

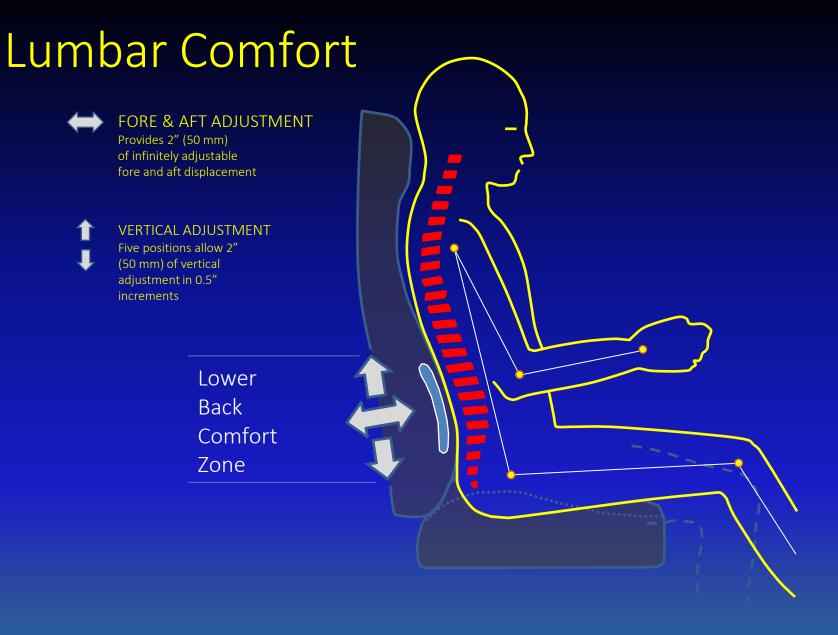
# Automotive Design Avoiding Plastic Design Pitfalls

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## Fixing Honda Pitfall







#### Aftermarket Lumbar Support



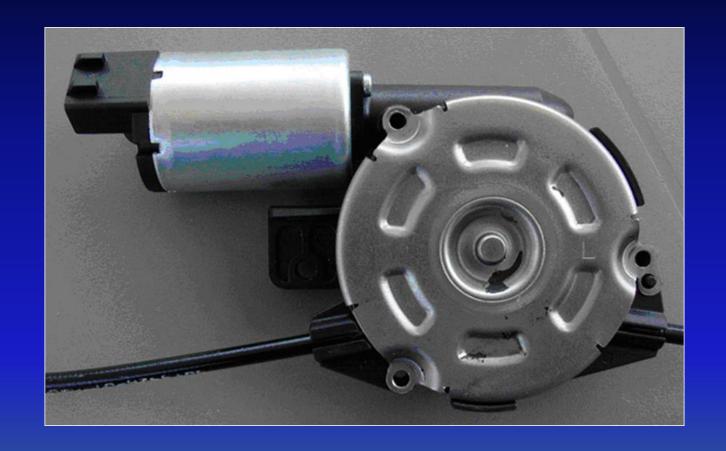


#### Honda Accord

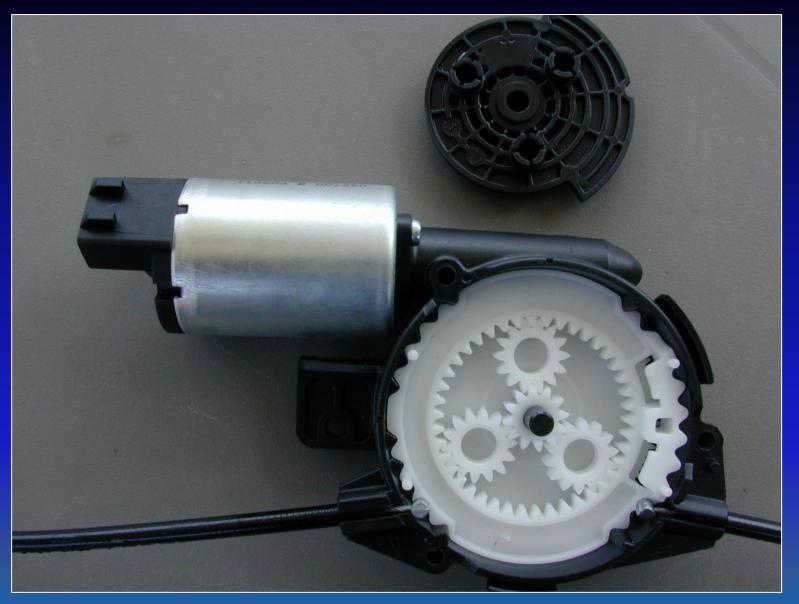




#### Lumbar Gear Drive







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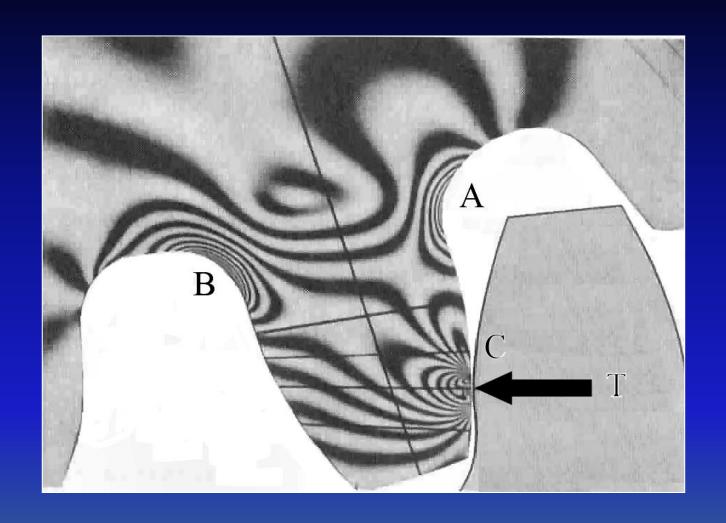


#### Satellite Gear Calculations

- Number of gear teeth = 14
- Metric module = 1.00
- Pressure angle = 20°
- Tooth arc thickness = 1.83 mm
- HOB addendum = 1.33 mm
- HOB tip radius = 0.43 mm
- Roll angle for loading = 42.556°
- Tooth face width = 4.5 mm
- Gear input torque = 953.5 N·mm
- Root diameter = 12.052 mm
- Y –Lewis form factor = 0.37039
- Load tangent to base circle = 144.956 N
- Load normal to tooth center line = 119.872 N
- Parabola height = 1.72
- Parabola base = 1.995
- Bending moment arm = 1.422 N·mm
- Load radius at center of tooth = 7.954 N



#### Satellite-Sun Gears FEA



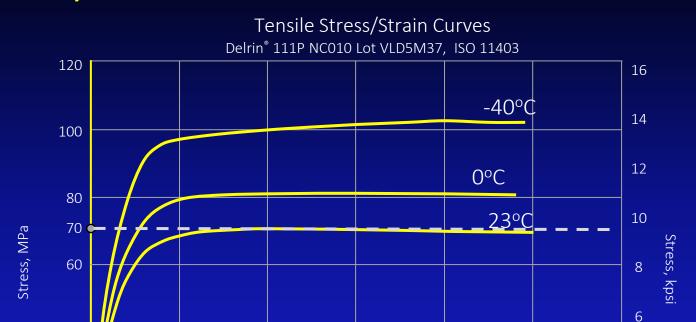


#### Satellite Gear MSA





#### Polymer Used: Delrin® 111P NC010



Strain, %

80°C

100°C

120°C



#### Solution





#### Fixing Mercedes Pitfall











## Washer Fluid Bottle



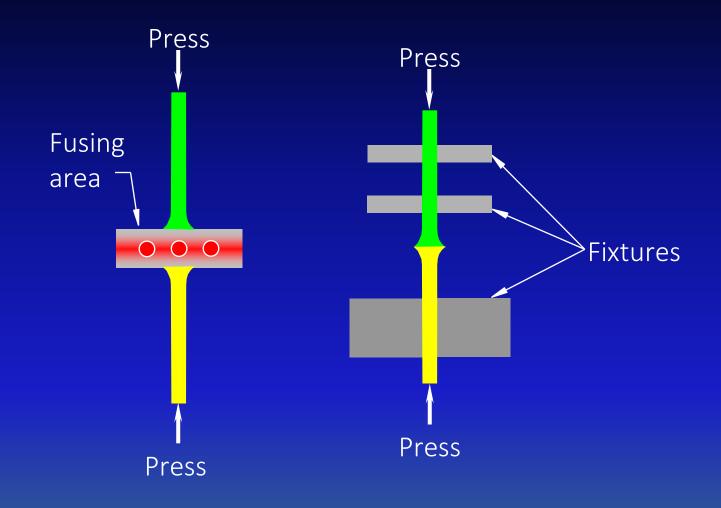


## Polypropylene Properties

PP Grade	PD-626	Units
Yield Stress	4,400	psi
Yield Strain	13	%
Flexural Modulus @ 1% secant	170,000	psi
Rockwell Hardness	N/A	R Scale
Heat Deflection Temperature @ 66 psi	190	٥F
Notched Izod Impact @ 73°F	0.5	ft·lb/in
Water Absorption after 24 hour	N/A	%
Density	0.9	g/cm³
Melt Flow Rate	12	dg/min

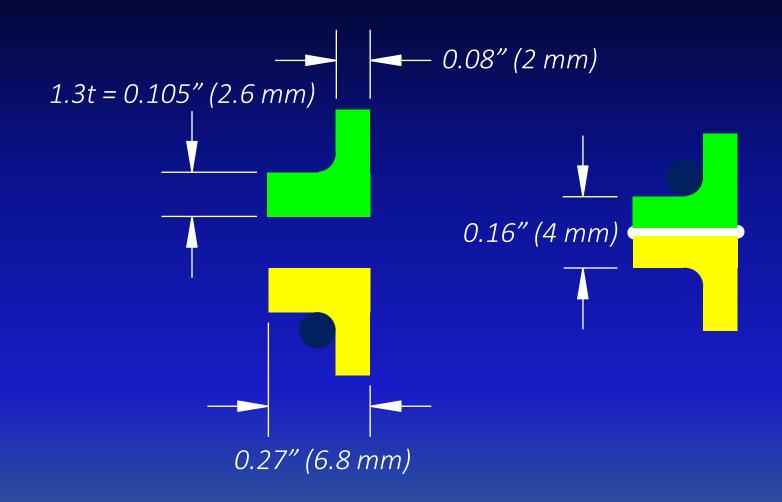


#### Hot Plate Welding Process





#### Weld Joint Design



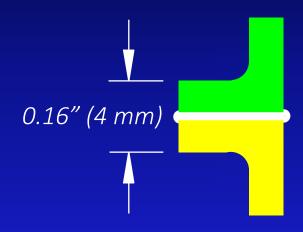


#### Bottle Volume Increased - 7.61





#### Weld Joint Desired



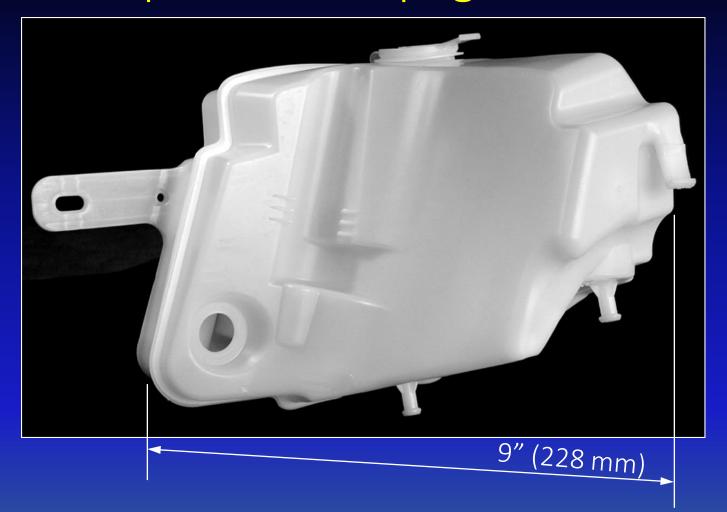


## Weld Joint Achieved





#### Deep Draw Warpage





#### Blow Molding for Redesign

- 9" deep draw induces large warpage
- Increasing 5l initial volume to 7.6l compounded the problem
- Welding tried to compensate for warpage
- Creates pre-stress condition in the weld joint

Solution

Blow molding process

eliminates the design pitfall





#### Paul A. Tres

#### **Designing Plastic Parts for Assembly**



Tres

Paul A. Tres

For over 20 years, Designing Plastic Parts for Assembly has been the definitive guide for both seasoned part designers and novices to the field, facilitating cost-effective design decisions and ensuring that the plastic parts and products will stand up under use.

The detailed yet simplified discussion of material selection, manufacturing techniques, and assembly procedures enables the reader to evaluate plastic materials and design plastic parts with confidence. Good joint design and implementation, the geometry and nature of the component parts, the types of load involved, and other fundamental information necessary for a successful outcome are all included. Throughout, the treatment is practice-oriented and focused on everyday problems and situations.

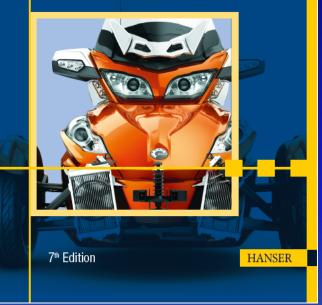
The 7th edition introduces a completely new chapter on overmolding and in-mold assembly, as well as a new chapter on bonding, including accompanying examples, Laser molding and ultrasonics coverage are also brought up to date, with illustrative case histories.

#### Content

- · Understanding Plastic Materials
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- Strength of Materials for Plastics
- · Nonlinear Considerations
- · Assembly Techniques for Plastics
- Press Fitting
- Living Hinges
- Snap Fitting
- Bonding
- . In-Mold Assembly

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www.hanserpublications.com Hanser Publications ISBN 978-1-56990-555-5

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## Thank you!

Questions??