Compatibility Between Two Rear Impact Dummies and Two Rear Impact Pulses

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NHTSA
Annex 9/FMVSS 202 Pulse Testing

- **Objective**
  - Test BioRID II & HIII 50th with FMVSS 202 pulse
    - In four levels of backset
    - Very bad, bad, good, very good
  - Test BioRID II & HIII 50th with Annex 9 pulse
    - In four levels of backset
    - Very bad, bad, good, very good
- **Evaluate results**
  - Dummy response – same trend?
  - 202a & J-NCAP, E-NCAP scores – are seats rated similarly?
FMVSS 202 vs Annex 9

Curves are approximate

FMVSS 202 – 17.3 ± 0.6 kph
Annex 9 -- 15.65 ± 0.8 kph

Comparison:
min to max ΔV:
17.30 – 0.6 = 16.70 kph
15.65 + 0.8 = 16.45 kph

max G:
8.0 G to 9.4 G
9.0 G to 11.0 G
Four Head Restraint Positions

<table>
<thead>
<tr>
<th>Head Restraint Backset</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 mm</td>
</tr>
<tr>
<td>75 mm</td>
</tr>
<tr>
<td>50 mm</td>
</tr>
<tr>
<td>25 mm</td>
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</tbody>
</table>

Very   Good  Bad   Very   Good  Bad   Very   Good  Bad

100 mm  75 mm  50 mm  25 mm
## Test Matrix by test number

<table>
<thead>
<tr>
<th>Test</th>
<th>Pulse</th>
<th>Backset</th>
<th>Occupants</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 4</td>
<td>202a</td>
<td>25, 50 mm (Good) 75, 100 mm (Bad)</td>
<td>BioRID II &amp; HIII</td>
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<tr>
<td>5 - 8</td>
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<td>Repetition of above conditions</td>
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<tr>
<td>9 - 12</td>
<td>Annex 9</td>
<td>25, 50 mm (Good) 75, 100 mm (Bad)</td>
<td>BioRID II &amp; HIII</td>
</tr>
<tr>
<td>13 - 16</td>
<td></td>
<td>Repetition of above conditions</td>
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</tbody>
</table>

- Rear Impact Research Buck
- Repeatable seat back “collapse”
- Instrumented seat backs (load, acceleration, angular velocity)
- Side-by-side configuration

- Backset conditions randomized

- Instrumentation and video analysis redundancies/comparisons
Analysis

Dummy Results:
- Upper neck My
- Lower neck My
- Upper neck Fz
- Upper neck Fx
- Lower neck Fz
- Lower neck Fx
- Head X & Z acceleration
- HIC
- T1 X & Z acceleration
- Head w/r T1 Angle
- NIC
- Nkm

Do the two dummies and two pulses rate seats the same?
Analysis: FMVSS 202a

- Head to T1 max. angular displacement < 12°
- $HIC_{15} < 500$

![3D diagram showing classifications based on P/F and HIII/BioRID scores.](image)

- Very Good seat
- Good seat
- Bad seat
- Very Bad seat

202 Annex 9
## Analysis: EuroNCAP

### High, Low and Capping limits – medium pulse

<table>
<thead>
<tr>
<th>Euro NCAP Criteria</th>
<th>Units</th>
<th>HPL</th>
<th>LPL</th>
<th>CL</th>
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<tbody>
<tr>
<td>NIC</td>
<td>m²/s²</td>
<td>11,00</td>
<td>24,00</td>
<td>27,00</td>
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<tr>
<td>Nkm</td>
<td>-</td>
<td>0,15</td>
<td>0,55</td>
<td>0,69</td>
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<td>Rebound velocity</td>
<td>m/s</td>
<td>3,20</td>
<td>4,80</td>
<td>5,20</td>
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<td>Upper Neck Shear Fx</td>
<td>N</td>
<td>30,00</td>
<td>190,00</td>
<td>290,00</td>
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<tr>
<td>Upper Neck Tension Fz</td>
<td>N</td>
<td>360,00</td>
<td>750,00</td>
<td>900,00</td>
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<tr>
<td>T1 acceleration</td>
<td>g</td>
<td>9,30</td>
<td>13,10</td>
<td>15,55</td>
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<tr>
<td>Time to head restraint first contact</td>
<td>ms</td>
<td>57,00</td>
<td>82,00</td>
<td>92,00</td>
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</tbody>
</table>
Six criteria * 0.5 points max. each = 3 points max.
Analysis: EuroNCAP

HIII

BioRID

E-NCAP points

E-NCAP points

202

Annex 9

Very Good seat

Good seat

Bad seat

Very Bad seat
Analysis: J-NCAP

NIC – 4 points max.
Upper/Lower My – 4 points max.
Upper/Lower Fx – 4 points max. (head backward)
Upper Fz – 4 point max. (tension)
Lower Fz – 4 points max. (tension)

Score = NIC + Worst * 2
12 points max.
Analysis: J-NCAP

HIII

BioRID

J-NCAP points

J-NCAP points

J-NCAP points

Very Good seat

Good seat

Bad seat

Vary Bad seat

202

Annex 9
## Schedule

### Annex 9/FMVSS 202 Testing with BioRID and HIII

<table>
<thead>
<tr>
<th>Tasks</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
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<td>Prepare testing plan</td>
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<td>Select seats for testing - &quot;good&quot; &amp; &quot;bad&quot;</td>
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### Current Status
Thank you