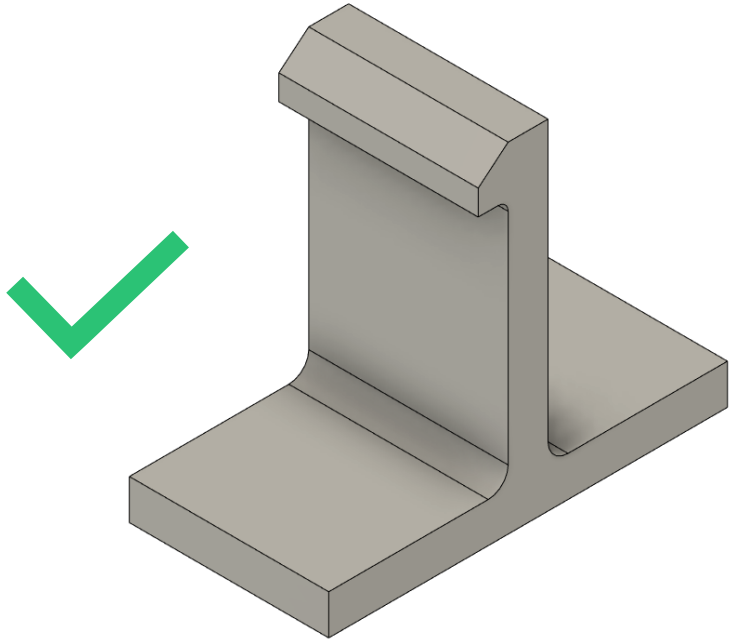




Rule #3 : Radii

- Sharp Corners create stress concentrations





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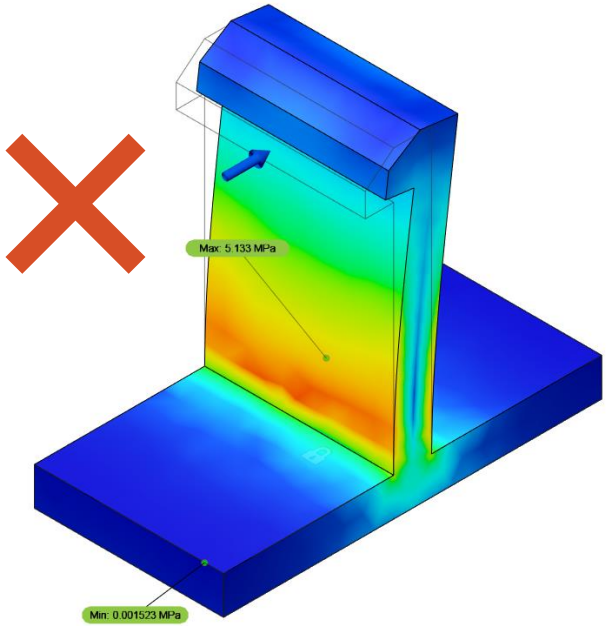
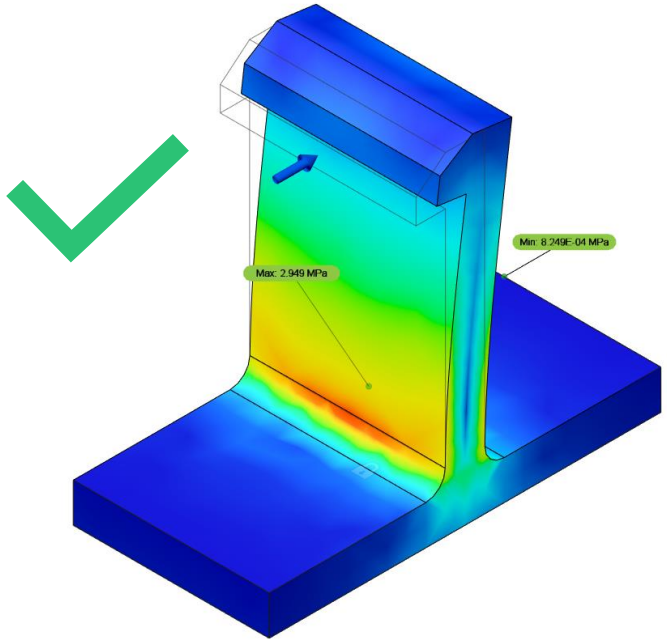
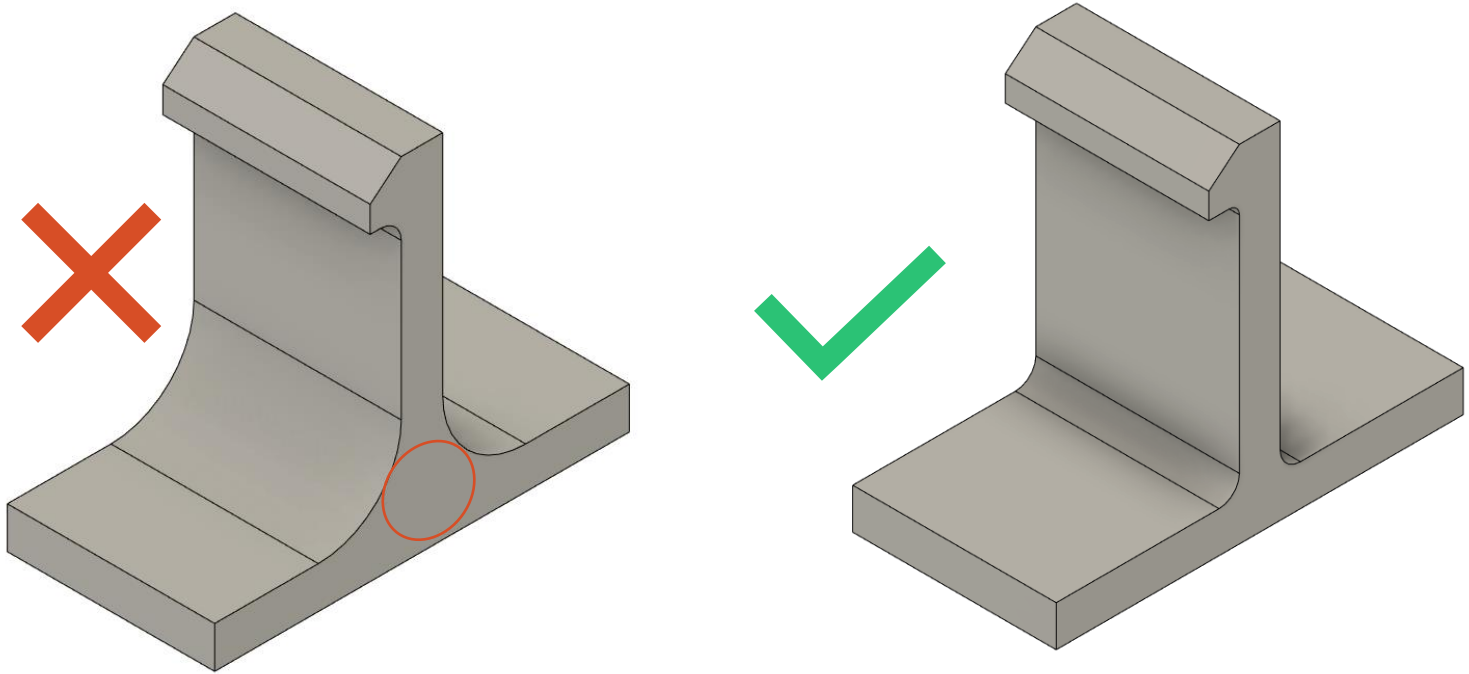




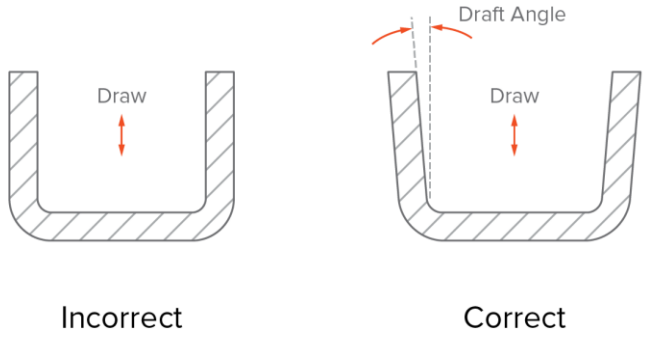
Rule #3 : Radii

- Too much of a good thing can be bad

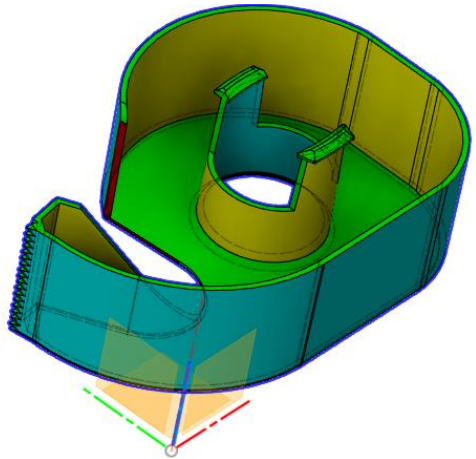


Rule #4 : Draft

- Draft on a design allow it to be pulled from the tool

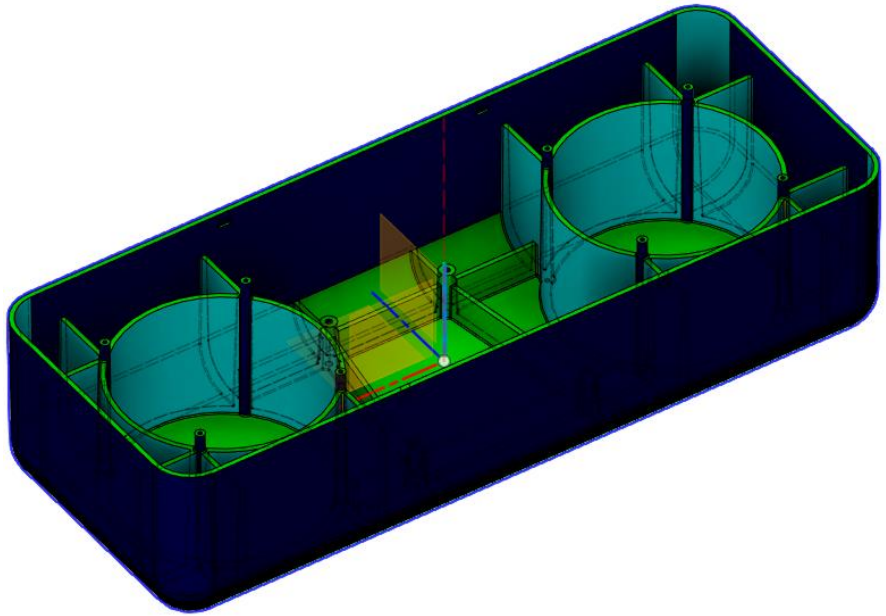


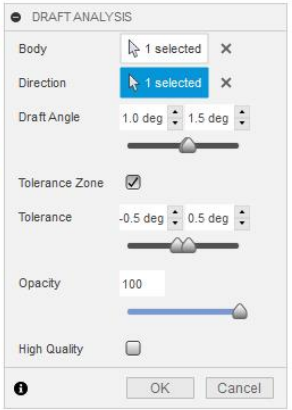
- The amount of draft will depend on the material, surface finish, and length of draw

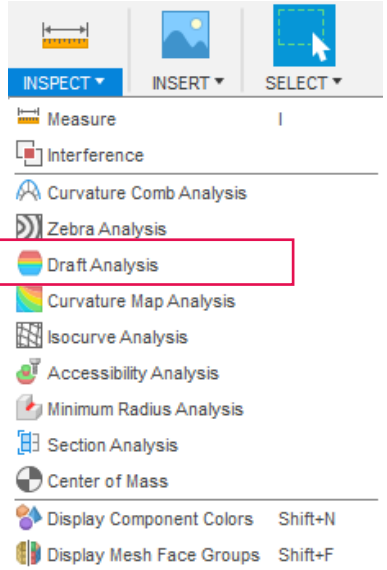


Rule #4 : Draft

- Use Draft Analysis to double check your design

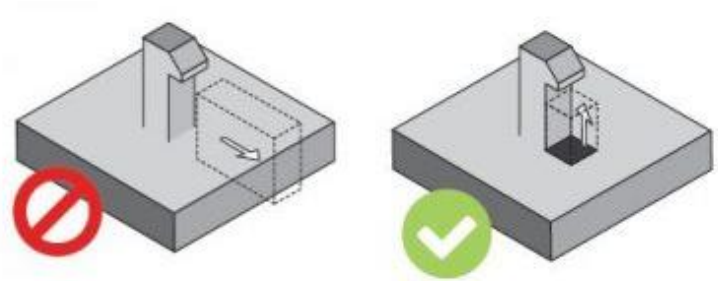


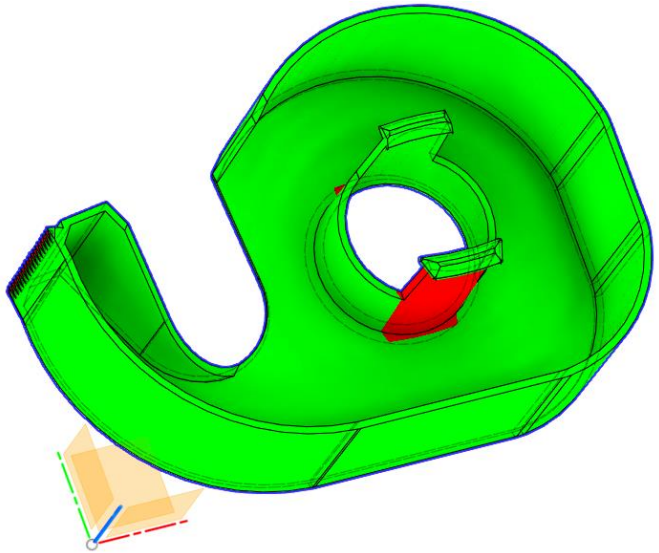




Rule #5 : Undercuts

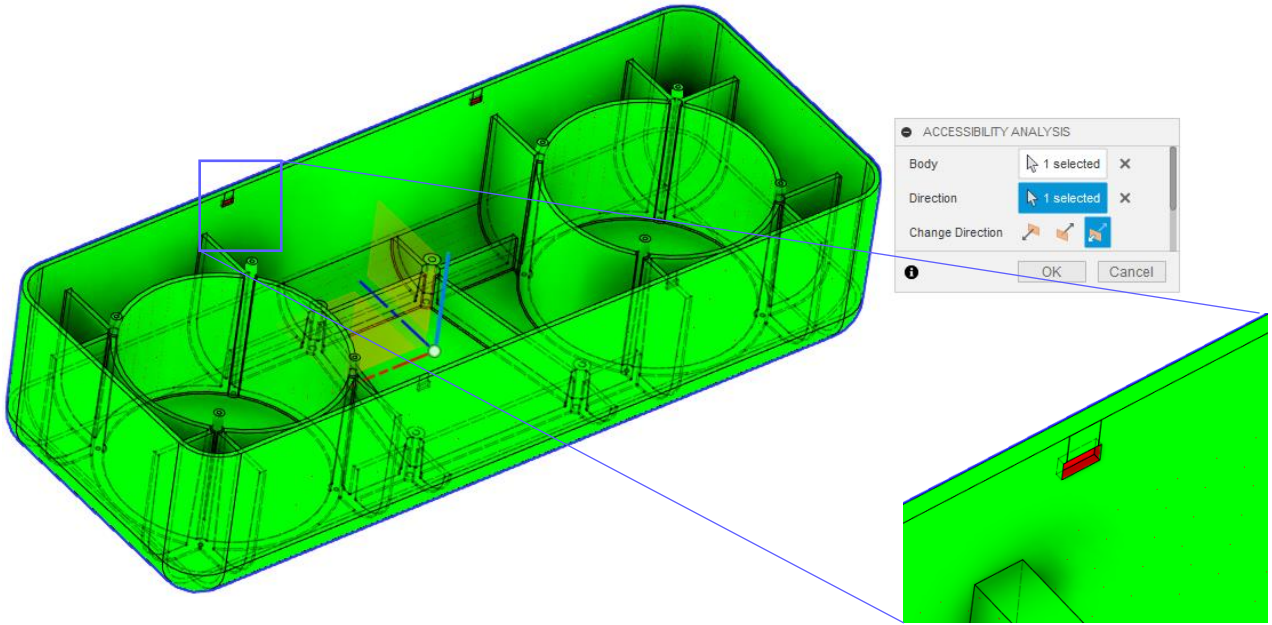
- An Undercut prevents the tool from opening after the part has been made
- “Action” in the tool can relieve these undercuts so that the part can be ejected

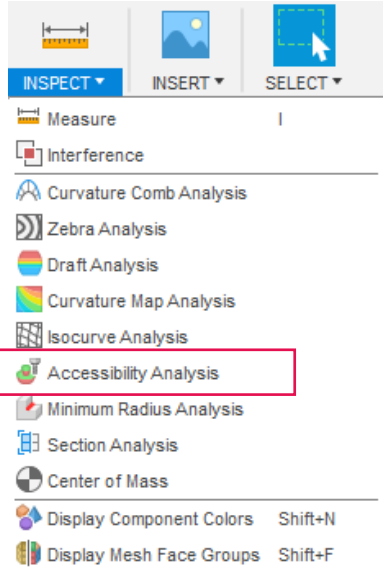


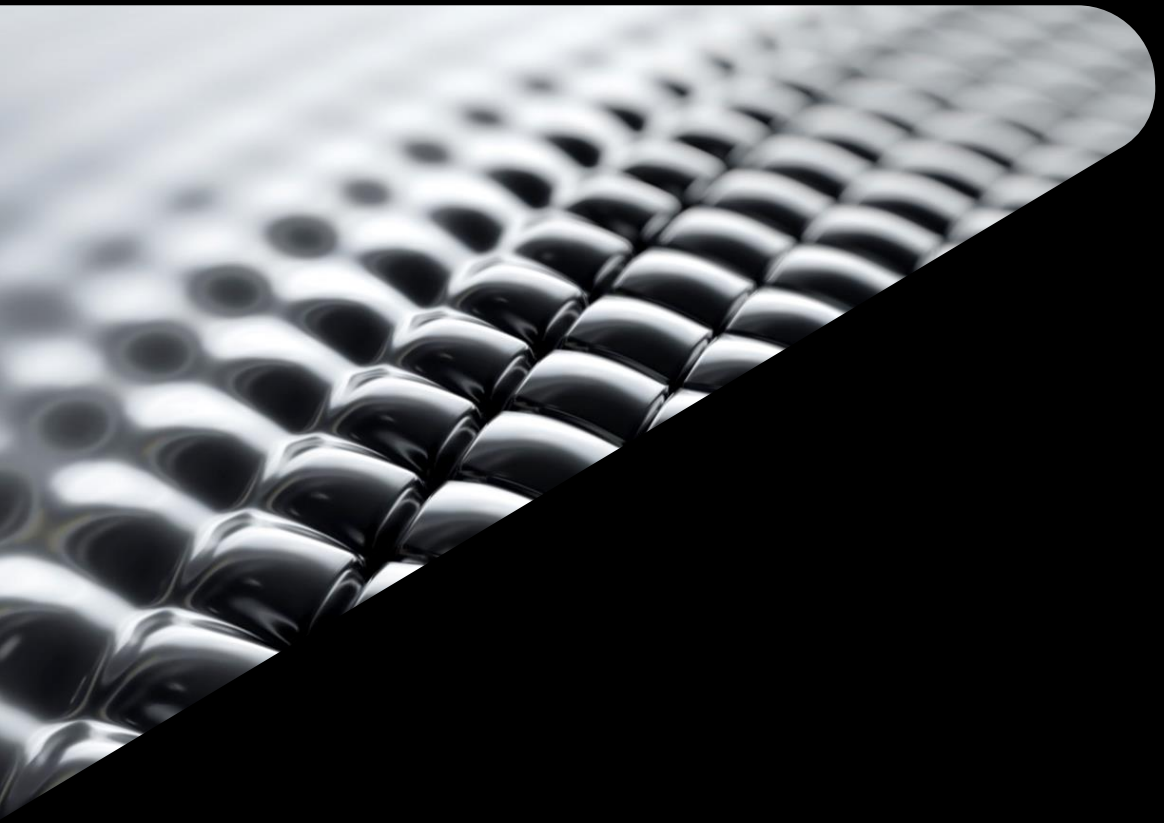


Rule #5 : Undercuts

- Use Accessibility Analysis to double check your design

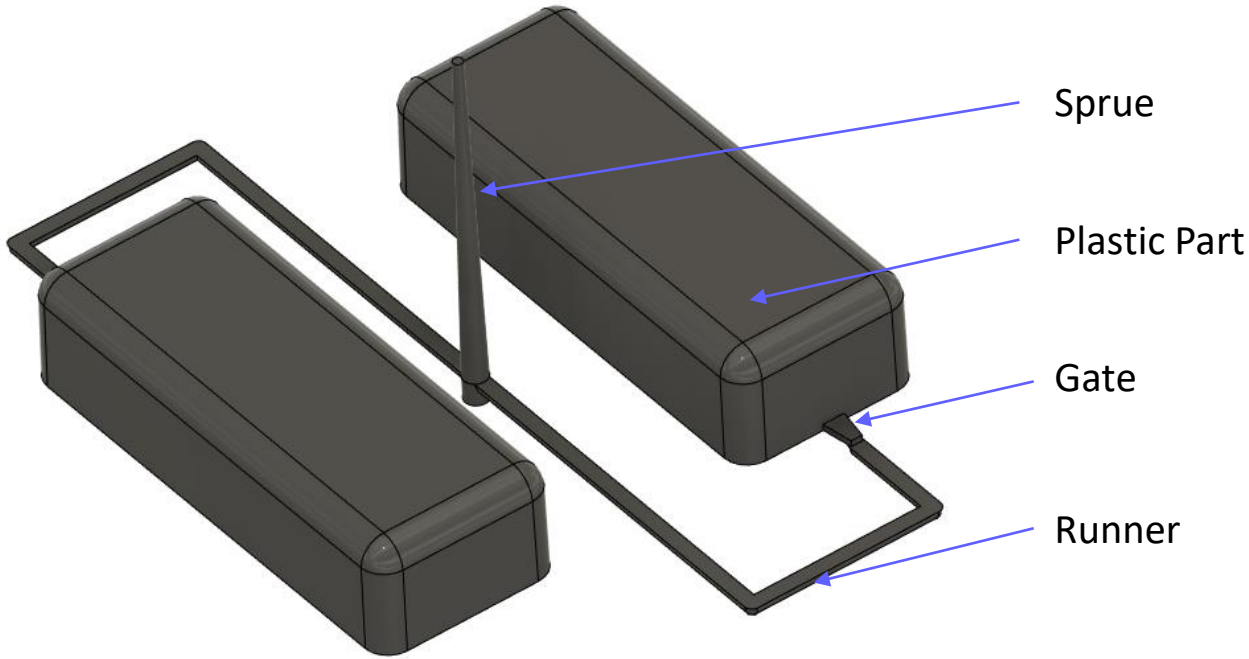




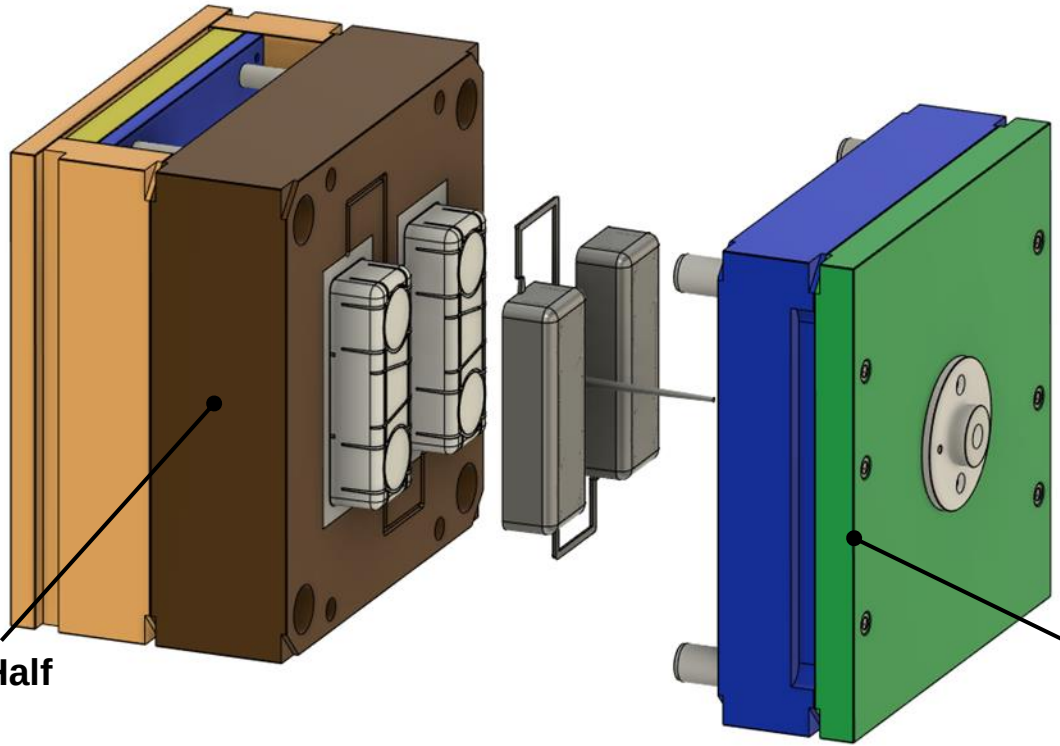


Review of an Injection Molding Tool

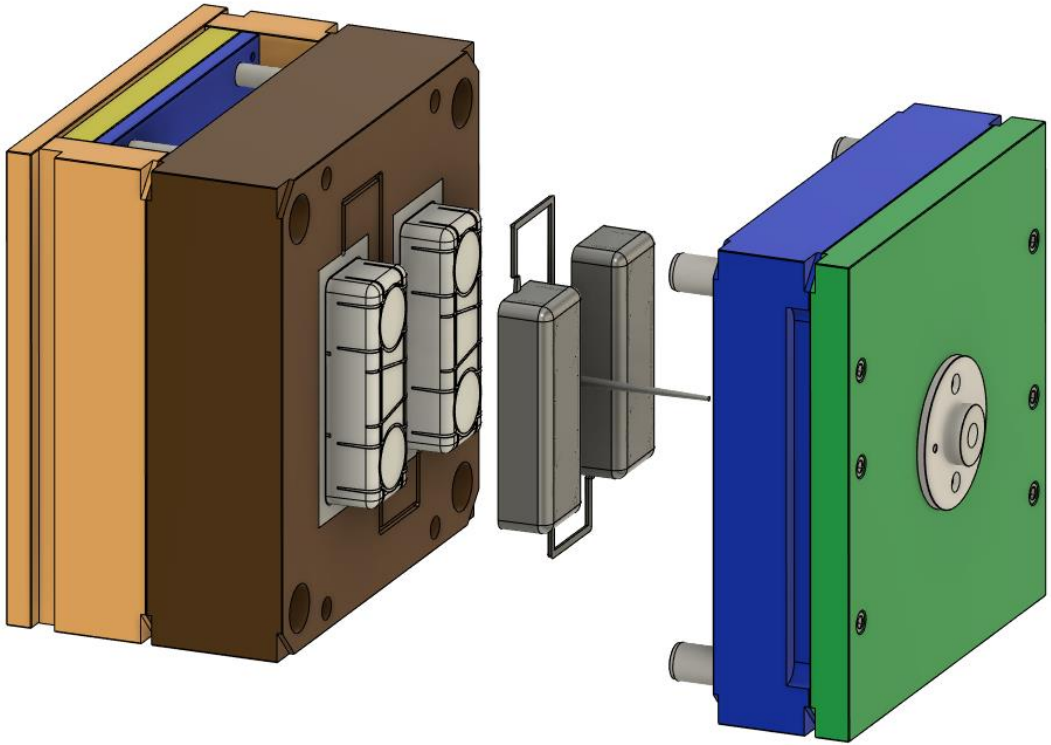
Gate and Runner



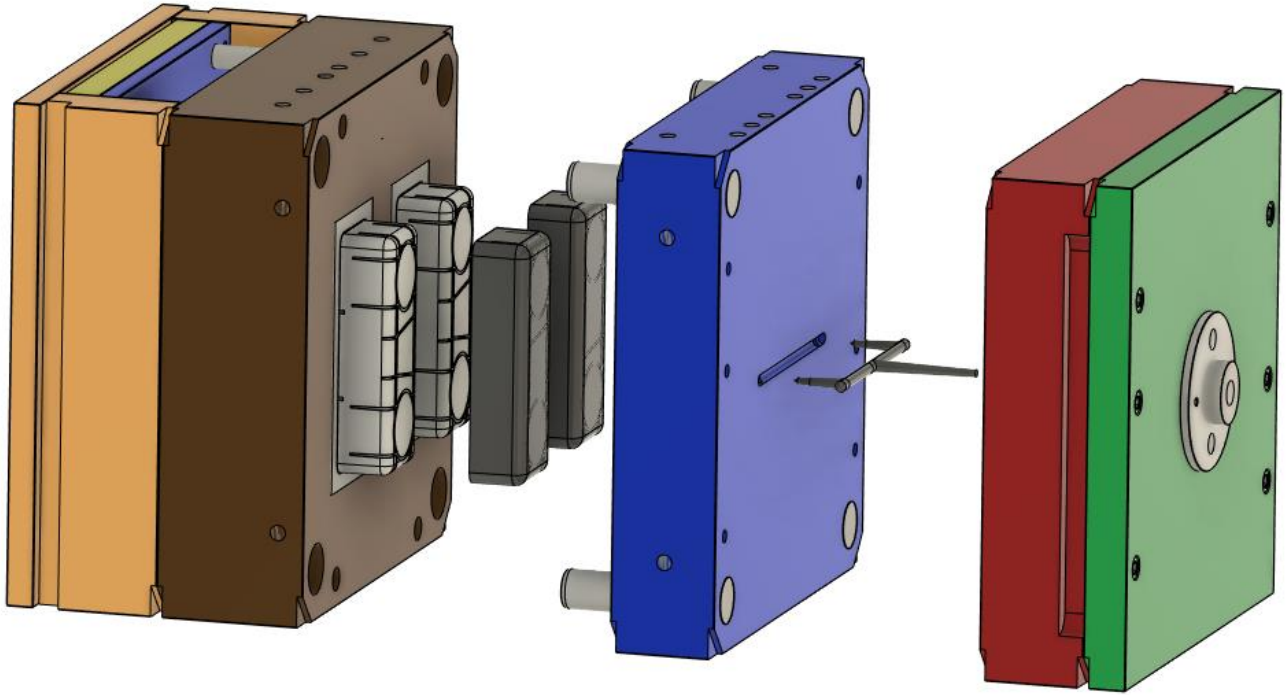
The Injection Mold



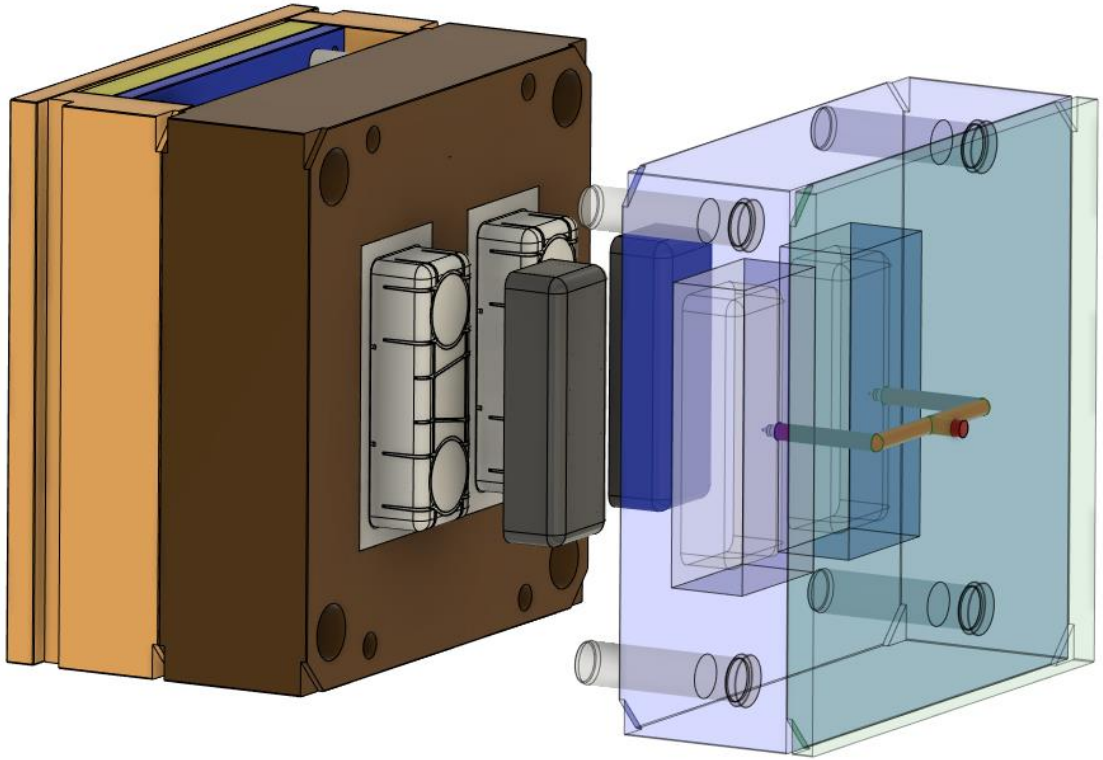
2 Plate Cold Runner



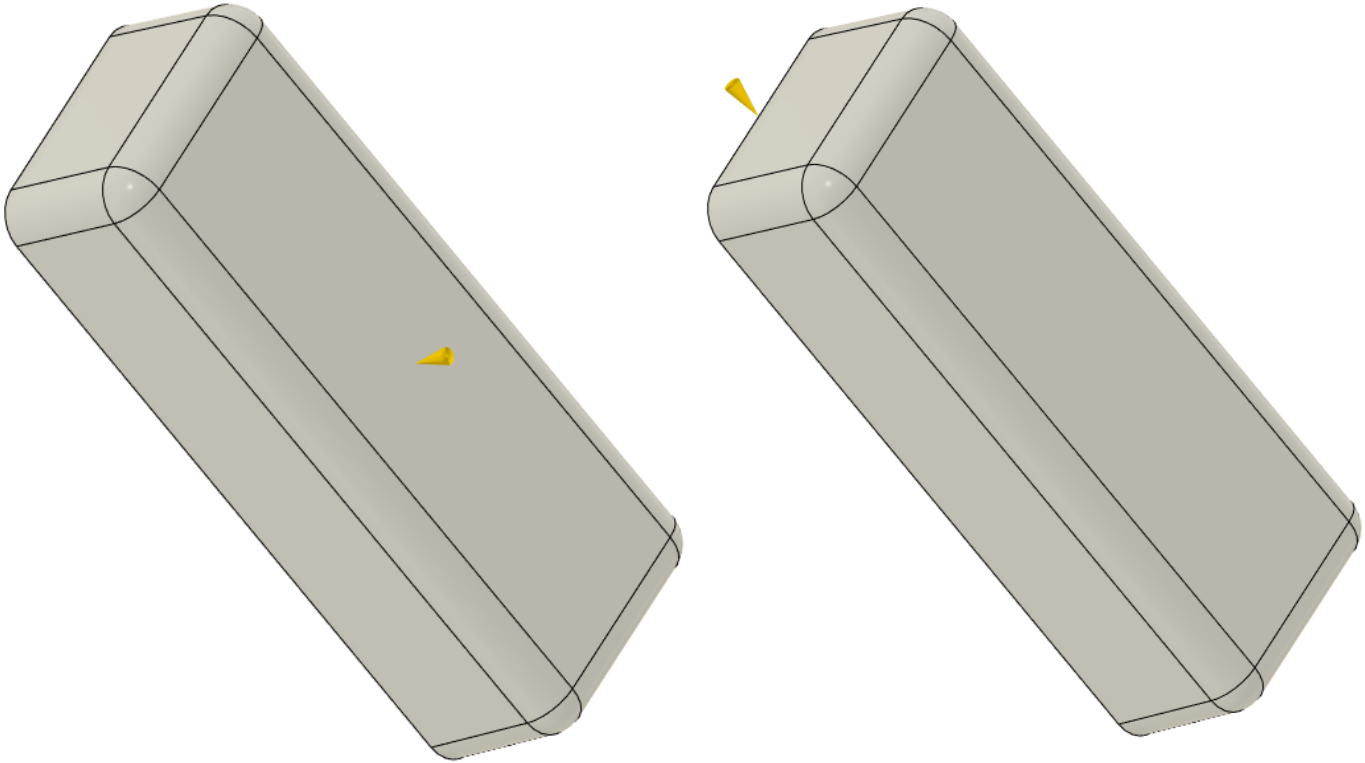
3 Plate Cold Runner



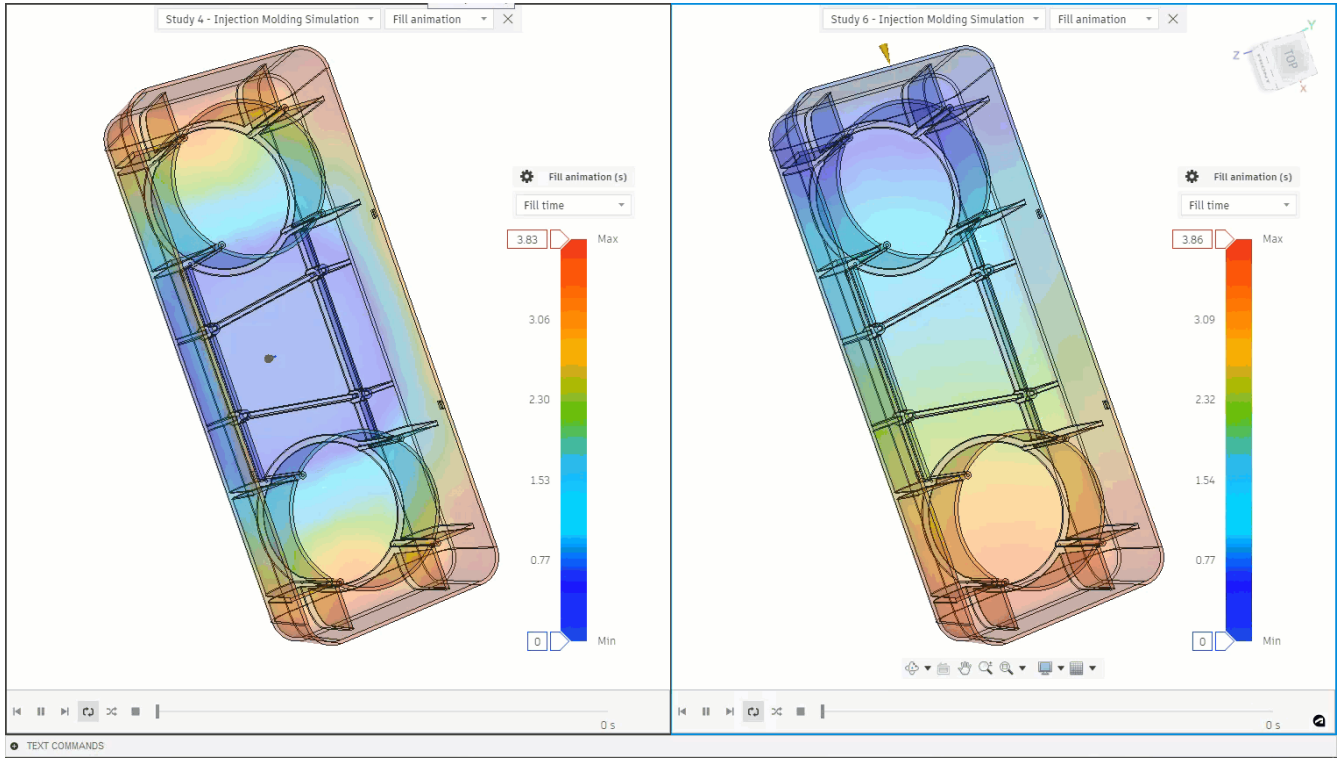
Hot Runner



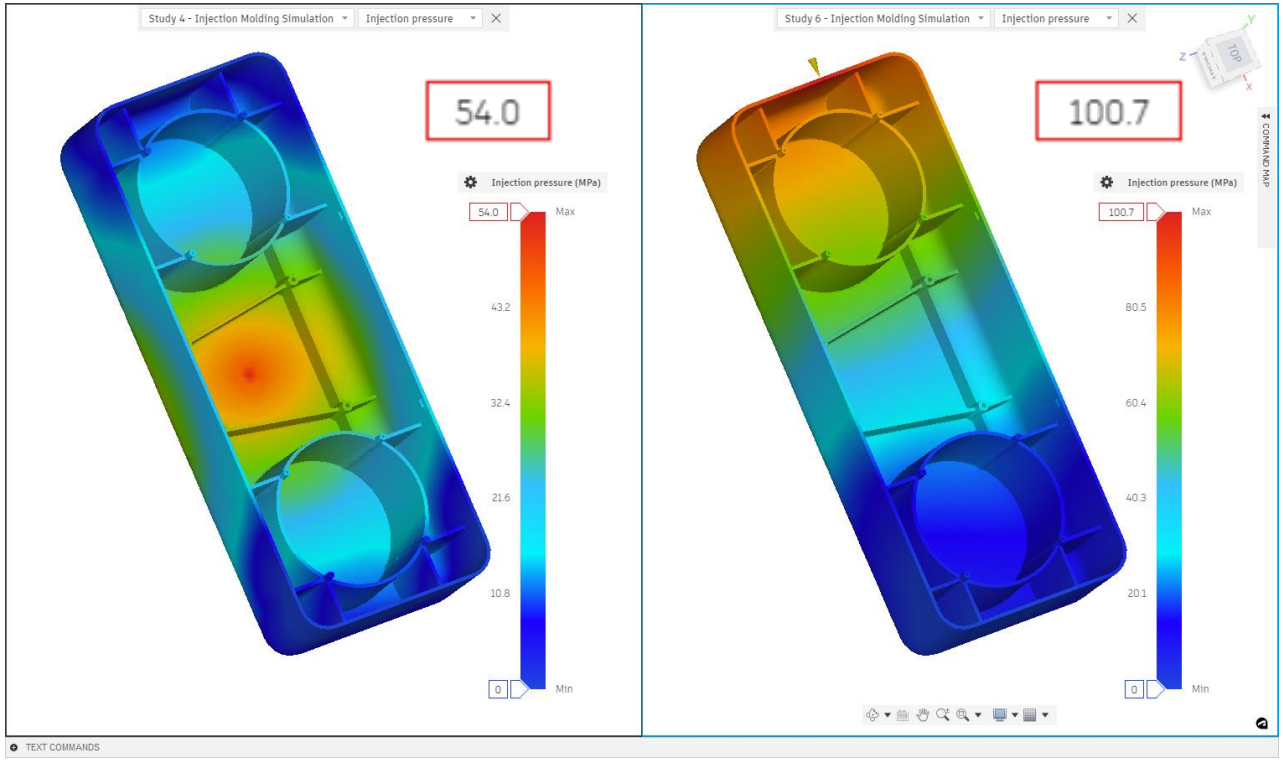
Gate Location



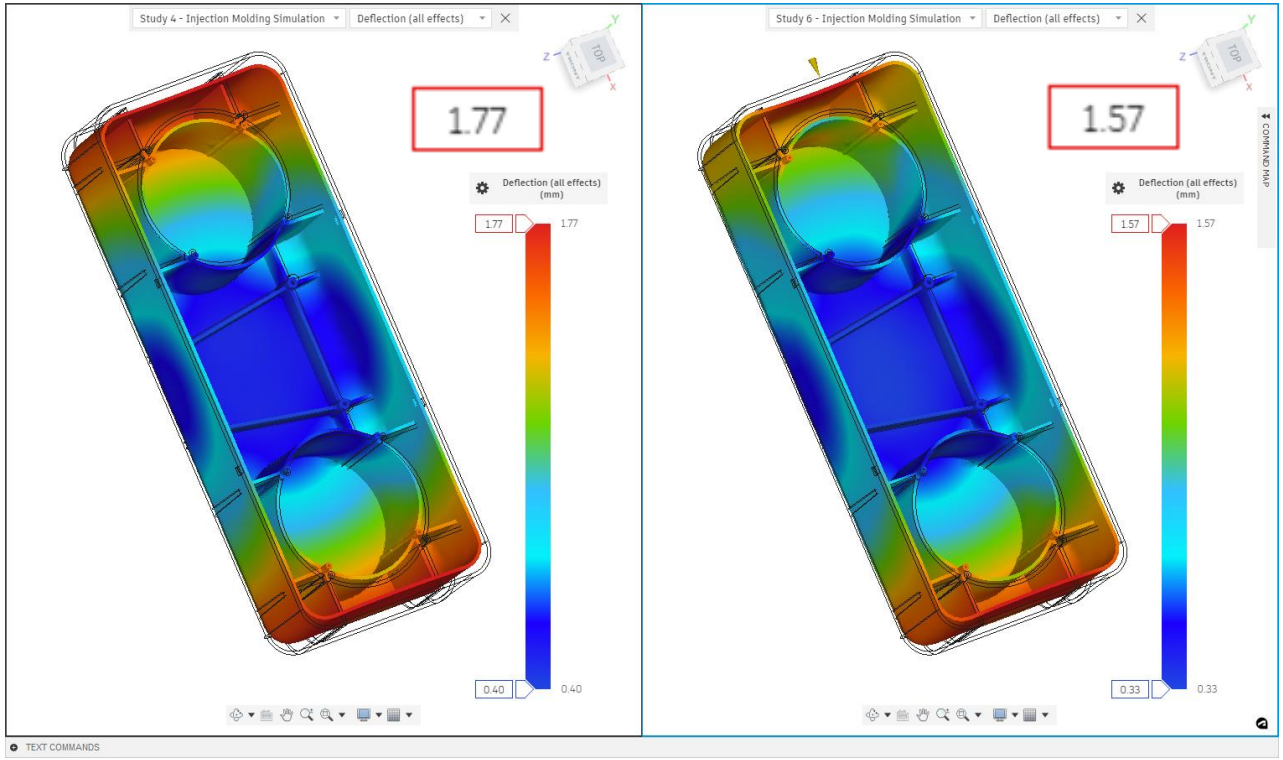
Gate Location Comparison - Filling

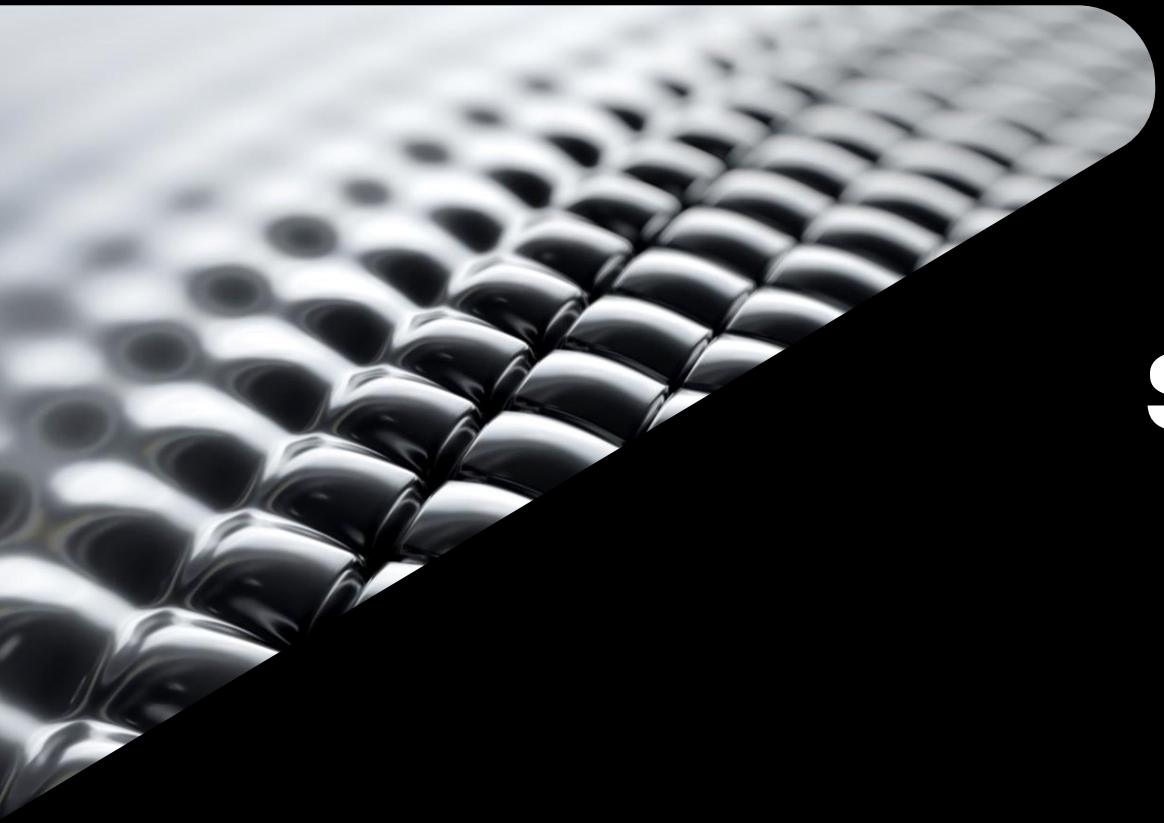


Gate Location Comparison – Injection Pressure



Gate Location Comparison - Deflection





Injection Molding Simulation in Fusion 360

Summary

1. **Uniform wall thickness**
2. Uniform wall thickness
3. Radii
4. Draft
5. Undercuts