2019 Acura RDX World’s First Inner & Outer Door Ring System

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Honda R&D Americas, Inc.
Ohio R&D Center

- Location: Raymond, Ohio
- Size of Building: +1.6 million sq. ft.
- Number of Associates: 1,600+
- Began operations in current building: 1993
- Started operations in Ohio: 1984
- HRA began in California: 1975
The All-New Acura RDX

The third generation RDX is the quickest, best-handling RDX ever
Top-class cabin and cargo space, and a host of groundbreaking new Acura technologies

- Recent New York auto show debut
- Most extensive overhaul in a decade
- First new styling direction full model change
- Exclusive platform
- VTEC® Turbo engine
- 10-speed transmission
- Acura's True Touchpad Interface
BODY CONCEPT
This body development is all about Super Handling, Acura’s pursuit of new levels of dynamic capability, with no sacrifice to safety.

**Super Handling | Protected**

New Rigid load paths for stiffness

Double Ring Construction for improved stiffness

Outer & Inner Hot Stamp Door Rings (World First)

Outer & Inner Door Ring Maintains safety targets with Panoramic Roof Opening

Front Crash, Side Crash, Roll-over Meet or exceed targets
This body development is all about Super Handling, Acura’s pursuit of new levels of dynamic capability, with no sacrifice to safety.

**Super Handling | Protected**

- New Rigid load paths for stiffness

**Panoramic Roof Opening**

Front Crash, Side Crash, Roll-over Meet or exceed targets
50% increase in ultra high strength material
Contributes to 19kg weight-down

- 56% of whitebody is some form of High Strength Steel
- 26% of whitebody is Advanced High Strength Steel or higher
INNER & OUTER HOT STAMPED DOOR RING SYSTEM
Acura has been advancing hot-stamped door ring technology forward for over a decade, working closely with our partners – beginning with 2014 MDX.
History of Single Ring Concept

The Door ring was a natural progression in the application of hot stamp material on Acura vehicles.
In a world first, Acura has created an inner and outer door ring system that takes full advantage of this technology and frees-up tremendous design possibilities.
Inner ring incorporates inner side sill
Enables improved connections to floor structure & roof structure
Tailor welding enables thickness optimization around the ring
Maximizes performance & material utilization
Outer ring evolution has continued since first application on 2014 Acura MDX
As part of a system, outer ring can be further optimized to balance with inner ring for reduced weight
Tailor welding enables thickness optimization around the ring
Maximizes performance & material utilization
Door Ring System Benefits

- The Welded joints are the weak point in the system and typically need c/m.
- Deleting overlapping material allows for weight down
- Pillar offset from Sill structure, Not efficient load path.
- From MDX & TLX we learned that smooth joints can allow for more efficient design

Conventional

Ring System concept

Front Pillar  
Center Pillar
B-pillar Gauge Optimization

**Ctr-Plr Lower Joint Study**

Vehicle load cases applied

<table>
<thead>
<tr>
<th>Start</th>
<th>Result (New RDX)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.700 kg</td>
<td>11.704 kg</td>
</tr>
<tr>
<td>3.85 E+06 Nm</td>
<td>3.281 E+06 Nm</td>
</tr>
</tbody>
</table>

15% Lighter
0% change in stiffness
MANUFACTURING
Inner structure is welded to floor before outer structure is applied

1. Front inner & rear inner welded to floor structure
   Front roof rail, rear roof rail, & windshield lower welded to structure
2. Outer panel comp & roof comp applied to the whitebody
HIGH PERFORMANCE ADHESIVE
Starting with HPA in all Level-1 comp flanges (excluding engine room), optimization found best HPA layout for the least total volume.
Resulting HPA pkg allows for 8.7 kg weight down

Starting HPA pkg
Optimization (hotspots shown)
Optimized Pkg
Gauge up parts necessary to achieve same performance
Total mass up = +9.8 kg
RESULTS
While adding a standard panoramic sunroof, Acura increased fitting point stiffness & body rigidity by every measure.

### Super Handling

#### Fitting Point Stiffness

<table>
<thead>
<tr>
<th></th>
<th>17M</th>
<th>19M</th>
<th>%</th>
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</thead>
<tbody>
<tr>
<td>Front Damper</td>
<td>22.94</td>
<td>33.37</td>
<td>+46%</td>
</tr>
<tr>
<td>C Mount</td>
<td>15.41</td>
<td>24.85</td>
<td>+61%</td>
</tr>
<tr>
<td>D Mount</td>
<td>15.59</td>
<td>27.65</td>
<td>+77%</td>
</tr>
<tr>
<td>Rear Damper</td>
<td>23.94</td>
<td>30.11</td>
<td>+26%</td>
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</tbody>
</table>

#### Body Rigidity

<table>
<thead>
<tr>
<th></th>
<th>17M</th>
<th>19M</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tire Patch Lateral</td>
<td>389</td>
<td>878</td>
<td>+125%</td>
</tr>
<tr>
<td>Damper Torsion</td>
<td>801</td>
<td>843</td>
<td>+5%</td>
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<tr>
<td>Damper Bending</td>
<td>1519</td>
<td>2259</td>
<td>+49%</td>
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<tr>
<td>Tire Patch Lateral</td>
<td>1295</td>
<td>1314</td>
<td>+35%</td>
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<tr>
<td>Damper Torsion</td>
<td>602</td>
<td>614</td>
<td>+2%</td>
</tr>
<tr>
<td>Damper Bending</td>
<td>1349</td>
<td>1536</td>
<td>+14%</td>
</tr>
</tbody>
</table>

Increased Fitting Point Stiffness

- Improves Road Noise

Increased Body Rigidity

- Contributes to improved handling

37m of High performance Adhesive

- Results in – 9kg of mass,
- While increasing stiffness
Expected Safety Results

- Applying a Standard Panoramic Sunroof, RDX excepts to achieve all safety requirements (based on internal testing)

### Roof Crush

- Roof Crush Testing

### CRASHWORTHINESS
- SMALL OVERLAP
- MODERATE OVERLAP
- SIDE
- ROOF STRENGTH
- HEAD RESTRAINTS & SEATS

### CRASH AVOIDANCE & MITIGATION
- FRONT CRASH PREVENTION (ACURA WATCH™)
- HEADLIGHTS + AFS*
  *ADAPTIVE FRONT-LIGHTING SYSTEM AVAILABLE ON ADV
Honda R&D & Dassault codeveloped Real Impact software
CONCLUSION

50% increase in ultra high strength material
Contributes to 19kg weight-down