EV STRUCTURE - LIGHTWEIGHT COMBO MADE OF OLPB DOOR RING & WAVE ROCKER

Dean Bartolomucci
Gestamp – Product Engineering Manager
EV PRODUCT FAMILY EXTREME SIZE PARTS

EXTREME SIZE PRODUCTS

1. ONE PIECE DOOR RING
2. ONE PIECE FLOOR
3. RING FRAME
4. ONE PIECE REAR FRAME
5. ONE PIECE DASHBOARD
6. ROOF RING
7. ROCKER REINFORCEMENT
8. FRONT RAIL SYSTEM

ADVANTAGES

GIGA STAMPING
- Integration of functions
- cost / performance / CO2 reduction
- Improved quality vs big assemblies

ASSEMBLY LINE AT OEM
- Reduction of complexity
- Less floor space

PERFORMANCE
- Optimum Crash & NVH performance.
- PHS hardened with ductile grades.
- Use of 2Gpa new PH grades.

POST TREATMENTS
- Laser Heat treatments to improve energy management performance and mechanical assembly options.
PRODUCTION DOOR RINGS

Dodge RAM

SUV

C Segment

~3.5 Million Door Rings produced

5 New awarded Door Ring projects:

1 DR TWB – Japanese OEM
1 DR TWB – UK OEM
1 DR Overlap Patch – US OEM
1 DR Overlap Patch – US OEM
1 DR Overlap Patch – German OEM

~3.5 Million/year
Key idea: Replace TWB process by simple RSW blank welding thanks to overlap the blanks.

**TWB SOLUTION**

- **Ablation needed**
  - Laser welding blanks
  - Complex welding process

**GESTAMP OVERLAP PATCH SOLUTION**

- **No Ablation Needed**
  - In-house Spot Welding
  - Easy blank welding adjustment

- **10-15% Part Price reduction vs Multi Piece**

**Overlap Joints are developed to structural requirements**

Disruptive in design, legacy processes
## BENEFITS OF OLPB DOOR RING

<table>
<thead>
<tr>
<th>PRODUCT PERFORMANCE GOALS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong> Overlapping Material Where Required</td>
</tr>
<tr>
<td>Best Crash performance and local / Global Stiffness. Glove Fit, no gaps, structural joints</td>
</tr>
<tr>
<td><strong>2</strong> Part Integration (with Patches)</td>
</tr>
<tr>
<td>Patch Solution (great weld integrity, no HAZ)</td>
</tr>
<tr>
<td>Integrated Reinforcements (e.g. Hinge Reinf.)</td>
</tr>
<tr>
<td><strong>3</strong> Right Material In The Right Place</td>
</tr>
<tr>
<td>Ductile Material Use To Prevent Failure Risk</td>
</tr>
<tr>
<td><strong>4</strong> Savings vs Multi-Piece Design</td>
</tr>
<tr>
<td>Complexity Reduction (~300 less OEM welds)</td>
</tr>
<tr>
<td>Reduction of material (addendum) and Tooling Improved dimensional quality</td>
</tr>
<tr>
<td>0 - 10% mass and 10 - 15% CO₂ reduction</td>
</tr>
</tbody>
</table>
DOOR RINGS NOW WITH PROPRIETARY OVERLAP TECHNOLOGY
GIGA STAMPING™ – OVERLAP PATCH DOOR RING

PATCH OVERLAP BLANKING WELDING PROCESS DESCRIPTION

A Pillar & Rocker blank centering

B & H Pillar centering

Welding process (RSW)

Overlapped areas

Geo weld Joints → Re-spot

Confidential - Proprietary Information of Gestamp: Any use, disclosure or reproduction of this information without Gestamp’s written permission is a violation of Gestamp’s right. All rights reserved.
WAVE ROCKER
ROCKER REINFORCEMENT

SPECIFIC PRODUCT FOR EV ARCHITECTURES

CHALLENGES

OEM Requirements

• Battery & occupant protection
• High energy absorption
• Cost & weight optimisation
ROCKER REINFORCEMENT FAMILY

SPECIFIC PRODUCT FOR EV ARCHITECTURES

Hydroformed Steel
Aluminum Extrusion
PHS

BENEFITS

OEM
- Architecture and material options
- Need to use specific materials
- Co-development of rocker concepts

- Family of energy mgt. solutions
- Aluminium and Steel alternatives
- New ductile PHS material grades
PH ROCKER ELIMINATING THE HIGH COST AL EXTRUSION
HIGHLY ENGINEERED PRODUCT - ROCKER REINFORCEMENT

Alternative to Aluminium extrusions:
- Same level of Energy absorption
- Stamped in E-Coat drainage channels
- Mass neutral potential
- Full battery protection in any given pole position

Savings:
- 20 - 30% Part Price reduction vs aluminium extrusion
- 0%-5% weight reduction vs aluminium
- Avoid adhesives in the assembly
- No KTL/E-Coat required
- 5% CO2 reduction

OEM Body assembly line simplification:
- No changes in joining strategy – Savings in body shop
- Standard resistance spot-welding
- No KTL drainage issues (channels in parts)

Industrial facilities available:
- Existing Mfg. facilities (Hydroforming & PHS)
Highly engineered product – rocker reinforcement

Flexible solution:
Customized design/materials for side crash strategy

Performance:
Equal against aluminum extrusion

Solutions for different battery tray strategy + passenger protection
**EV STRATEGIC PARTS:** ROCKER REINFORCEMENT

**FOR NON-STRUCTURAL BATTERY TRAY CONFIGURATION**

- Main load path to Seat Crossmembers
- Narrow sections possible
- Traditional RSW joining method
- Alternative to small aluminum rocker reinforcements

**HYDROFORMED CONCEPT**

**FOR STRUCTURAL BATTERY TRAY CONFIGURATION**

- Works with battery frame
- Same mass as Aluminum extrusion
- Avoids adhesives and multi-material joining

**HOT STAMPED CONCEPT**
WAVE ROCKER: ROCKET CONCEPT – STRUCTURAL BATTERY TRAY

Key idea: Replace Aluminum extrusion with PHS Wave design

GESTAMP ROCKET REINFORCEMENT CONCEPT

- Rear Support
  - USIBOR 1500
  - Thickness 1.3mm

- Rocket outer
  - DUCTIBOR 1000
  - Thickness 2.5mm

- Rocket patch
  - USIBOR 1500
  - Thickness 2.5mm

- Brackets
  - ZSTE 420
  - Thickness 1.5mm

- KTL drainage Channels

- Same level of energy absorption
  - Material grades – wave design and Rocket shape

- Equivalent intrusion
  - Battery protection for all pole positions

- Mass neutral potential

- Avoids adhesives in the assembly

- Part price reduction potential 20 - 30%

REF ALUMINIUM EXTRUSION

100% STEEL PROPOSAL

16.2 kg

15.8 kg
EV STRATEGIC PARTS: ROCKERS REINFORCEMENT

ROCKER WAVE DESIGN FOR EV’S

- **ALUMINUM REFERENCE**
  - Speed: 45km/h 
  - Scale: 1200

- **GESTAMP PROPOSAL**
  - Speed: 45km/h 
  - Scale: 1200

**CONCEPT VALIDATION**

- **t = 0ms**
- **t = 10ms**
- **t = 12ms**
- **t = 14ms**
- **t = 20ms**
EV STRATEGIC PARTS: ROCKER REINFORCEMENT

PRESS HARDENING – Steel solution

ROCKER WAVE DESIGN FOR EV’S

CONCEPT VALIDATION

Rocker Intrusion

Energy Absorption

ALUMINIUM REFERENCE

Reinforcement | Sub Assembly
---|---
35,5 | 56,4

GESTAMP PROPOSAL

Reinforcement [Relative %] | Sub Assembly [Relative %]
---|---
34,3 | 96% | 56,4 | 100%

max intrusion at battery contact surface: 71.2mm

max intrusion at battery contact surface: 70.2mm
SMART Hydroforming Reinforcement Concept

Smart Hydroforming Rocker Reinforcement

MATERIAL OPTIONS:
- TRIP/DP/CP 600/800 grades
- 3rd generation steels

Maximize energy absorption and adapt to environment

Flexible spot weld location

Removal of adhesives needed in Aluminum designs

Improved KTL coverage concept with design gaps

Forming sims courtesy of Vari-Form
WAVE ROCKER: HYDRO CONCEPT

HYDROFORMING – STEEL SOLUTION

PROTOTYPING

TESTING VALIDATION
WAVE ROCKER: HYDRO CONCEPT

Hydro Prototypes: Full validation on going

STATIC POLE TEST IN PROGRESS
Summary

- **OLPB Door Rings**
  - Key Benefits
    - Cost/Weight reduction vs. Multipiece
    - Cost Reduction vs. TWB One-piece
    - Part consolidation: OEM Body Shop space, complexity & dimensional
    - Technology risks mitigated – Validation projects complete
      - Lessons learned – Design/Tooling best practices
      - Surrogate panel performance confirms functional objectives achieved
  - Launching now

- **Wave Rocker**
  - Key Benefits
    - Cost
    - Standard RSW joining method
    - Minimal to no change to BIW assembly
    - Existing Mfg. facilities (Hydroforming & PHS)
    - Comparable weight/performance to Aluminum