Moldflow Summit 2018
DME/Milacron

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AUTODESK.

Introduction

Introduction

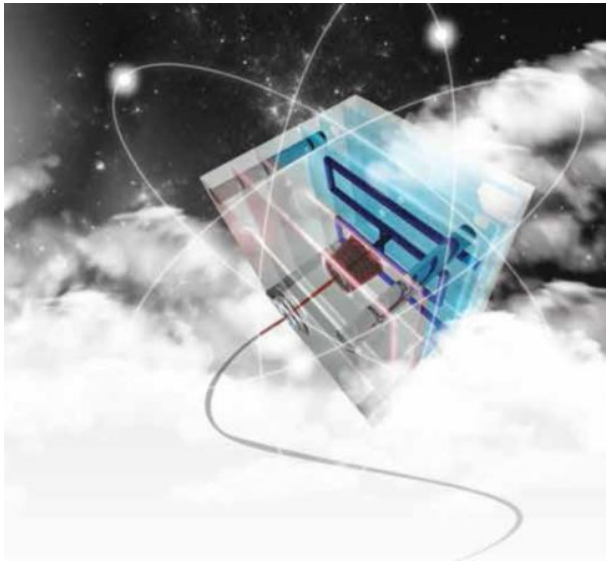
DME's history

- **1940's**
  - **Founded in 1942**
  - **Begin to standardize mold industry with immediate delivery of every-day mold components**
- **1950's**
  - **New Unit Dies and Quick-Change systems launched**
  - **Increases reach with international warehouse**
- **1960's**
  - **Introduction of Collapsible Cores**
- **1970's**
  - **DME's first runnerless system introduced**
  - **Hot sprue bushing introduced**

Introduction

DME's history

- **1980's**
  - **STC-1500 controller for improved temperature control and part quality is launched**
  - **Smart Series line of temperature control systems hits market**
- **1990's**
  - **DME receives General Motors Mark of Excellence**
  - **DME joins Milacron family of companies**
- **2000's**
  - **DME goes digital with online order capabilities**
  - **Helical Gear stack mold centering devices developed**
- **2010's**
  - **Hydraulic locking core pull cylinders developed**
  - **DME TruCool™ mold thermal control services launched**

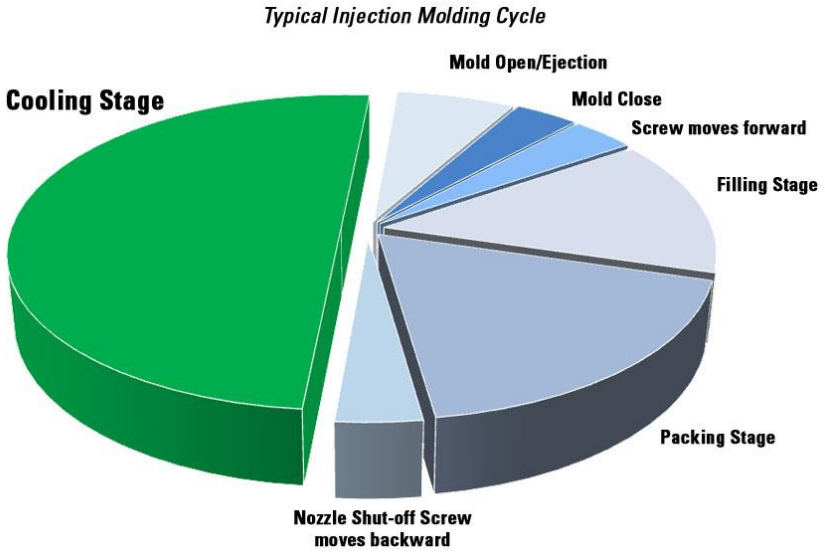


Thermal conditions in today’s molds

Thermal conditions in today's molds

Needs

- What are never ending goals of plastic injection?
  - **Faster processes**
  - **Lightweight products/materials**
  - **Superior consumer goods**
  - **Reduced carbon footprint**
  - **Reduced cost**
  - **Greater global interaction**
  - **Automation**



Thermal conditions in today's molds

Troubles of injection molding

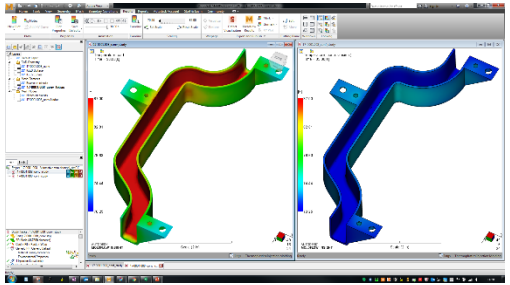
- Excessive warpage
  - Many geometries in parts produced have varying wall thickness. The cooling effect is uneven producing a high temp delta throughout. This uneven cooling ends up warping the part and makes it fall out of tolerance once completely cooled. This is a major contributor to the long cycle times as it increases warpage when shorter cycle is run. Another factor in warpage is moveable action that can't be cooled efficiently and those areas suffer resulting in the same warped part. Commonly, these are areas that needs even better cooling than maybe the core block or moldbase because of the detail they are creating.
- Long cycle times
  - This can drive the inability to hit EAU (Expected Annual Units) or a quoted/expected cycle time. This also can lead to loss of revenue by not supplying the demand for product. Long cycle times limits flexibility of press time and often causes undesired scheduling conflicts where limited press time is available. Overtime and weekends are many times added where not expected in order to hit desired values.
- High part stress
  - While running a cycle in an acceptable timeframe and producing a part that is warp free (either through holding long enough to reduce the delta at ejection or even using cooling fixtures), there is often times a high level of stress due to uneven cooling. while it sits in the mold, it pulls and twists as it cools and may look okay at ejection but is just waiting for the right circumstance to relax. This can happen during shipment, for instance, you produce a part that looks good but has high stress and as it ships and maybe sits on a train somewhere in a hot region, these parts now begin to heat up and relax, losing their intended shape and now the product actually delivered to the customer is not as expected.

DME TruCool™

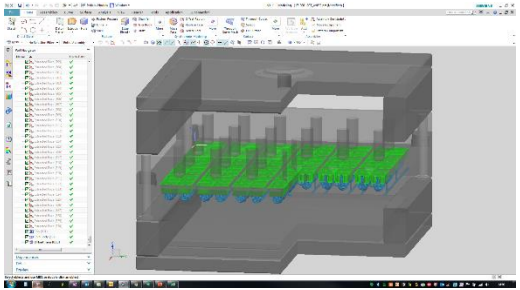
DME TruCool™

Family of products

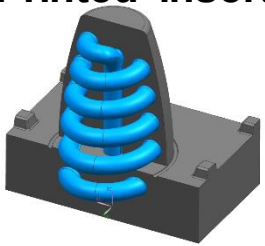
1 - Mold analysis



2 -Channel Design and Mold consultation



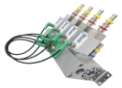
3 - Printed inserts



4 - Control & Monitoring

5 - Hot Runner

6 – supplemental components



Manifolds

Components

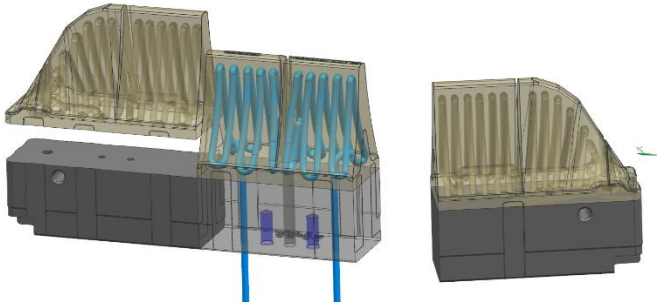
Chillers & Thermolators

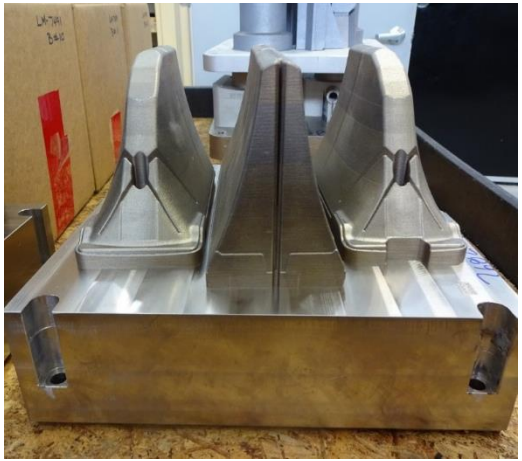
D-Scaler Unit & Fluid

DME TruCool™

Manufacture 3D metal inserts

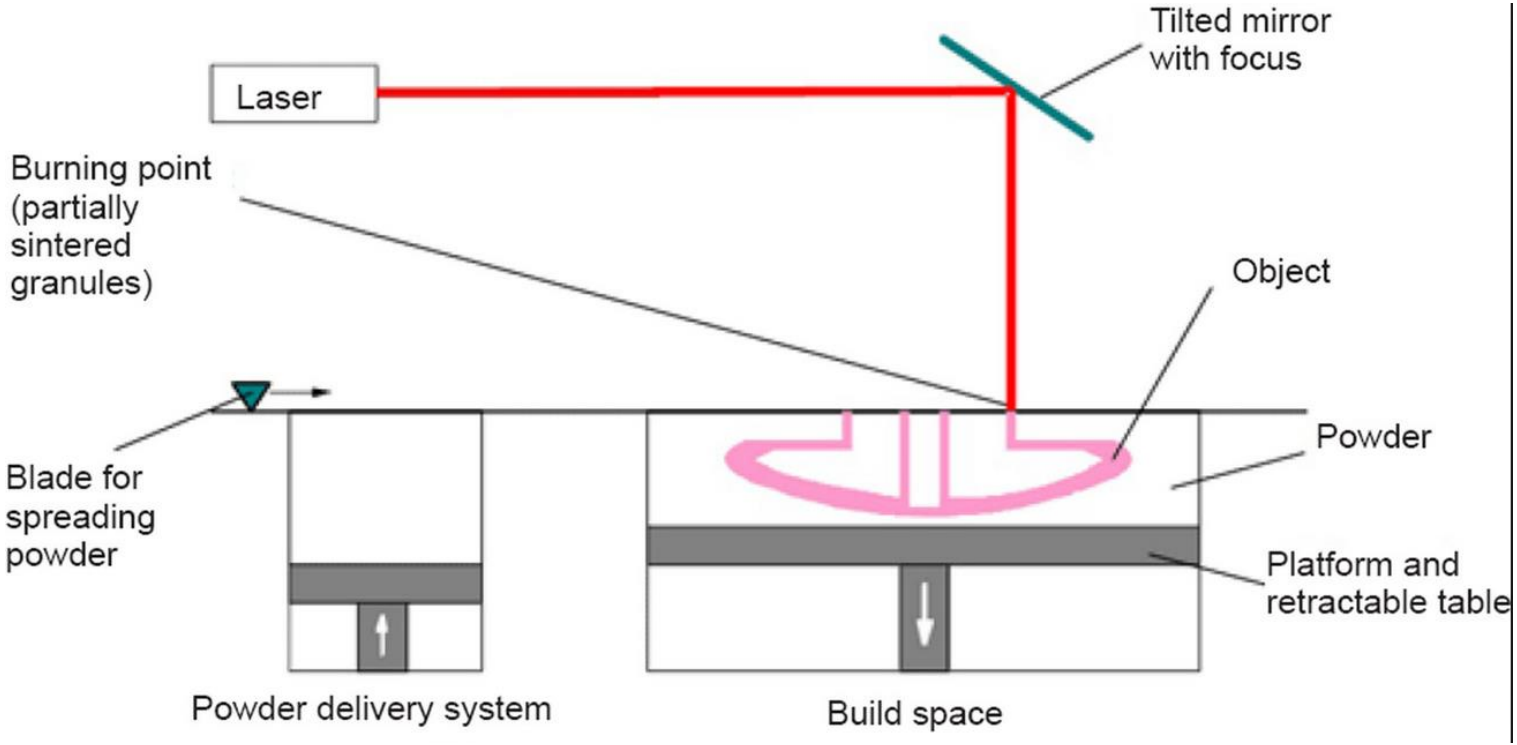
- Conventional cooling generally means straight drilled lines that need intersecting junction points which limits flexibility and creativity
- Inserts/lifters/slides are created not by conventional, subtractive processes but by 3D additive metal printing which allows endless possibilities in creating efficient cooling channels
- Cooling channels can now be placed right where needed and the additive process is what enables this
- Conformal cooling can be integrated into existing tooling by a plug and play swap of components
- In addition, hybrid printing can help reduce cost and timing:
  - We can start with base plate and 3D print directly on top
  - We can fuse multiple prints together for larger sizes
  - We can start with a pre-created base portion and print only needed 3D portion





DME TruCool™

3D Laser Sintering\Melting Process

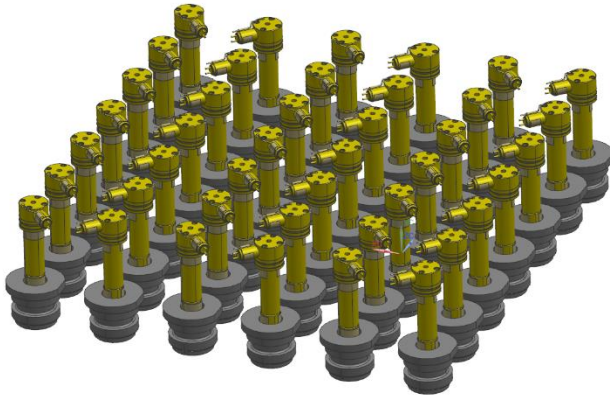


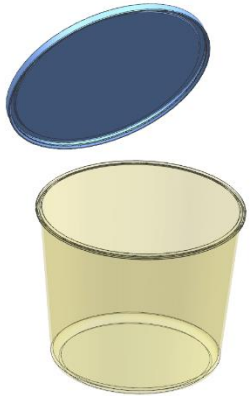
DME TruCool™ and Moldflow software

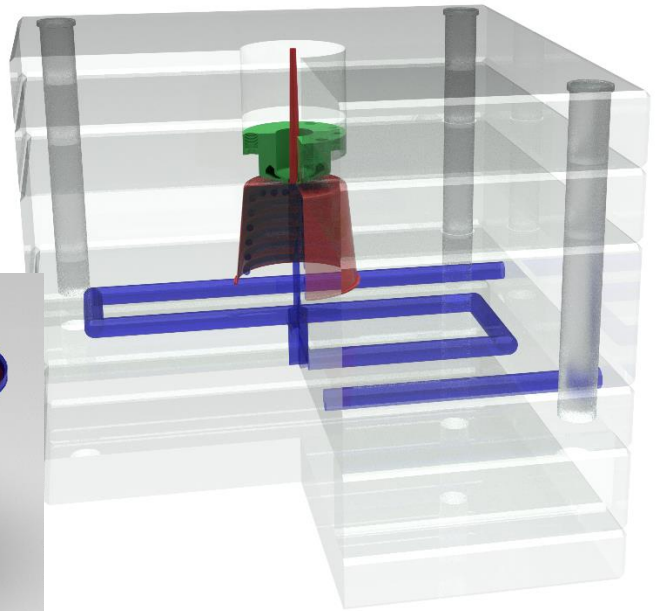
DME TruCool™ and Moldflow software

Moldflow Case study – Cup portion of a carry out soup set

Annual output requirement increased from 125M/Y to 175M/Y.
Study was performed to determine best course of action; add 2 new tools or convert 2 exiting tools to conformal cooling



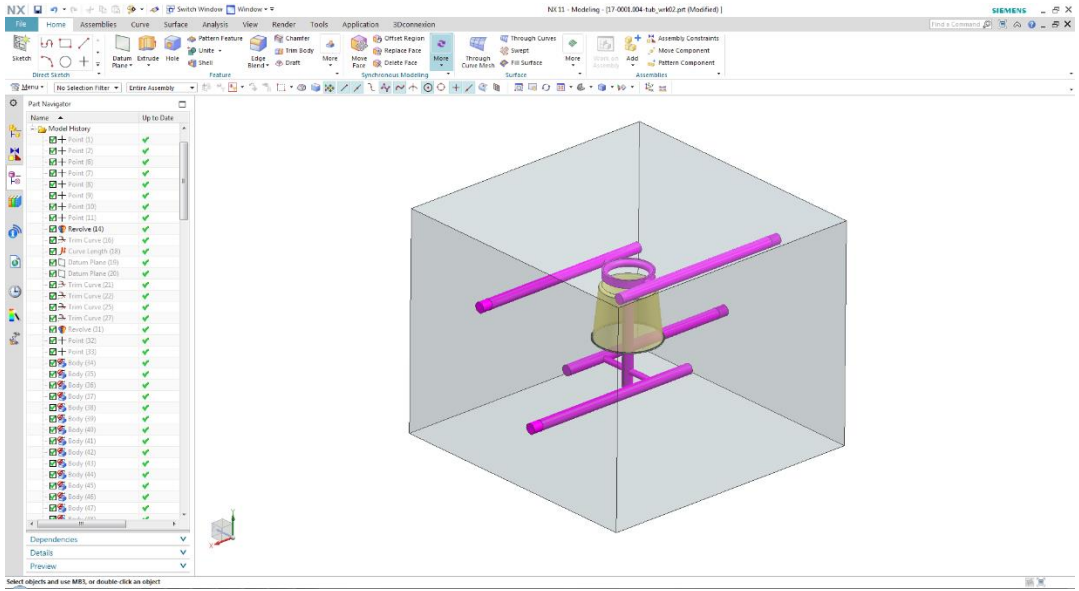


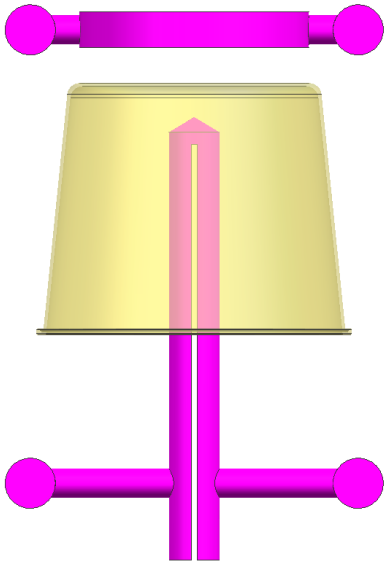


DME TruCool™ and Moldflow software

Baseline review of a project

Customer data with conventional cooling circuit



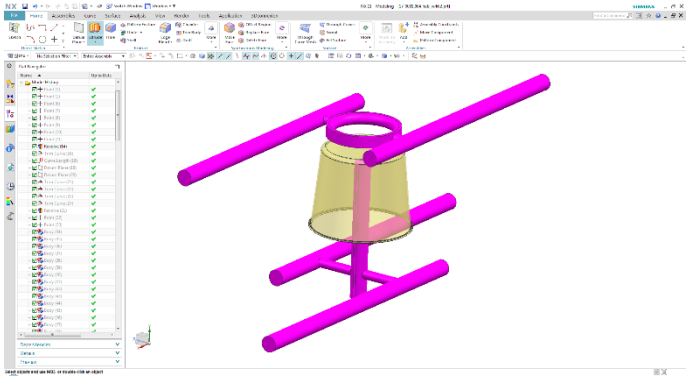


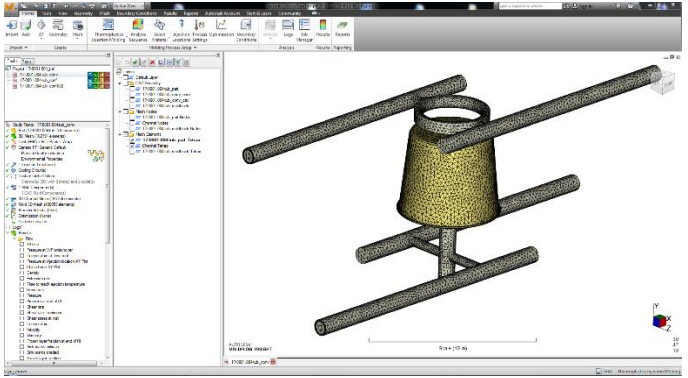
Traditional baffle style cooling lacks capability to cool entire core side

DME TruCool™ and Moldflow software

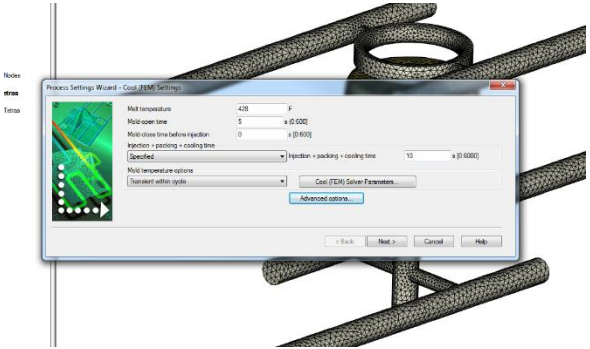
Moldflow analysis

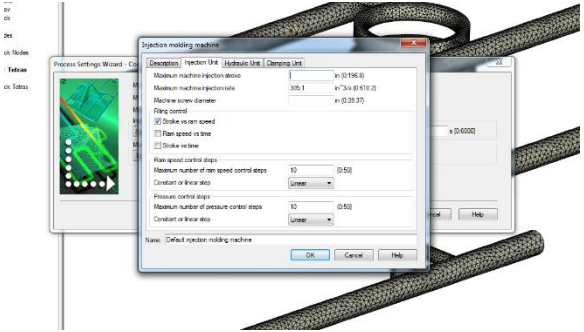
- Involves in-depth review of the cooling channel designs. Components are then imported to run baseline analysis

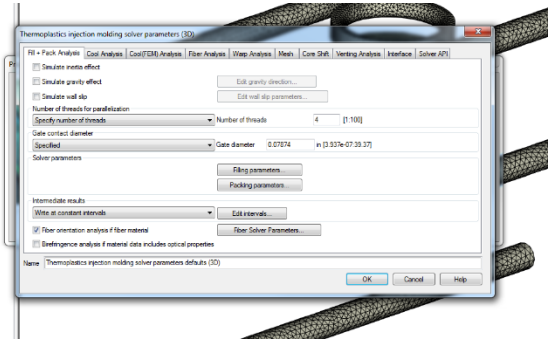




- Using actual parameters from the injection process, such as material properties, fill time, cooling time, pressures etc., we simulate the most lifelike scenario possible

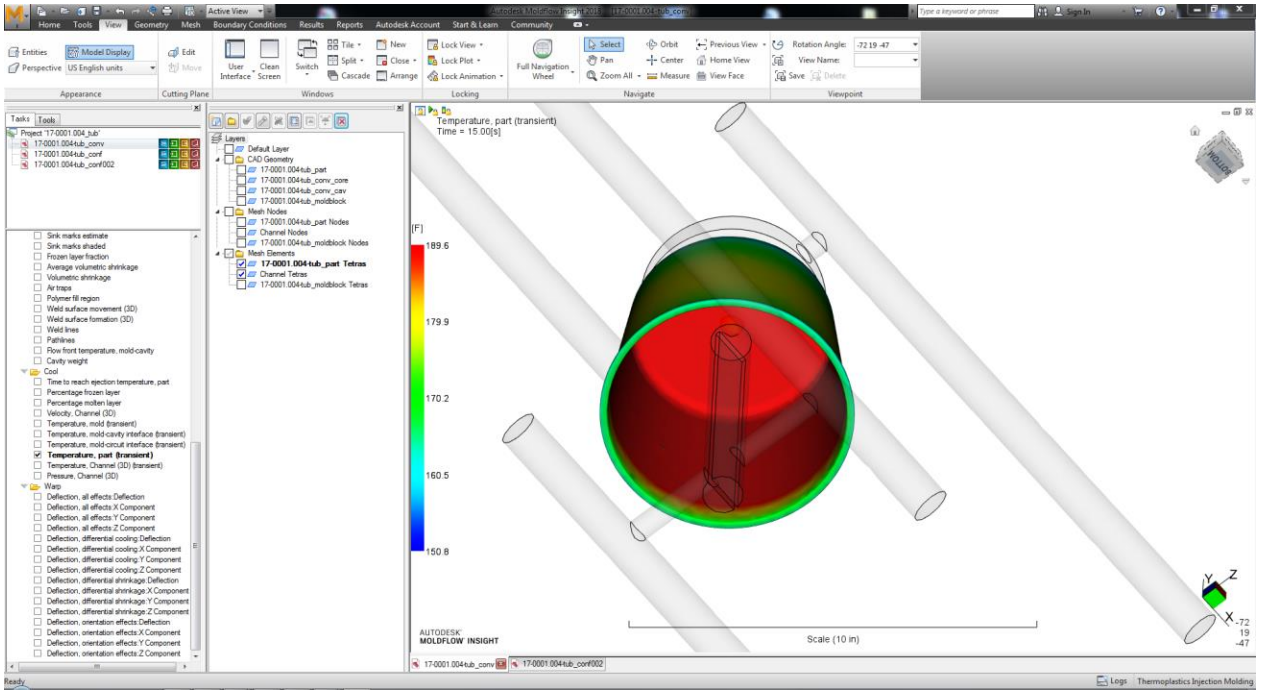






DME TruCool™ and Moldflow software

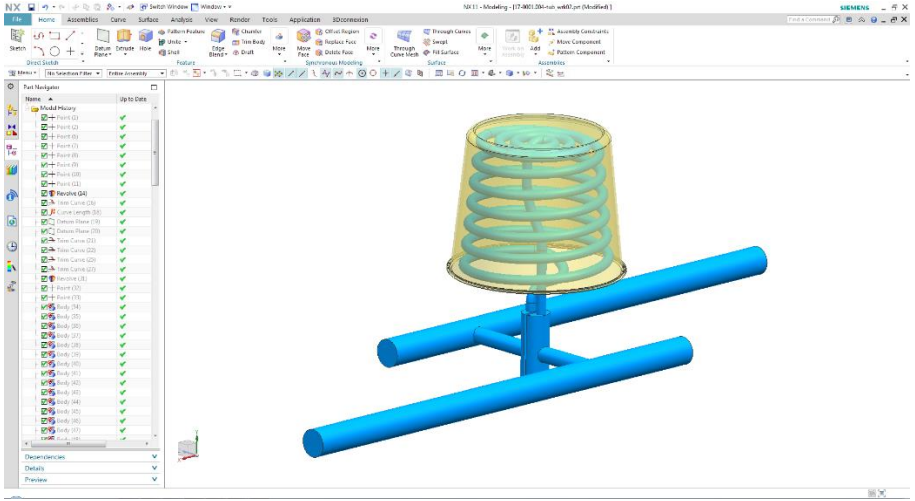
Baseline Review

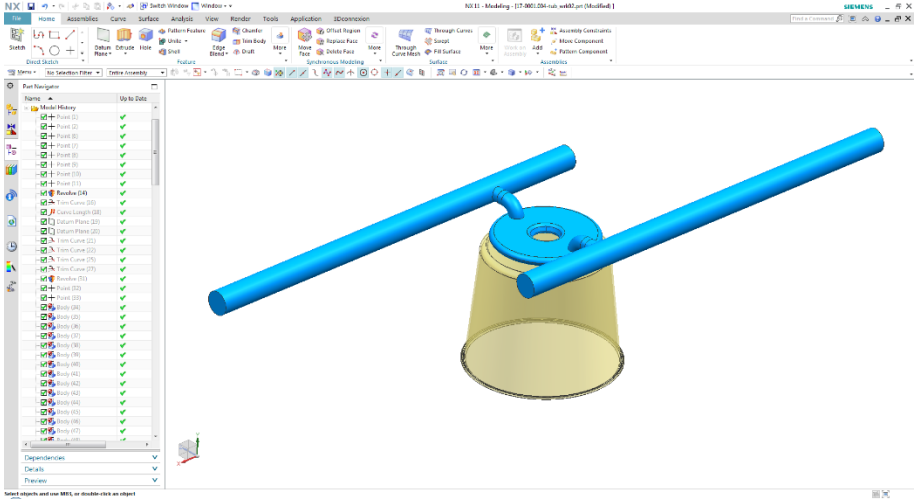


- Limited cooling effect from single baffle
- High temps prevent reducing cycle
- Reducing cycle would result in excessive warpage lower quality

DME TruCool™ and Moldflow software

Conformal Channel Design



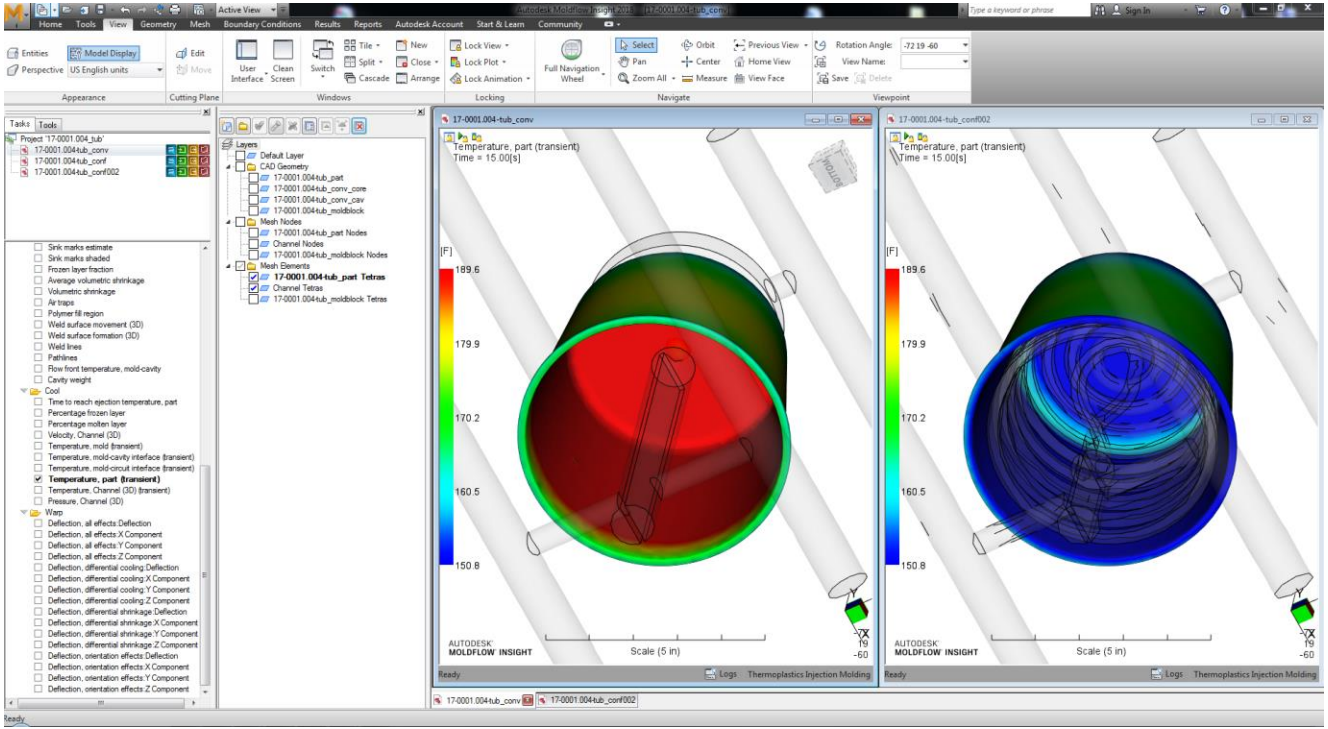


- Complex cooling channels with greater overall coverage
- Even distribution of cooling
- Capable of providing individual insert temperature control

DME TruCool™ and Moldflow software

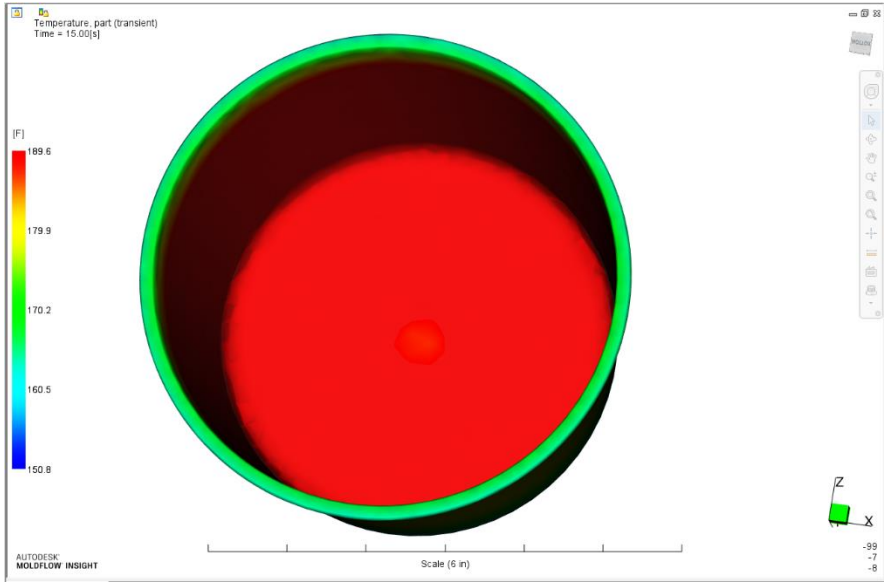
Moldflow Conformal Analysis

Side by side results show conformal cooling potential

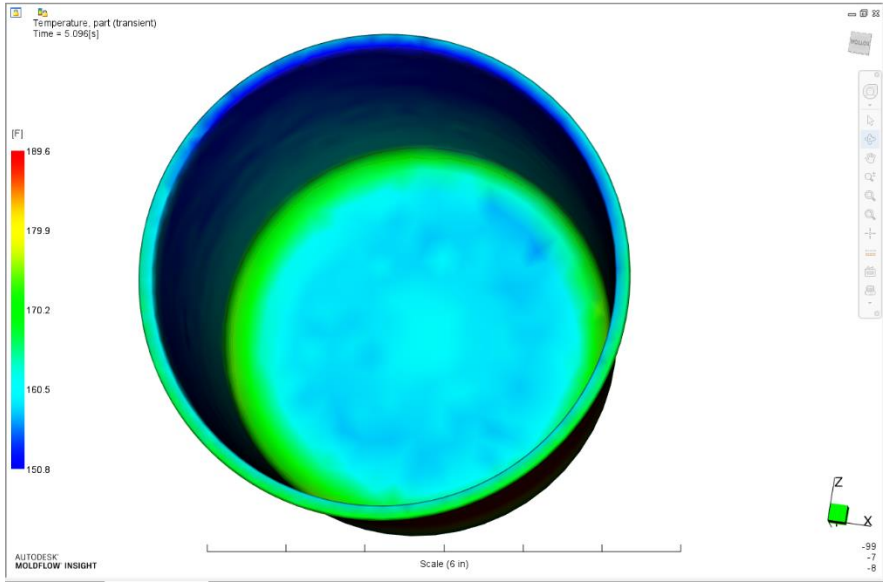


DME TruCool™ and Moldflow software

Reducing cycle time and increasing output



Conventional

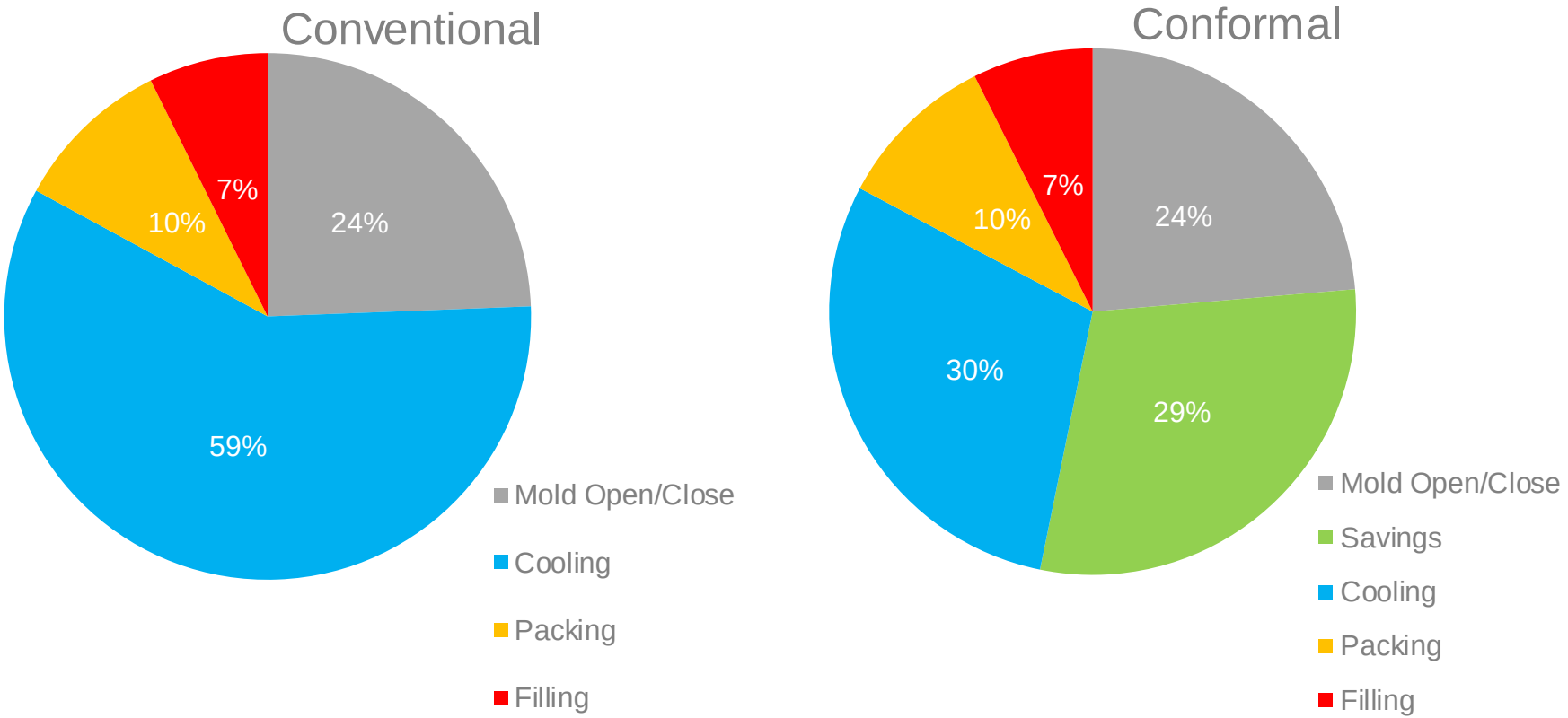


Conformal

49% Cooling Cycle Reduction

DME TruCool™ and Moldflow software

Conformal benefit by cycle breakdown

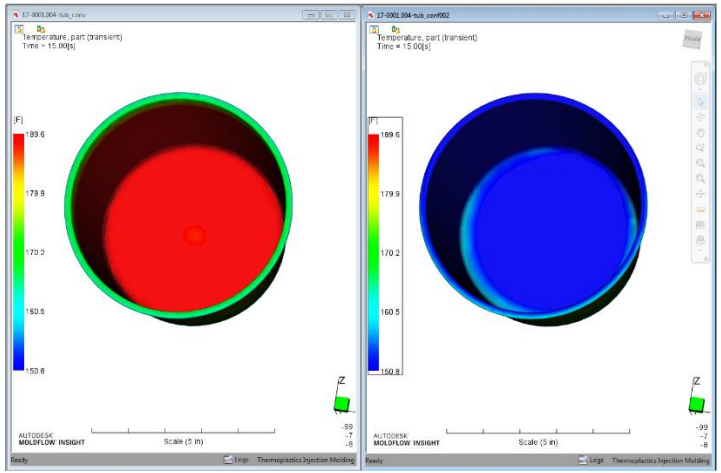


DME TruCool™ and Moldflow software

Solutions provided

Adding 1 new tool
New EAU: 173,069,568
Tool build: $153,481
New press: $465,412
TOTAL: $618,893
INSUFFICIENT PRODUCTION

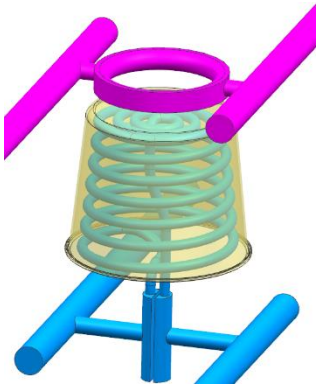
Adding 2 new tools
New EAU: 216,336,960
Tool builds: $287,000
New presses: $774,957
TOTAL: $1,061,957
UNDESIREABLE COST



To hit required EAU

2 new conv tools: $1,061,957
Or
Converting 2 tools: $279,948

Cost savings of $782,009



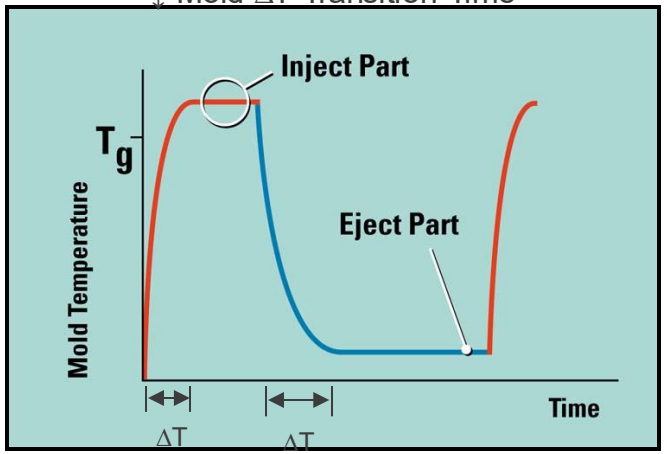
Converting 2 existing tools
New EAU: 181,645,783
Print inserts: $252,746
Mill inserts: $13,750
Insert swap: $13,452
New press(es): $0
TOTAL: $279,948
PREFERRED CHOICE

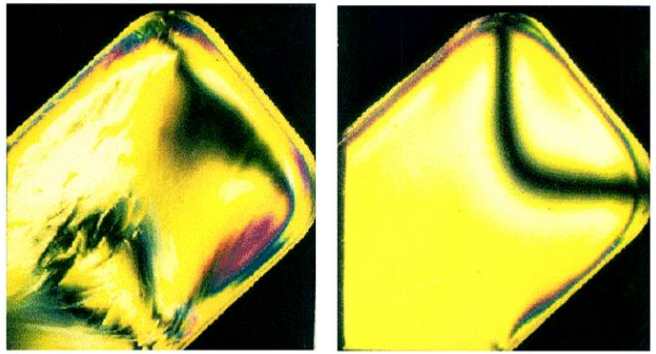
DME TruCool™ and Moldflow software

Dynamic Thermal Cycling

- Technology
  - Cycle cavity temperature with molding process
  - Structural mass reduction and conformal heating/cooling with dynamic temperature control
- Application
  - Long flow lengths
  - High aesthetic requirement
  - Difficult to fill areas
- **Conformal Cooling Benefit:**
  - Decrease cooling cycle time
  - Reduced stress
  - Improved dimensional control
  - Longer flow length
  - Reduced injection pressure
  - Decrease reheating time

Dynamic Conformal Cooling & Heating
↓ Mold ΔT Transition Time



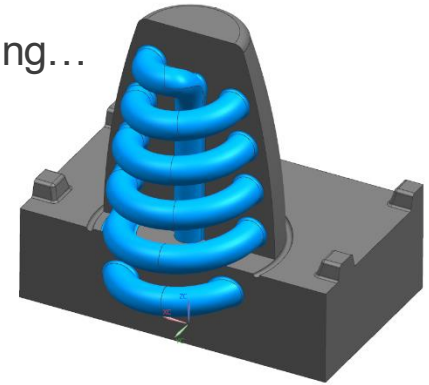


Constant temperature tool | Thermally cycled tool

DME TruCool™ and Moldflow software

Thermal solutions

- In existing molds conformal cooling provides…
  - Reduced cycle time
  - Reduced warpage
  - Increased mold output
  - Reduced scrap
  - Reduced press time
  - Saves material
  - Improved part quality
- In new projects/tool conformal cooling provides all the above while adding…
  - Reduced cavity count
  - Reduced overall mold cost
  - Complete thermal control
  - Part design flexibility
  - Allows tool to run in smaller press



Moldflow enables DME's TruCool™ success and accuracy

AUTODESK®

Make anything™