DESIGN OF BAKING RACK FOR BICYCLE RIMS

Sponsor: Kory Moore, Manager of Operations and Supply – DT Swiss

By: Alain De la Bastide, Luke Caires, and Gregory Gonzales

Background

- DT Swiss is a high-end bicycle rim manufacturer located in Grand Junction, CO (20000 rims/year)
- Decals of the company's logo are applied to the outside of the carbon fiber rims before adding the spokes
- The project's design was based upon the Application Process of the Decals:
  1) Add waterslide decal to raw rim
  2) Hang on bread rack (inspection 1)
  3) Transfer rims from bread rack to the baking rack
  4) Move the baking rack into the oven
  5) Bake 1 (20min, @80°C)
  6) Inspection 2 (pink film removal)
  7) Bake 2 (30min, @150°C)
  8) Inspection 3
  9) Boxed for spoke addition
- Our solution is to improve this process by combining steps 2 & 3. Instead of hanging the rim in step two onto a bread rack it will go directly into a rack designed for the oven

Design Requirements

- Fit in oven's inner dimensions (48"x51.5"x72")
- Fits 25% more rims than the current baking rack
- Include a labeling system to indicate rim diameters and thicknesses, and baking process number
- Decrease the damage of handling by 5%
- Hold variety of rims (Diameter of 27.5-29" and width of 18-45mm)

Design Evaluation

This project will be evaluated considering 2 approaches:
- Physical testing of the rack's performance:
  • ie. Size, Rim stability.
  • Value added to the company:
  • ie. Overall decal process time, Process efficiency

Half Rack Design

Overhang Pressure Mechanism
- Fits a range of diameters
- Stabilize rims when rack is moving
- Reduce rim loading and unloading damage

Labeling System

Frame material: Extruded 80/20 1" Aluminum

Wooden Rods
- Allow for range of thicknesses
- Don't scratch rims

Oven

20 rims

71.5 in

25 in

46 in

51.5 in

72 in

20 rims

80 rims

48 in

Contact Information

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Acknowledgements

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# Design Evaluation

<table>
<thead>
<tr>
<th>Physical tests</th>
<th>Method</th>
<th>Pass/Fail Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oak-Rim Contact Damaging</td>
<td>Put a rim in the rack for 20-30 seconds and take it out</td>
<td>DT Swiss employee will perform and eye inspection and determine if the rim is acceptable</td>
</tr>
<tr>
<td>Static “Universal” Performance</td>
<td>Load five 35 mm rims next to each other. Then, load one more and check for contact between rims.</td>
<td>Is there contact between rims?</td>
</tr>
<tr>
<td>Dynamic “Universal” Performance</td>
<td>Load five 35 mm rims next to the frame. Roll the rack from decal station and into the oven</td>
<td>Is there contact between rims?</td>
</tr>
<tr>
<td>Expansion of different materials in contact</td>
<td>Measure the maximum thermal expansion of the Oak Beams and Metal Screws at 150°C using SOLIDWORKS</td>
<td>Is there Significant thermal expansion that could damage the design?</td>
</tr>
</tbody>
</table>

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## Design Evaluation

### Value Added Evaluation

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<tr>
<td>Measure the time to load and unload a rack with rims. Divide the total time by amount of rims (time per rim)</td>
<td>Compare time per rim with old rack and determine if our rack is easier to load</td>
</tr>
<tr>
<td>Measure the number of rims that go through the oven in one day</td>
<td>20% increase in produced rims?</td>
</tr>
<tr>
<td>Measure the number of damaged rims within a day</td>
<td>Damaged rims less than 5% of total?</td>
</tr>
</tbody>
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## Production Efficiency

- Ease of Use
- Production Efficiency
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Conclusion
• Considering limitations, the project was successful
• The team was able to design a rack that meets all the requirements from sponsor
  • Fits the oven inner dimensions (48"x51.5"x72")
  • Fits at least 74 rims
  • Includes a labeling system to indicate rim diameters and thicknesses, and baking process number
  • Holds variety of rims (Diameter of 27.5-29" and width of 18-45mm)
• Even though the rack is not fully manufactured at the moment, complete documentation will be handed off for a straightforward completion.
• Learning process
  • Improved working in team format for long periods of time
  • Improved long term project management
  • Improved machining skills and design for manufacturing concepts

Next Steps
• Complete Manufacturing of the rack
• Finalize testing and evaluations
• Manufacture second half of the rack
• Implement new racks in the DT Swiss Decals application process

Recommendations for future rack manufacturing
• Weld the frame together (Use Aluminum 1x1in square profile)
  • Reduce Assembly time and complexity.
  • Reduce maintenance
  • Increase stability and durability of the rack
• Utilize thicker wooden beams for holding wooden rods
  • Increase stability
  • Increase safety
  • Reduce maintenance frequency
• Consider redesigning the support wooden rods
  • Simplify attachments
• Casters positioning
  • Smaller Caster

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