



# **DESIGN SOLUTIONS UTILIZING LIQUID SILICONE RUBBER**

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- Dymotek Corporation
- Intro to Liquid Silicone Rubber (LSR)
- Key properties
- Paradigms and shifts
- Case Studies
  - Damper
  - Valve Assembly



# Dymotek Corporation

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*“Our technical and service excellence creates world class customer experiences”*



## Who we are...

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- Privately owned, 27 years old
- Two locations, Ellington and Somers CT
- Contract manufacturer, specializing in thermoplastic, LSR, multi-material molding, and assembly

**Plastics News**  
**Processor**  
**OF THE YEAR**  **2016**



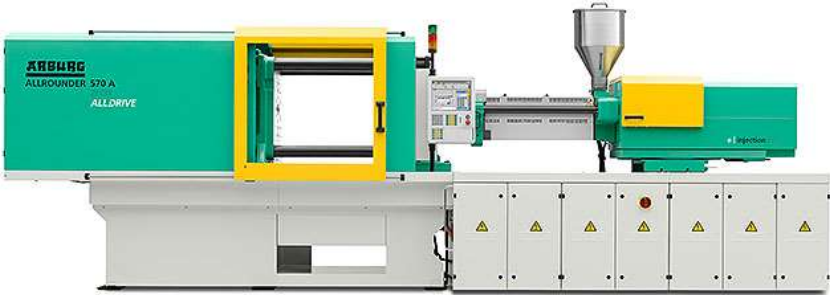
- Case study in one technology that can aid your process
- Often late to the design.
  - Looked to for an individual part, not to improve the assembly
- Strive to bring the latest technology to our customers.
- Suppliers and manufacturers can provide invaluable input to design if involved **early!**
  - How can specialized manufacturing knowledge assist in the DFMA process?
  - How can vendors maximize your tooling expenditure?

- Injection molded material, “opposite” of thermoplastic
- Thermoset, cross-linked material (irreversible)
- Delivered in two-component kits (1:1 ratio), mixed at point of injection, high temperature cure



# The Challenge

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# Key Properties, Traditional benefits

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- Good flexibility with good mechanical properties (compression set, tear, tensile)
- No plasticizers, phthalates or latex additives
- Excellent temperature stability (-58°F to 392°F)
- Biocompatibility / Food contact compliance
- Weathering resistance (UV, Ozone)
- Broad chemical / fluid resistance
- Cost-efficient processing (short cycle, flash-free)
- Favorable burning characteristics (Low-toxicity gas & flame retardant)
- Good transparency and easily pigmentable
- Water repellency (very low surface energy)
- Odor & Tasteless

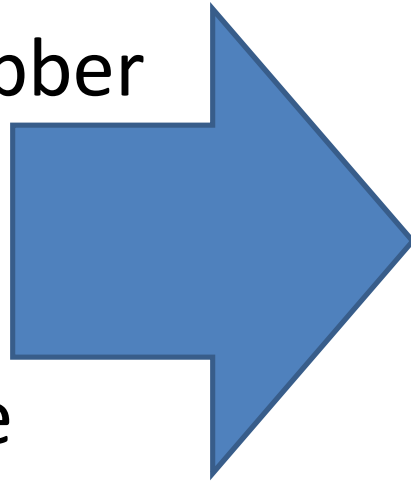
**These properties by themselves solve a specific and typically narrow problem!**



## First Paradigm Shift (Molders)

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- Originally marketed to traditional rubber molders
- Flash
- Process waste
- Hand-mixed
- Batch processed



- Precision injection molders
- Vacuum systems, sealed parting lines
- Cold decks
- Meter-mix/Dosing systems
- High volume production

# Typical traditional uses

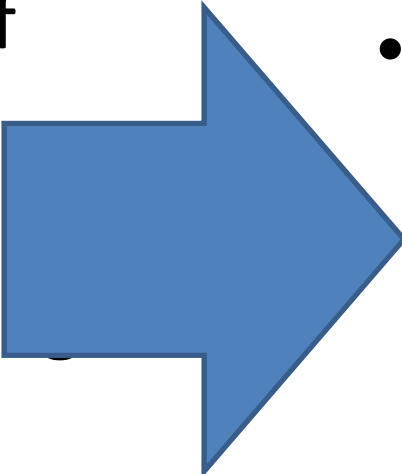
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- O-rings/gaskets/seals
- Valves
- Tubing
- Bottle nipples

## Second Paradigm Shift (Designers)

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- Discrete components
  - Replacement of EPDM/natural/latex rubber
  - Designed utilizing traditional thermoplastic methods/constraints
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- Molded assemblies
  - Designs *for* material's properties/strengths

- Multi-functional molded assemblies, ready from injection molding machine
- Two+ shot molding
- Insert molding (combined with above)



# Key Design Points

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- Wall sections can vary without quality (sink) or process (fill) issues
- Undercuts are easy to demold, eliminating mold actions
- High flow
  - Thin sections and long flow lengths possible
  - Internal runner systems in substrate for two-component molding
  - Flashes at .0002"/.005mm
- Low durometer, stress-free molding for critical geometry
  - Suited to replace TPE/TPR/TPV in multi-cavity production with cavity/balance/stress/warp concerns

These properties make unique parts possible. Combining them makes unique processes possible.

- Valves
- Gaskets
- Pumps
- Access Ports
- Tactile inputs (buttons)
- Optics (light pipes)
- Vibration isolation
- Insulation/  
Conductivity
- Hinges
- Lubricating
- Grips
- Springs

- Engage with product designers and design teams
- Drive functional element integration at beginning of design process
- Focus on device, not individual elements



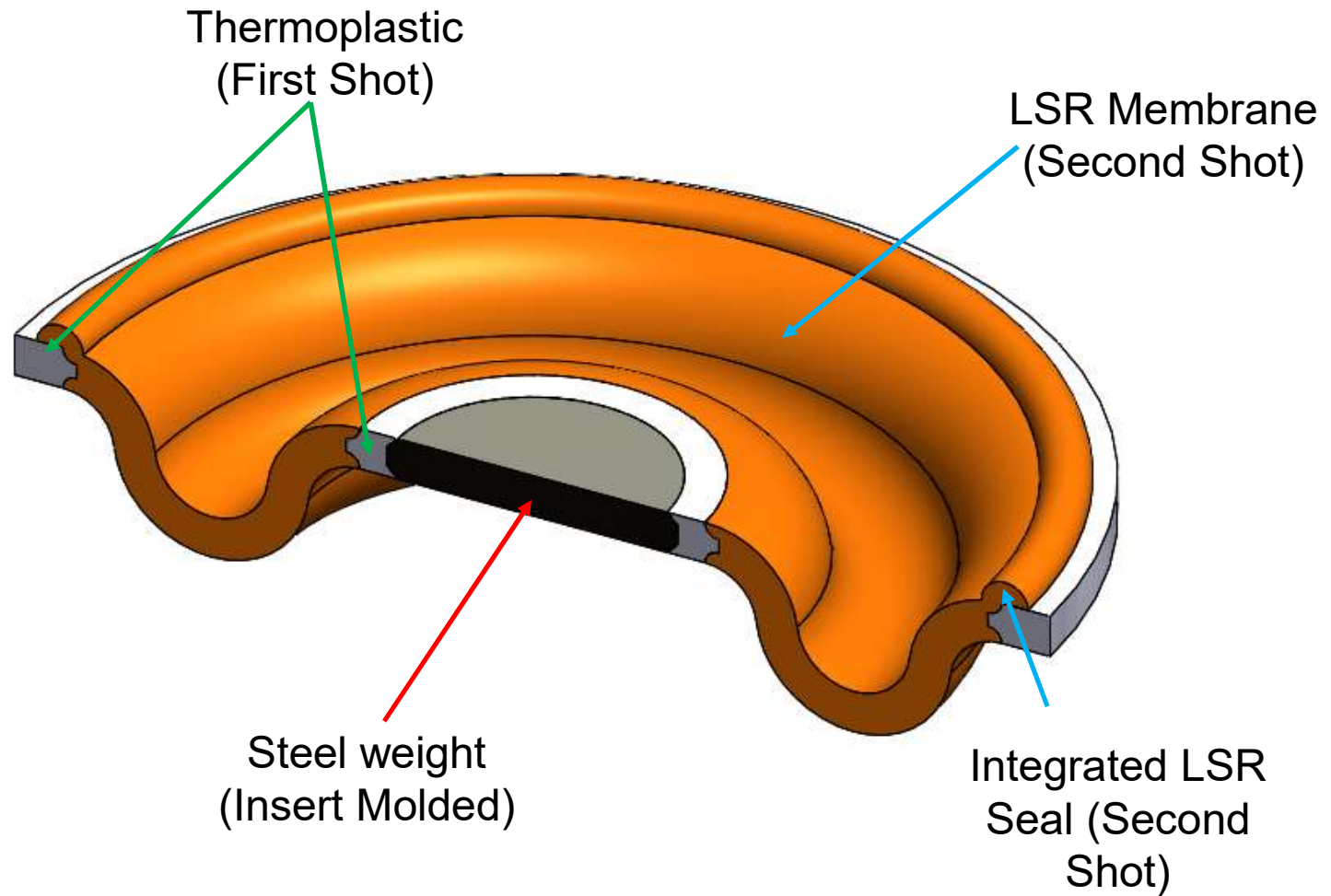
- General Purpose
- Self-adhesive
- Fast cure
- Optical
- Healthcare
- Low durometer
- High voltage
- Heat & flame
- Self-lubricating
- High tear
- Implantable
- Low compression set





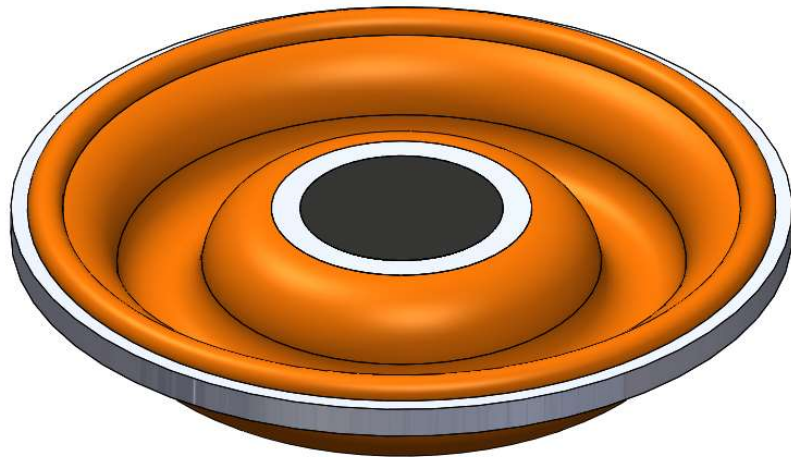
- Use data sheets as a guideline
- Custom grades do *not* command a significant cost premium
- Standard offerings are based on broadest appeal
- Customization possibilities can make an otherwise impossible program achievable

# Case Study: Damper



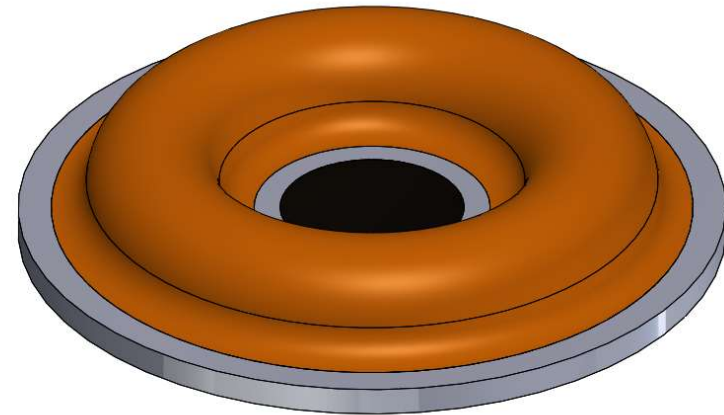
# Design Requirements

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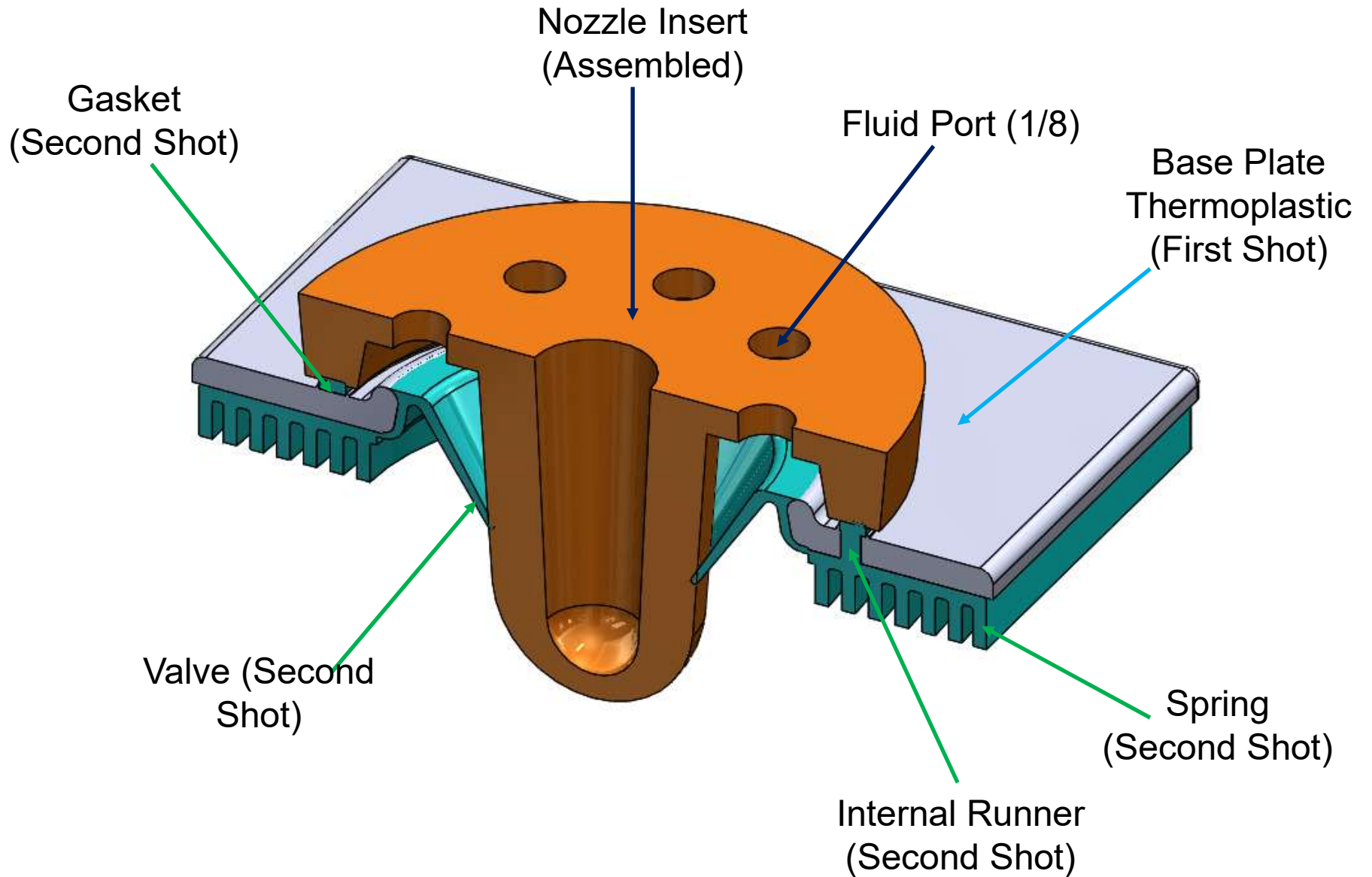


- Temperature stability
- Seal's compression set resistance
- Membrane elasticity, elongation, creep resistance, low durometer (10A), stress/warp free
- Thermoplastic for assembly/interface

- 4+4+4 transfer mold
- Hot runner for thermoplastic
- Cold deck for LSR
- Robotically inserted weights
- Robot transfer between thermoplastic and LSR cavities
- Cohesive bond between thermoplastic and LSR

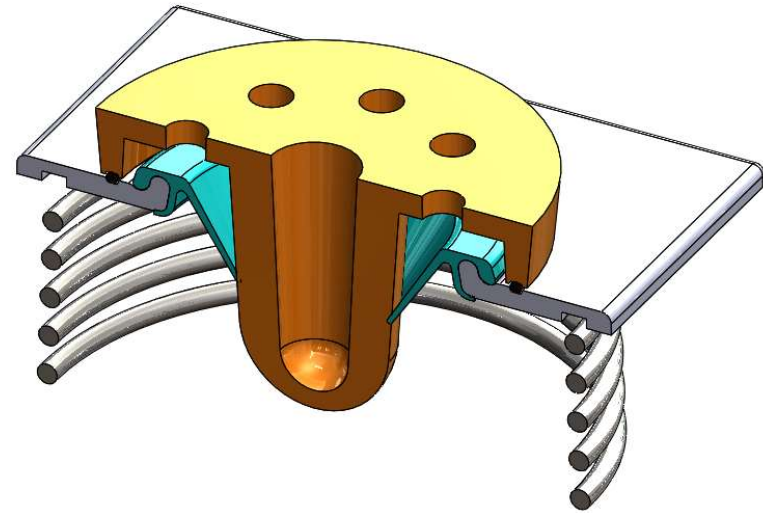
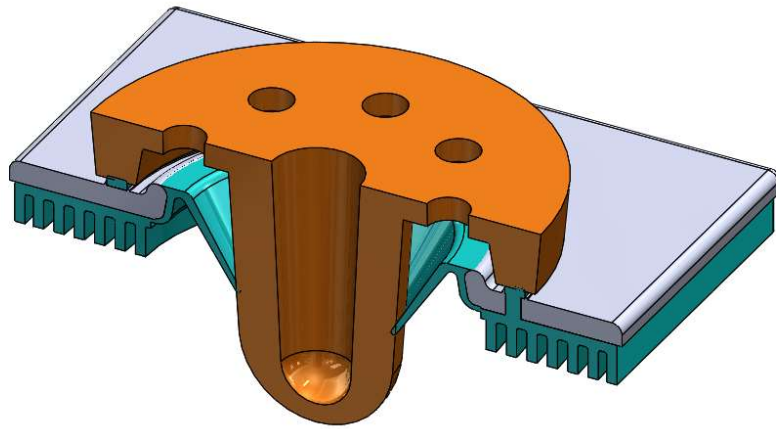


# Case Study: Multifunction Valve

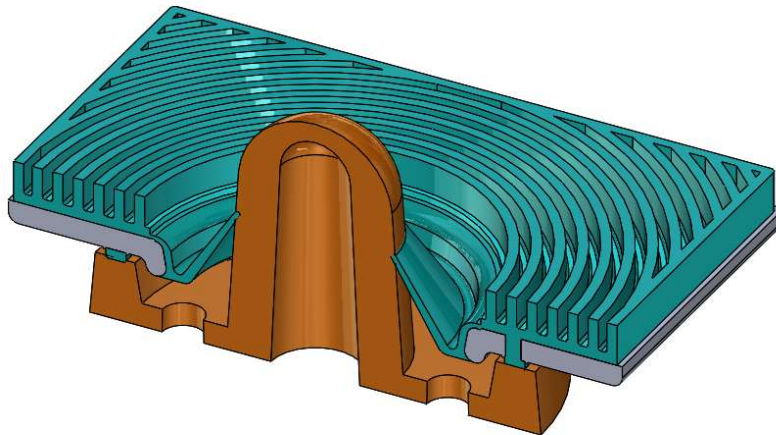


# Comparison

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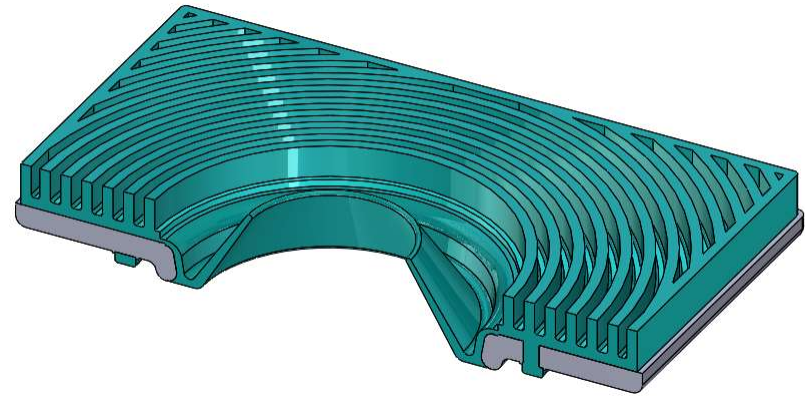


# Design Requirements



- Spring designed to press nozzle insert against dispenser (dispenser not shown)
- O-Ring to seal nozzle insert against Base Plate
- Valve seals against nozzle insert, pressure increase cracks valve, dispensing fluid
- Two components, one assembly operation
  - Original design is three molded components, two purchased components, four assembly operations

- 4+4 rotary mold
- Hot runner for thermoplastic
- Cold deck for LSR
- Rotary table thermoplastic on B-side to LSR overmolding position, core-back for gasket.
- Cohesive bond between thermoplastic and LSR





- Utilize key high-technology vendors as part of your DFMA process to ensure incorporation of the latest possibilities offered by their capabilities
- LSR has opened a new arena for injection molding functional parts ready from the mold
- Without early engagement, more traditional designs take root without utilizing existing technologies
- A single molded part can perform a variety of functions without a proportional increase in complexity



Thank you!

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