

**REPORT NUMBER TR-P28003-01-NC**

**NEW CAR ASSESSMENT PROGRAM  
SIDE IMPACT TEST**

**TOYOTA MOTOR MANUFACTURING CANADA  
2008 LEXUS RX350  
5-DOOR MPV**

**NHTSA NUMBER: M85103**

**PREPARED BY:  
KARCO ENGINEERING, LLC  
9270 HOLLY ROAD  
ADELANTO, CALIFORNIA 92301**



**SEPTEMBER 5, 2007**

**FINAL REPORT**

**PREPARED FOR:  
U.S. DEPARTMENT OF TRANSPORTATION  
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION  
RULEMAKING  
OFFICE OF CRASHWORTHINESS STANDARDS  
MAIL CODE: NVS-111  
1200 NEW JERSEY AVE SE, ROOM W43-410  
WASHINGTON, D.C. 20590**

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# Technical Report Documentation Page

|                                                                                                                                                                                                                                                                                                                                                                                                          |  |                                                                |                  |                                                                                                                                                                                                                             |                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| <b>1. Report No.</b><br>TR-P28003-01-NC                                                                                                                                                                                                                                                                                                                                                                  |  | <b>2. Government Accession No.</b>                             |                  | <b>3. Recipients Catalog No.</b>                                                                                                                                                                                            |                  |
| <b>4. Title and Subtitle</b><br>Final Report of an Evenflo Discovery CRS<br>NIHTSA No. M85103                                                                                                                                                                                                                                                                                                            |  |                                                                |                  | <b>5. Report Date</b><br>September 5, 2007                                                                                                                                                                                  |                  |
|                                                                                                                                                                                                                                                                                                                                                                                                          |  |                                                                |                  | <b>6. Performing Organization Code</b><br>KAR                                                                                                                                                                               |                  |
| <b>7. Authors</b><br>Mr. Johnny H. Dutto, Project Engineer, Karco<br>Mr. Frank Richardson, Program Manager, Karco                                                                                                                                                                                                                                                                                        |  |                                                                |                  | <b>8. Performing Organization Report No.</b><br>TR-P28003-01-NC                                                                                                                                                             |                  |
| <b>9. Performing Organization Name and Address</b><br>Karco Engineering, LLC<br>9270 Holly Rd.<br>Adelanto, CA, 92301                                                                                                                                                                                                                                                                                    |  |                                                                |                  | <b>10. Work Unit No.</b>                                                                                                                                                                                                    |                  |
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| <b>12. Sponsoring Agency Name and Address</b><br>U. S. Department of Transportation<br>National Highway Traffic Safety Administration<br>Rulemaking<br>Office of Crashworthiness Standards<br>Mail Code NVS-111<br>1200 New Jersey Ave SE, Room W43-410<br>Washington, D.C 20590                                                                                                                         |  |                                                                |                  | <b>13. Type of Report and Period Covered</b><br>Final Test Report                                                                                                                                                           |                  |
|                                                                                                                                                                                                                                                                                                                                                                                                          |  |                                                                |                  | <b>14. Sponsoring Agency Code</b><br>DOT/NHTSA/NRM/OCS                                                                                                                                                                      |                  |
| <b>15. Supplementary Notes</b>                                                                                                                                                                                                                                                                                                                                                                           |  |                                                                |                  |                                                                                                                                                                                                                             |                  |
| <b>16. Abstract</b><br><br>A side impact test was conducted on the subject CRS Evenflo Discovery in conjunction with side impact NCAP testing on a 2008 Lexus RX350 5-Door MPV and in accordance with the specifications of the Office of Crashworthiness Standards Test Procedure for the determination of CRS crashworthiness. This test was conducted at Karco Engineering, LLC on September 5, 2007. |  |                                                                |                  |                                                                                                                                                                                                                             |                  |
| <b>Measurement Description</b>                                                                                                                                                                                                                                                                                                                                                                           |  | <b>Units</b>                                                   | <b>Threshold</b> | <b>Right Rear (P3)</b>                                                                                                                                                                                                      |                  |
| Head Injury Criteria (HIC15)                                                                                                                                                                                                                                                                                                                                                                             |  | N/A                                                            | 390              | 78.0                                                                                                                                                                                                                        |                  |
| 3 msec. Chest Clip                                                                                                                                                                                                                                                                                                                                                                                       |  | G's                                                            | 50               | 23.4                                                                                                                                                                                                                        |                  |
| <b>17. Key Words</b><br>New Car Assessment Program (Side Impact NCAP)<br>Side Impact<br>Moving Deformable Barrier (MDB)<br>Final Report of an Evenflo Discovery CRS                                                                                                                                                                                                                                      |  |                                                                |                  | <b>18. Distribution of Statement</b><br>Copies of this report available from:<br>NIHTSA Technical Reference Division<br>National Highway Traffic Safety Admin.<br>1200 New Jersey Ave SE, W43-410<br>Washington, D.C. 20590 |                  |
| <b>19. Security Classification (this report)</b><br>Unclassified                                                                                                                                                                                                                                                                                                                                         |  | <b>20. Security Classification (this page)</b><br>Unclassified |                  | <b>21. No. of Pages</b><br>44                                                                                                                                                                                               | <b>22. Price</b> |

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## SECTION D-1

### PURPOSE AND SUMMARY OF TEST M85103

The purpose of this test is to obtain CRS performance data during a 55/28 km/h 90 deg. Moving Deformable Barrier Side Impact NCAP Test

The Side Impact NCAP test was conducted in accordance with the Office of Crashworthiness Standards (OCS) NCAP Laboratory Test Procedure.

### SUMMARY

One 12-month old CRABI (P3) was instrumented with head, chest, and six-axis upper neck load cells. A tri-axial accelerometer was installed on the CRS and the CRS base. Seat belt load cells were placed on the inboard and outboard lower tethers.

The right rear (Serial No. 022) CRABI was calibrated prior to this test. CRABI calibration information is found in Section D-4.

| CHILD DUMMY VALUES |             |                    |
|--------------------|-------------|--------------------|
| Location           | HIC15 Value | 3 Msec. Chest Clip |
| CRABI (P3)         | 78.0        | 23.4               |

**DATA SHEET NO.1**  
**CRASH TEST SUMMARY**

Test Vehicle: 2008 Lexus RX3505-Door MPV

NHTSA No.: M85103

Test Program: 55/28 km/h Side Impact NCAP

Test Date: 9/05/07

**CHILD RESTRAINT SYSTEM INFORMATION**

| Description      | Position #3 CRS |
|------------------|-----------------|
| Manufacturer     | Evenflo         |
| Model Name       | Discovery       |
| Model No.        | 3901698 L1      |
| Type             | Infant          |
| Forward/Rearward | Rearward        |

**VISIBLE DUMMY CONTACT POINTS**

| Description        | Position #3 CRS   |
|--------------------|-------------------|
| Head Contact       | Right Side of CRS |
| Chest Contact      | None              |
| Abdomen Contact    | None              |
| Left Knee Contact  | None              |
| Right Knee Contact | None              |
| Left Toe Contact   | Seatback          |
| Right Toe Contact  | Seatback          |

**POST-TEST DOOR OPENINGS**

| Description     | Position #3 CRS                                   |
|-----------------|---------------------------------------------------|
| Right Rear Door | Opened without tools, Remained closed during test |

**CAMERAS**

| Description | Standard |
|-------------|----------|
| High Speed  | 1        |
| Real Time   | 0        |
| Total       | 1        |

**DATA CHANNELS**

|                    |    |
|--------------------|----|
| CRABI (P3) Sensors | 13 |
| Belt Sensors       | 2  |
| CRS Sensors        | 6  |
| Total              | 21 |

**DATA SHEET NO.2**  
**VEHICLE PARAMETER DATA**

Test Vehicle: 2008 Lexus RX3505-Door MPV

NHTSA No.: M85103

Test Program: 55/28 km/h Side Impact NCAP

Test Date: 9/05/07

**TEST VEHICLE WEIGHTS**

|        | Units | As Delivered Weights (UVW) |           |       | As Tested Weights (ATW) |           |       |
|--------|-------|----------------------------|-----------|-------|-------------------------|-----------|-------|
|        |       | Front Axle                 | Rear Axle | Total | Front Axle              | Rear Axle | Total |
| Left   | kg    | 540                        | 379       | 919   | 584                     | 471       | 1055  |
| Right  | kg    | 517                        | 363       | 880   | 534                     | 443       | 977   |
| Ratio  | %     | 58.8                       | 41.2      | 100   | 55.0                    | 45.0      | 100   |
| Totals | kg    | 1057                       | 742       | 1799  | 1119                    | 914       | 2032  |

**TARGET TEST WEIGHT CALCULATION**

| Measured Parameter                   | Units | Value |
|--------------------------------------|-------|-------|
| Total Delivered Weight (UVW)         | kg    | 1799  |
| Weight of 2 P572 ATD's               | kg    | 162   |
| Rated Cargo/Luggage Wt. (RCLW)       | kg    | 79    |
| Calculated Vehicle Target Wt. (TVTW) | kg    | 2040  |

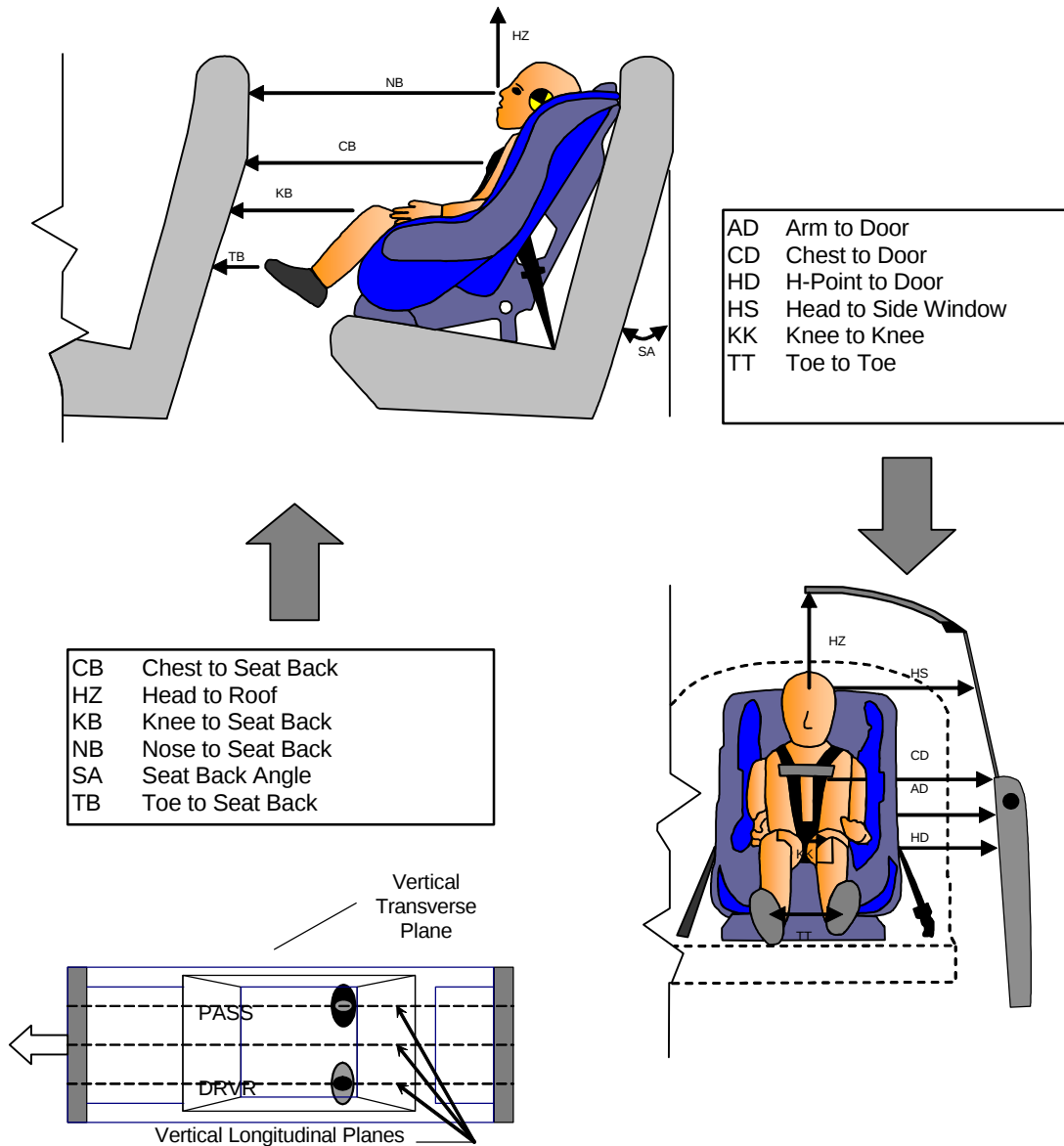
# **DATA SHEET NO.3** **CRABI POSITIONING IN VEHICLE**

Test Vehicle: 2008 Lexus RX3505-Door MPV

NHTSA No.: M85103

Test Program: 55/28 km/h Side Impact NCAP

Test Date: 9/05/07



## **DUMMY MEASUREMENTS FOR REAR SEAT OCCUPANTS**

**DATA SHEET NO.3**  
**CRABI POSITIONING IN VEHICLE...(CONTINUED)**

Test Vehicle: 2008 Lexus RX3505-Door MPV

NHTSA No.: M85103

Test Program: 55/28 km/h Side Impact NCAP

Test Date: 9/05/07

**CRABI POSITION MEASUREMENTS**

| Code     | Measurement         | P3 (Passenger's Side) |           |
|----------|---------------------|-----------------------|-----------|
|          |                     | Length (mm)           | Angle (°) |
| SA       | Seat Back Angle     |                       | 76.4      |
| HZ       | Head to Roof (Z)    | 390                   |           |
| CD       | Chest to Door       | 385                   |           |
| KK       | Knee to Knee (Y)    | 125                   |           |
| HS       | Head to Side Window | 410                   |           |
| HD       | H-Point to Door (Y) | 290                   |           |
| AD       | Arm to Door         | 265                   |           |
| NB       | Nose to Seat Back   | 510                   |           |
| CB       | Chest to Seat Back  | 430                   |           |
| FF       | Foot to Foot        | 120                   |           |
| KB-Left  | Knee to Seat Back   | 190                   |           |
| KB-Right | Knee to Seat Back   | 185                   |           |
| TB-Left  | Toe to Seat Back    | 46                    |           |
| TB-Right | Toe to Seat Back    | 43                    |           |

**DATA SHEET NO.4**  
**CRS PERFORMANCE DATA**

Test Vehicle: 2008 Lexus RX3505-Door MPV

NHTSA No.: M85103

Test Program: 55/28 km/h Side Impact NCAP

Test Date: 9/05/07

**CRS PERFORMANCE DATA**

| Location                    | CRS (P3) |           |
|-----------------------------|----------|-----------|
|                             | Damage   | Post-Test |
| Upper Tether Strap          |          |           |
| Upper Tether Buckle         |          |           |
| Upper Tether Hook           |          |           |
| Veh. Upper Tether Anchor    |          |           |
| Lower Anchor Strap          | No       | None      |
| Lower Anchor Buckle         | No       | None      |
| Lower Anchor Hooks          | No       | None      |
| Veh. Lower CRS Anchors      | No       | None      |
| 5-Point Harness Connections | No       | None      |
| Cracks on CRS               | *No      | None      |
| Fabric Tears on CRS         | No       | None      |
| Vehicle Seat Structure      | No       | None      |
| Vehicle Seat Fabric Tears   | No       | None      |

\*CRS seat separated from CRS base during impact.

**DATA SHEET NO. 5**  
**CRS ACCELEROMETER LOCATIONS**

Test Vehicle: 2008 Lexus RX350 5-Door MPV

Test Program: 55/28 km/h Side Impact NCAP

NHTSA No.: M85103

Test Date: 9/5/07

**CRS ACCELEROMETER PRE-TEST LOCATIONS**

| Loc.<br>No. | Accelerometer Location | Measurements (mm) |     |     |
|-------------|------------------------|-------------------|-----|-----|
|             |                        | X                 | Y   | Z   |
| 1           | CRS                    | 1745              | 560 | 815 |
| 2           | CRS Base               | 1765              | 560 | 730 |

Reference Planes: X=From Rear Surface of Vehicle, Y=Vehicle Centerline, Z=Ground Plane

**DATA SHEET NO.6**  
**CRS CAMERA LOCATIONS AND DATA**

Test Vehicle: 2008 Lexus RX3505-Door MPV

NHTSA No.: M85103

Test Program: 55/28 km/h Side Impact NCAP

Test Date: 9/05/07

**CAMERA LOCATIONS**

| No. | Camera View          | Location(mm) |      |       | Angle<br>(Deg.) | Film<br>Plane to<br>Head | Lens<br>(mm) | Speed<br>(fps) |
|-----|----------------------|--------------|------|-------|-----------------|--------------------------|--------------|----------------|
|     |                      | X            | Y    | Z     |                 |                          |              |                |
| 1   | Passenger CRS (O.B.) | 1330         | 2360 | -1640 | -2              | n/a                      | 10           | 1000           |

X = Barrier Face Y = Monorail Centerline Z = Ground DNR = Did Not Run NTM = No Time Marks

SECTION D2

PHOTOGRAPHS

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**Manufactured in 13JUN07**

**Model # 3901698 L1**

Figure D2-1: Position 3 CRS Label

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Figure D2-2: Pre-Test Frontal View of Position 3 CRS



Figure D2-3: Post-Test Frontal View of Position 3 CRS



Figure D2-4: Pre-Test Rear View of Position 3 CRS



Figure D2-5: Post-Test Rear View of Position 3 CRS



Figure D2-6: Pre-Test Left Side View of Position 3 CRS



Figure D2-7: Post-Test Left Side View of Position 3 CRS



Figure D2-8: Pre-Test Right Side View of Position 3 CRS



Figure D2-9: Post-Test Right Side View of Position 3 CRS



Figure D2-10: Pre-Test Position 3 Front View (Head and Seat Belt Position)



Figure D2-11: Post-Test Position 3 Front View (Head and Seat Belt Position)



Figure D2-12: Pre-Test Position 3 Front View (Seat Belt Position)



Figure D2-13: Post-Test Position 3 Front View (Seat Belt Position)



Figure D2-14: Pre-Test Position 3 Right Side View



Figure D2-15: Post-Test Position 3 Right Side View



Figure D2-16: Pre-Test Position 3 Right Side View (Through Window)



Figure D2-17: Post-Test Position 3 Right Side View (Through Window)



## SECTION D3

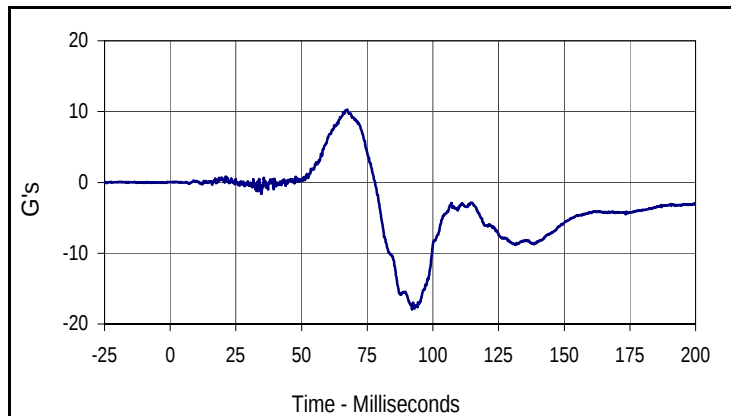
### CRABI RESPONSE AND CRS DATA TRACES

# LIST OF DATA PLOTS

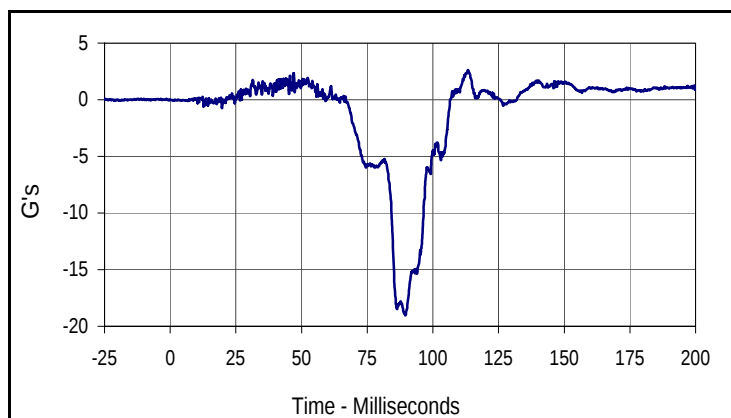
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| <div>D3-2</div> <div>Right Rear CRABI Chest X</div> <div>Right Rear CRABI Chest Y</div> <div>Right Rear CRABI Chest Z</div> <div>Right Rear CRABI Chest Resultant</div> | <div>D3-2</div> <div>D3-2</div> <div>D3-2</div> <div>D3-2</div> |

Test Vehicle: 2008 Lexus RX350 5-Door MPV  
 Test Program: 55/28 km/h Side Impact NCAP

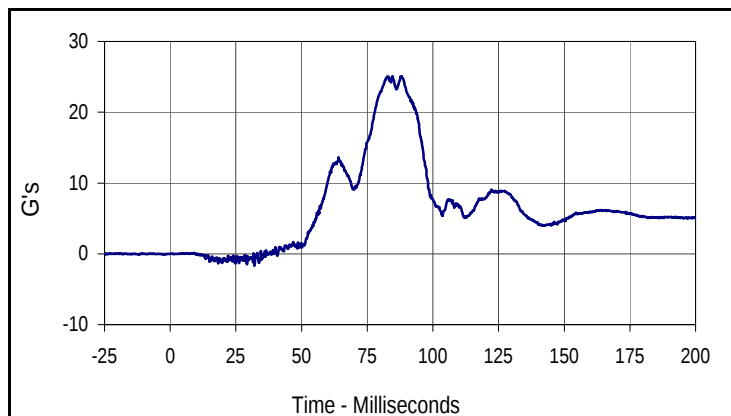
Test Date: 9/5/07  
 NHTSA No.: M85103



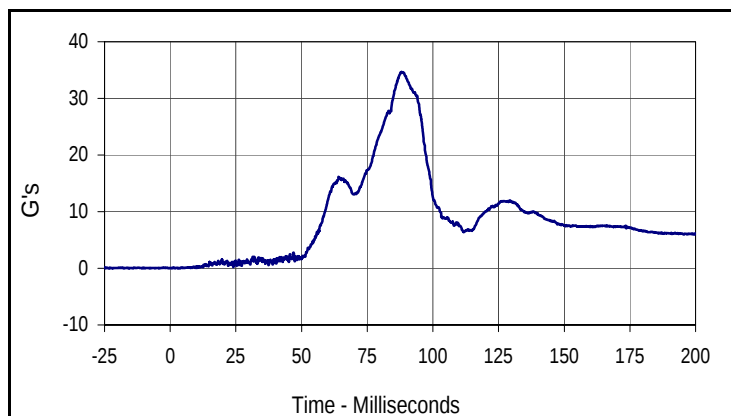
| Curve Description |      |           |       |
|-------------------|------|-----------|-------|
| CRABI Head X (P3) |      |           |       |
| CURNO             | Type | SAE Class | Units |
| 072               | FIL  | 1000      | G's   |
| Max               | Time | Min       | Time  |
| 10.3              | 67.4 | -17.9     | 92.1  |



| Curve Description |       |           |       |
|-------------------|-------|-----------|-------|
| CRABI Head Y (P3) |       |           |       |
| CURNO             | Type  | SAE Class | Units |
| 073               | FIL   | 1000      | G's   |
| Max               | Time  | Min       | Time  |
| 2.6               | 113.4 | -19.0     | 89.5  |



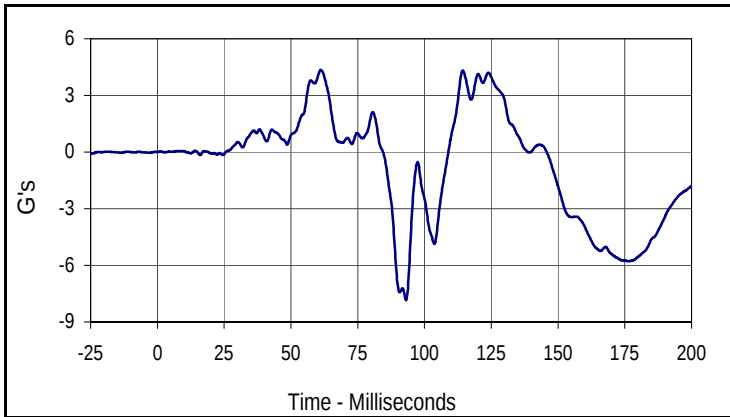
| Curve Description |      |           |       |
|-------------------|------|-----------|-------|
| CRABI Head Z (P3) |      |           |       |
| CURNO             | Type | SAE Class | Units |
| 074               | FIL  | 1000      | G's   |
| Max               | Time | Min       | Time  |
| 25.1              | 88.1 | -1.7      | 32.0  |



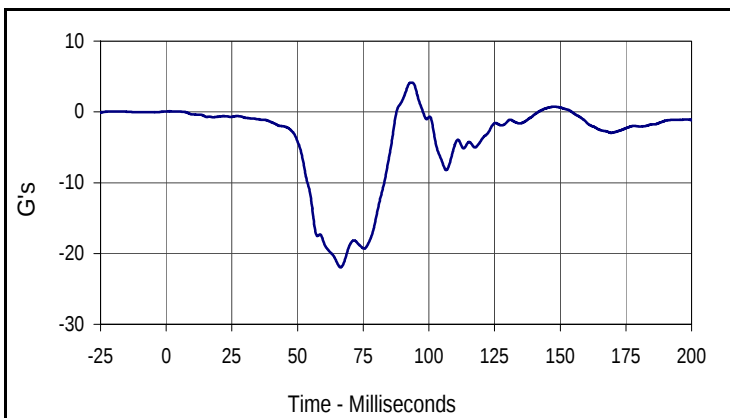
| Curve Description         |      |           |       |
|---------------------------|------|-----------|-------|
| CRABI Head Resultant (P3) |      |           |       |
| CURNO                     | Type | SAE Class | Units |
| 072                       | RES  | 1000      | G's   |
| Max                       | Time | Min       | Time  |
| 34.7                      | 88.0 | 0.0       | 1.7   |

Test Vehicle: 2008 Lexus RX350 5-Door MPV  
 Test Program: 55/28 km/h Side Impact NCAP

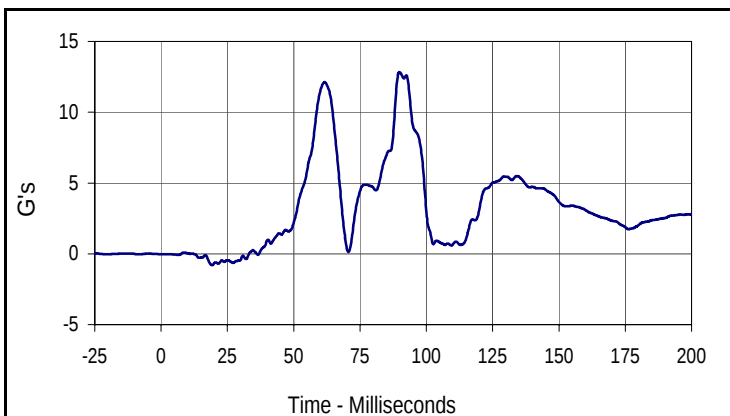
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 NHTSA No.: M85103



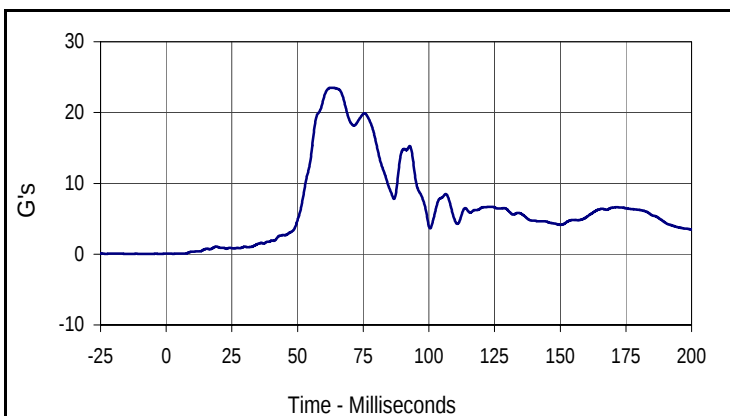
| Curve Description  |      |           |       |
|--------------------|------|-----------|-------|
| CRABI Chest X (P3) |      |           |       |
| CURNO              | Type | SAE Class | Units |
| 082                | FIL  | 180       | G's   |
| Max                | Time | Min       | Time  |
| 4.3                | 61.2 | -7.8      | 93.1  |



| Curve Description  |      |           |       |
|--------------------|------|-----------|-------|
| CRABI Chest Y (P3) |      |           |       |
| CURNO              | Type | SAE Class | Units |
| 083                | FIL  | 180       | G's   |
| Max                | Time | Min       | Time  |
| 4.1                | 93.4 | -21.9     | 66.4  |



| Curve Description  |      |           |       |
|--------------------|------|-----------|-------|
| CRABI Chest Z (P3) |      |           |       |
| CURNO              | Type | SAE Class | Units |
| 084                | FIL  | 180       | G's   |
| Max                | Time | Min       | Time  |
| 12.8               | 89.9 | -0.8      | 19.2  |



| Curve Description          |      |           |       |
|----------------------------|------|-----------|-------|
| CRABI Chest Resultant (P3) |      |           |       |
| CURNO                      | Type | SAE Class | Units |
| 082                        | RES  | 180       | G's   |
| Max                        | Time | Min       | Time  |
| 23.5                       | 63.1 | 0.0       | 2.7   |

## SECTION D4

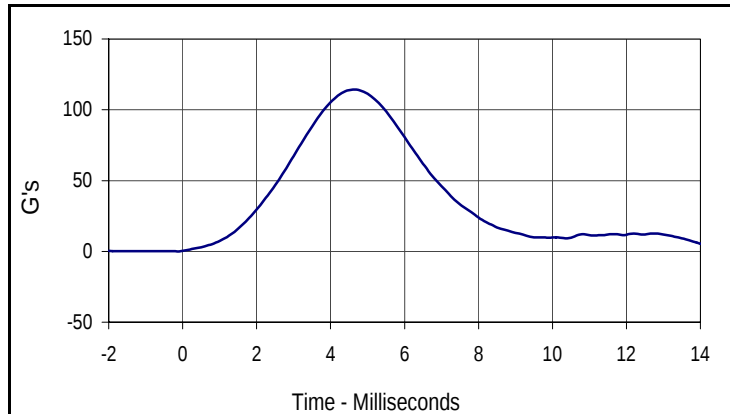
### CRABI CALIBRATION INFORMATION

Test Program: CRABI 12 Month Old Frontal Head Drop Test  
 ATD Serial No.: 022

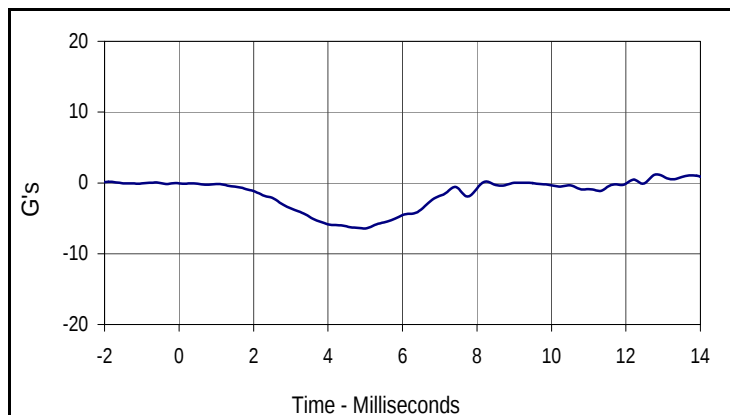
Test Date: 8/22/07  
 Test I.D.: FHD08Z



| Tested Parameter             | Units  | Specification  | Result | Pass/Fail |
|------------------------------|--------|----------------|--------|-----------|
| Laboratory Temperature       | °C     | 18.9 to 25.6   | 21.1   | Pass      |
| Laboratory Relative Humidity | %      | 10 to 70       | 30     | Pass      |
| Peak Resultant Acceleration  | G's    | 100.0 to 120.0 | 114.3  | Pass      |
| Peak Lateral Acceleration    | G's    | ≤15.0          | 6.4    | Pass      |
| Is Acceleration Unimodal?    | Yes/No | Yes            | Yes    | Pass      |
| Overall Test Results         |        |                |        | Pass      |



| Curve Description |      |           |       |
|-------------------|------|-----------|-------|
| Head Resultant    |      |           |       |
| CURNO             | Type | SAE Class | Units |
| 001               | RES  | 1000      | G's   |
| Max               | Time | Min       | Time  |
| 114.3             | 4.6  | 0.0       | -0.1  |



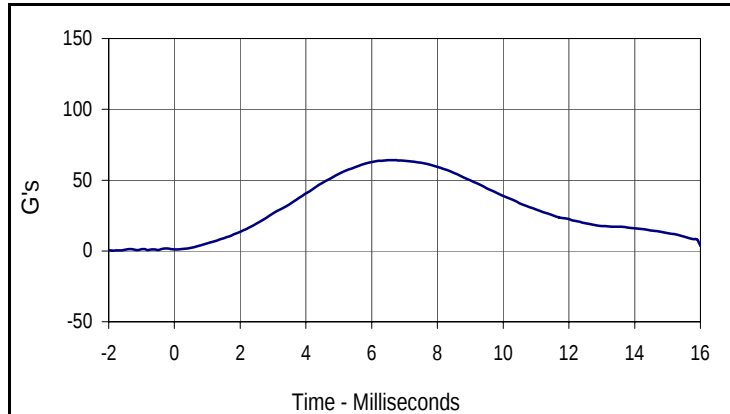
| Curve Description |      |           |       |
|-------------------|------|-----------|-------|
| Head Y            |      |           |       |
| CURNO             | Type | SAE Class | Units |
| 002               | FIL  | 1000      | G's   |
| Max               | Time | Min       | Time  |
| 0.1               | -1.9 | -6.4      | 5.0   |

Test Program: CRABI 12 Month Old Rear Head Drop Test  
 ATD Serial No.: 022

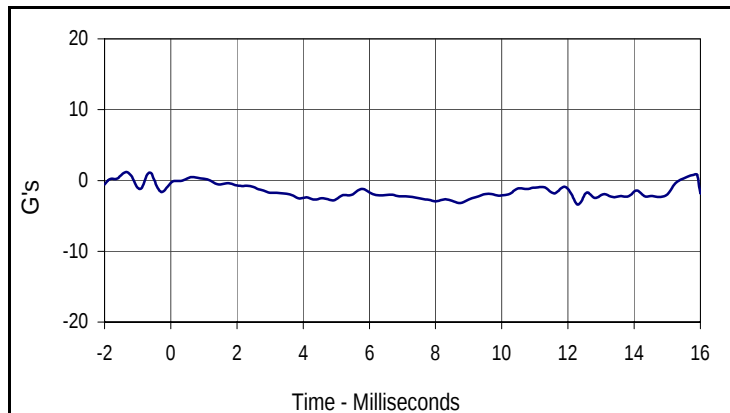
Test Date: 8/22/07  
 Test I.D.: RHD08Z



| Tested Parameter             | Units  | Specification | Result | Pass/Fail |
|------------------------------|--------|---------------|--------|-----------|
| Laboratory Temperature       | °C     | 18.9 to 25.6  | 21.1   | Pass      |
| Laboratory Relative Humidity | %      | 10 to 70      | 30     | Pass      |
| Peak Resultant Acceleration  | G's    | 55.0 to 71.0  | 62.8   | Pass      |
| Peak Lateral Acceleration    | G's    | ≤15.0         | 2.8    | Pass      |
| Is Acceleration Unimodal?    | Yes/No | Yes           | Yes    | Pass      |
| Overall Test Results         |        |               |        | Pass      |



| Curve Description |      |           |       |
|-------------------|------|-----------|-------|
| Head Resultant    |      |           |       |
| CURNO             | Type | SAE Class | Units |
| 001               | RES  | 1000      | G's   |
| Max               | Time | Min       | Time  |
| 62.8              | 6.0  | 0.3       | -1.9  |



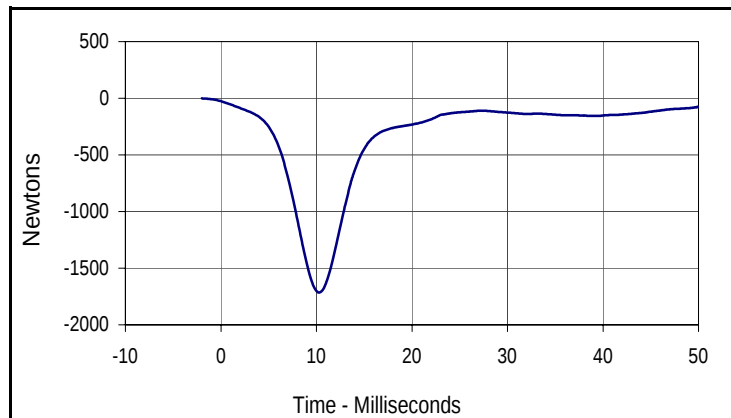
| Curve Description |      |           |       |
|-------------------|------|-----------|-------|
| Head Y            |      |           |       |
| CURNO             | Type | SAE Class | Units |
| 002               | FIL  | 1000      | G's   |
| Max               | Time | Min       | Time  |
| 1.1               | -1.3 | -2.8      | 4.9   |

Test Program: CRABI 12 Month Old Thorax Impact Test  
 ATD Serial No.: 022

Test Date: 8/22/07  
 Test I.D.: CH08Z



| Tested Parameter             | Units   | Specification  | Result | Pass/Fail |
|------------------------------|---------|----------------|--------|-----------|
| Laboratory Temperature       | °C      | 20.6 to 22.2   | 21.1   | Pass      |
| Laboratory Relative Humidity | %       | 10 to 70       | 30     | Pass      |
| Pendulum Velocity at T=0     | m/sec   | 4.90 to 5.10   | 4.95   | Pass      |
| Peak Probe Force             | Newtons | -1514 to -1796 | -1701  | Pass      |
| Overall Test Results         |         |                |        | Pass      |



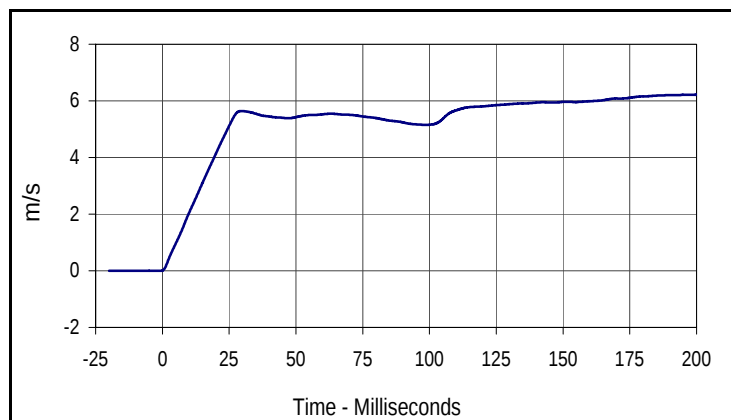
| Curve Description |      |           |         |
|-------------------|------|-----------|---------|
| Probe Force       |      |           |         |
| CURNO             | Type | SAE Class | Units   |
| 001               | FIL  | 60        | Newtons |
| Max               | Time | Min       | Time    |
| -1.2              | -2.0 | -1700.9   | 10.0    |

Test Program: CRABI 12 Month Old Neck Flexion Test  
 ATD Serial No.: 022

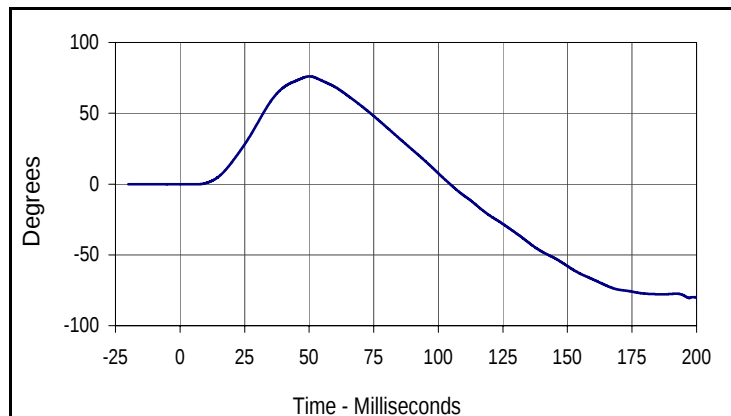
Test Date: 8/22/07  
 Test I.D.: NF08Z



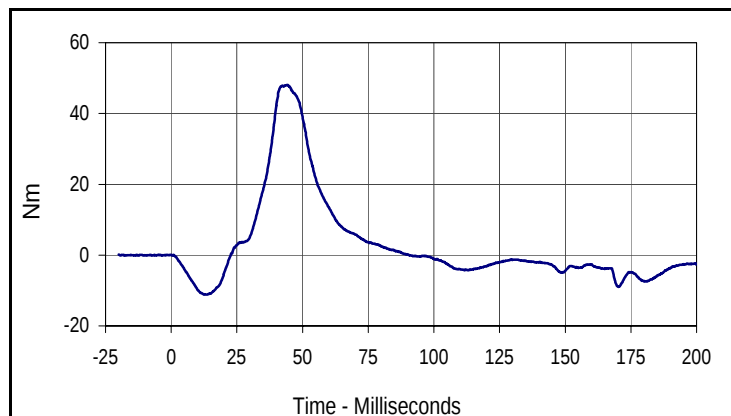
| Tested Parameter                    |          | Units   | Specification        | Result | Pass/Fail |
|-------------------------------------|----------|---------|----------------------|--------|-----------|
| Laboratory Temperature              |          | °C      | 20.6 to 22.2         | 21.1   | Pass      |
| Laboratory Relative Humidity        |          | %       | 10 to 70             | 30     | Pass      |
| Pendulum Velocity                   |          | m/s     | 5.10 to 5.30         | 5.22   | Pass      |
| Pendulum Deceleration               | 10 Msec. | m/s     | 1.6 to 2.3           | 2.0    | Pass      |
|                                     | 20 Msec. | m/s     | 3.4 to 4.2           | 4.1    | Pass      |
|                                     | 25 Msec. | m/s     | 4.3 to 5.2           | 5.1    | Pass      |
| "D" Plane Rotation                  | Max      | Degrees | 75.0 to 86.0         | 76.1   | Pass      |
| Peak Moment in Rotation             | Max      | Nm      | 36.0 to 45.0         | 45.0   | Pass      |
| Positive Moment Decay, Time To 5 Nm |          | Msec.   | 60.0 to 80.0         | 71.8   | Pass      |
|                                     |          |         | Overall Test Results |        | Pass      |



| Curve Description |       |           |       |
|-------------------|-------|-----------|-------|
| Pendulum Velocity |       |           |       |
| CURNO             | Type  | SAE Class | Units |
| 001               | FIL   | 180       | m/s   |
| Max               | Time  | Min       | Time  |
| 6.2               | 199.3 | 0.0       | -0.7  |



| Curve Description  |      |           |         |
|--------------------|------|-----------|---------|
| "D" Plane Rotation |      |           |         |
| CURNO              | Type | SAE Class | Units   |
| 003                | FIL  | 60        | Degrees |
| Max                | Time | Min       | Time    |
| 76.1               | 50.1 | -80.5     | 197.1   |



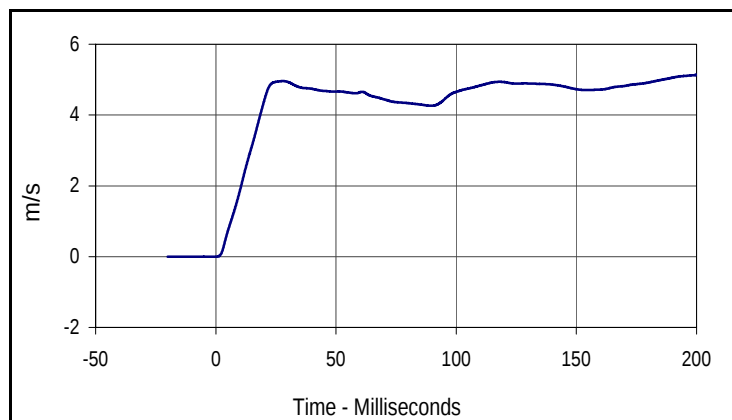
| Curve Description  |      |           |       |
|--------------------|------|-----------|-------|
| Upper Neck Force Y |      |           |       |
| CURNO              | Type | SAE Class | Units |
| 002                | FIL  | 600       | Nm    |
| Max                | Time | Min       | Time  |
| 48.1               | 44.3 | -11.2     | 13.5  |

Test Program: CRABI 12 Month Old Neck Extension Test  
 ATD Serial No.: 022

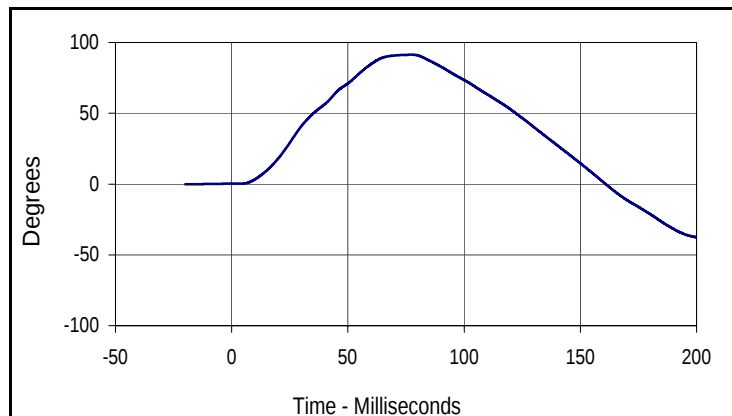
Test Date: 8/22/07  
 Test I.D.: NE08Z



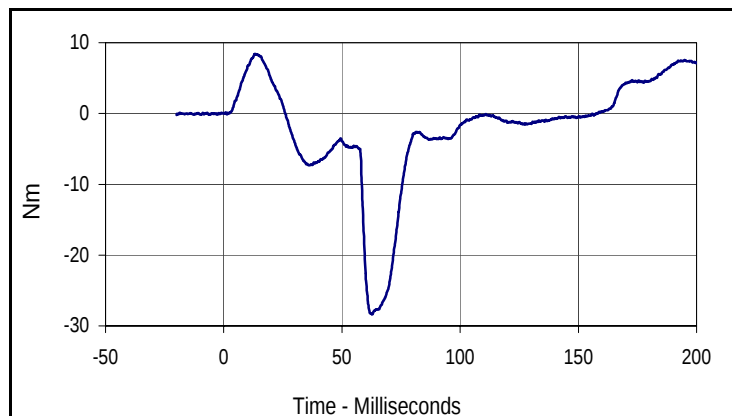
| Tested Parameter                     |          | Units   | Specification        | Result | Pass/Fail |
|--------------------------------------|----------|---------|----------------------|--------|-----------|
| Laboratory Temperature               |          | °C      | 20.6 to 22.2         | 21.1   | Pass      |
| Laboratory Relative Humidity         |          | %       | 10 to 70             | 30     | Pass      |
| Pendulum Velocity                    |          | m/s     | 2.4 to 2.6           | 2.40   | Pass      |
| Pendulum Deceleration                | 6 Msec.  | m/s     | 0.8 to 1.2           | 0.9    | Pass      |
|                                      | 10 Msec. | m/s     | 1.5 to 2.1           | 1.9    | Pass      |
|                                      | 14 Msec. | m/s     | 2.2 to 2.9           | 2.9    | Pass      |
| "D" Plane Rotation                   | Max      | Degrees | 80.0 to 92.0         | 91.4   | Pass      |
| Peak Moment in Rotation              | Max      | Nm      | -12 to -23           | -20.4  | Pass      |
| Positive Moment Decay, Time To -5 Nm |          | Msec.   | 76.0 to 90.0         | 78.3   | Pass      |
|                                      |          |         | Overall Test Results |        | Pass      |



| Curve Description |       |           |       |
|-------------------|-------|-----------|-------|
| Pendulum Velocity |       |           |       |
| CURNO             | Type  | SAE Class | Units |
| 001               | FIL   | 180       | m/s   |
| Max               | Time  | Min       | Time  |
| 5.1               | 200.0 | 0.0       | 0.1   |



| Curve Description  |      |           |         |
|--------------------|------|-----------|---------|
| "D" Plane Rotation |      |           |         |
| CURNO              | Type | SAE Class | Units   |
| 003                | FIL  | 60        | Degrees |
| Max                | Time | Min       | Time    |
| 91.4               | 77.5 | -37.6     | 200.0   |



| Curve Description   |      |           |       |
|---------------------|------|-----------|-------|
| Upper Neck Moment Y |      |           |       |
| CURNO               | Type | SAE Class | Units |
| 002                 | FIL  | 600       | Nm    |
| Max                 | Time | Min       | Time  |
| 8.4                 | 13.2 | -28.4     | 62.8  |

Test Program: CRABI 12 Month Old External Dimensions  
 ATD Serial No.: 022

Test Date: 8/22/07  
 Test I.D.: N/A



| Tested Parameter                            | Units | Specification  | Result | Pass/Fail |
|---------------------------------------------|-------|----------------|--------|-----------|
| Laboratory Temperature                      | °C    | 20.6 to 22.2   | 21.1   | Pass      |
| Laboratory Relative Humidity                | %     | 10 to 70       | 30     | Pass      |
| A - Total sitting height                    | mm    | 456.0 to 471.2 | 462    | Pass      |
| B - Shoulder pivot height                   | mm    | 276.6 to 291.8 | 279    | Pass      |
| C - "H" point height                        | mm    | 27.9 to 38.1   | 30     | Pass      |
| D - "H" point from backline                 | mm    | 40.1 to 50.3   | 45     | Pass      |
| E - Shoulder pivot from back                | mm    | 50.3 to 60.5   | 57     | Pass      |
| F - Thigh clearance                         | mm    | 63.0 to 73.2   | 68     | Pass      |
| G - Elbow pivot to fingertip                | mm    | 176.6 to 191.8 | 184    | Pass      |
| I - Shoulder pivot to elbow pivot           | mm    | 99.1 to 114.3  | 103    | Pass      |
| J - Elbow rest height                       | mm    | 150.1 to 165.3 | 158    | Pass      |
| K - Buttock to knee length                  | mm    | 202.7 to 217.9 | 208    | Pass      |
| L - Popliteal length                        | mm    | 138.7 to 153.9 | 144    | Pass      |
| M - Knee pivot height                       | mm    | 165.1 to 180.3 | 177    | Pass      |
| N - Buttock popliteal length                | mm    | 144.8 to 160.0 | 156    | Pass      |
| O - Chest depth with jacket                 | mm    | 107.5 to 122.7 | 116    | Pass      |
| P - Foot length                             | mm    | 92.4 to 102.6  | 96     | Pass      |
| Q- Stature                                  | mm    | 727.7 to 753.1 | N/A    | N/A       |
| R - Buttock to knee pivot length            | mm    | 178.5 to 188.7 | 180    | Pass      |
| S - Head Breadth                            | mm    | 124.4 to 134.6 | 125    | Pass      |
| T - Head Depth                              | mm    | 149.9 to 165.1 | 156    | Pass      |
| U - Hip breadth                             | mm    | 158.5 to 173.7 | 162    | Pass      |
| V - Shoulder breadth                        | mm    | 200.7 to 215.9 | 205    | Pass      |
| W - Foot breadth                            | mm    | 39.1 to 49.3   | 42     | Pass      |
| Y - Chest circumference with jacket         | mm    | 452.4 to 477.8 | 461    | Pass      |
| Z - Waist circumference                     | mm    | 447.0 to 472.4 | 457    | Pass      |
| AA - Reference location for dimension Y & O | mm    | 256.5 to 266.7 | 266    | Pass      |
| BB - Reference Location For dimension Z     | mm    | 106.7 to 116.9 | 113    | Pass      |
| CC - Shoulder Height                        | mm    | 299.7 to 314.9 | 308    | Pass      |
| DD - Chin Height                            | mm    | 289.6 to 304.8 | 291    | Pass      |
| Overall Test Results                        |       |                |        | Pass      |