Bobbins, designing for high volume production

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What it takes to commercialize great ideas……..
Coil Bobbin Function

Central to the design
- Motors, transformers, solenoids, sensors
- The bobbin is the base building block
- Bringing together multiple engineering disciplines
Design for production

- Be realistic with the design
  - Uniform Wall thickness #1
  - refer to tolerances for engineering plastic (DIN standard 16742)

- Have a full outline of requirements
  - Environment, UL EIS temperature class, UL94 flammability

- Choose engineering polymers wisely
  - Commercially available in the current market?

- Engage with your molder at the earliest stage
  - Choose your partners wisely
The molding process basics

Side Action/Slides

Mold tool fully open
The molding process basics

- Tool Closes
- Side Action/Slides
The molding process basics

Tool Fully closed- ready for injection
The molding process basics

Injection phase of polymer
The molding process basics

Tool
Opens
The molding process basics

Bobbins ejected from mold tool
The molding process basics

Molded bobbins connected with the central injection feed
The molding process basics

Sprue & runner are detached & recycled
The Fill Pattern

FEA Simulation

- Uniform, progressive & even fill pattern
- Homogenous melt
- Minimum weld lines
- Maximum strength
- Minimizes post-moulding distortion
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Wall Thickness #1 Rule

- Uniform thickness wherever possible

Injection Feed Point
Wall Thickness #1 Rule

- Uniform thickness wherever possible
Minimum Wall Thickness

- Depends on polymer choice and part geometry (flow length)
- UL yellow card
- Strength & distortion?
- High injection pressure needed causes other problems

2” high, Ø2.125” Flange OD, 0.033” wall thickness. LCP.
Polymer Selection

Melt front simulation

4”/ 100mm high bobbin 0.040”/ 1mm wall section

Liquid Crystal Polymer

30% GF Nylon PA66
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## Polymer Selection

**UL Yellow Card**

### SOLVAY ENGINEERING PLASTICS GBU
QUARTIER BELLE-ETOILE, AVE RAMBOZ, BOITE POSTALE 64, ST FONS CEDEX 69192 FR

**A 20 V25**  
Polyamide 66 (PA66), glass reinforced "Technyl", furnished as pellets

<table>
<thead>
<tr>
<th>Color</th>
<th>Min. Thk (mm)</th>
<th>Flame Class</th>
<th>HWI</th>
<th>HAI</th>
<th>RTI Elect</th>
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- Comparative Tracking Index (CTI): 1
- Dielectric Strength (kV/mm): 35
- High-Voltage Arc Tracking Rate (HVTR): 2
- Dimensional Stability (%): 0.0

- Inclined Plane Tracking (IPT) kV:
- Volume Resistivity (10^15 ohm-cm): 11
- High Volt, Low Current Arc Resis (D495): 5
## Polymer Selection

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# Polymer Selection

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Inclined Plane Tracking (IPT) kV: -
Volume Resistivity (10^9 ohm-cm): 11
High Volt, Low Current Arc Resis (D495): 5
Maximum Wall Thickness

- Typically no more than 0.120-0.160”/ 3-4mm
- Thicker is not better - leads to voids/ insulation breakdown
- Voids give a weaker & distorted part - sink
- Extended cycle time
  - If 0.040” equates to 10 secs, 0.080” equates to 21 secs
  - $45/hr press - 12.5c to 26.25c
# Common Bobbin Polymers

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<thead>
<tr>
<th></th>
<th>30% GF Nylon PA66 Zytel 70G30</th>
<th>30% GF PET Rynite FR530L</th>
<th>40% GF PPS Fortron 1140 L4</th>
<th>30% GF LCP Vectra e130i</th>
<th>30% GF PEEK Victex 150GL30</th>
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<td>RTI 0.75mm</td>
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Distortion

- Glass filled materials tend to distort inwards on 90° corners
  - Difficulties in winding & processing
  - Dimensional issues
Tool Compensation

- Compensation added in tool to overcome distortion
  - Permits perfect layer winding
  - >95% fill factors & higher speed winding
  - Win some space back to thicken wall sections
Perfect Layer Grooves

• Perpendicular flanges to the tube allow for PL grooves to be added
  • High fill factors
  • Optimum use of space
  • Precise winding

3,275 turns of 0.33mmØ (28AWG)
131 turns x 25 layers
Perfect Layer Grooves
IDC Pockets

- Insulation Displacement Connection
- Drive to eliminate a soldering operation for the magnet wire
- Can be used for flying leads or PCB connection
Summary

• Be realistic with your design and expectations.
• Partner with a technical molder who has bobbin experience & coil winding knowledge. Someone who is able to advise on bobbin design and provide molding simulation.
• Ensure you clearly define the bobbin requirements at the outset of the project - be realistic.
• Choose a material that’s appropriate for the part geometry, commercially available & affordable.
Contact Us for advice

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