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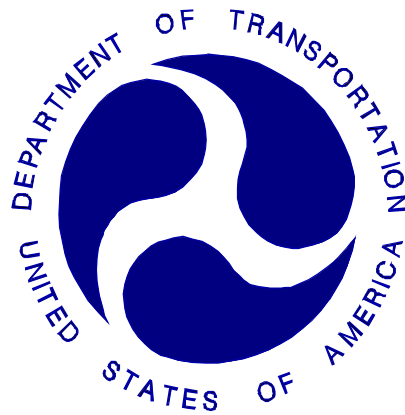
**NEW CAR ASSESSMENT PROGRAM (NCAP)**  
FRONTAL BARRIER IMPACT TEST

GRACE SAFESEAT REAR FACING  
EVENFLO EMBRACE REAR FACING

NHTSA NUMBER: O85900

CALSPAN TEST NUMBER: 8842-NCAP/CRS-01

CALSPAN  
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October 11, 2007

**FINAL REPORT**

U. S. DEPARTMENT OF TRANSPORTATION  
National Highway Traffic Safety Administration  
Rulemaking  
Office of Crashworthiness Standards  
Mail Code: NVS-111  
400 Seventh Street, SW, Room No. 5311  
Washington, DC 20590

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Approval Date:

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# **TECHNICAL REPORT STANDARD TITLE PAGE**

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                                                     |  |                                                                                                                                                                                                                          |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
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| 15. Supplementary Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                                                     |  |                                                                                                                                                                                                                          |  |
| 16. Abstract<br>This CRS test was performed in conjunction with a New Car Assessment Program (NCAP) load cell barrier test. A Graco SafeSeat Rear Facing rearward facing infant restraint was secured in Position 3 (P3) with the LATCH system. An Evenflo Embrace Rear Facing rearward facing infant restraint was secured in Position 4 (P4) with the LATCH system. This test was conducted at the Calspan Corporation Crash Test Facility in Buffalo, New York, on October 11, 2007. |  |                                                     |  |                                                                                                                                                                                                                          |  |
| 17. Key Words<br>New Car Assessment Program (NCAP)                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |                                                     |  | 18. Distribution Statement<br><u>Copies of this report are available from:</u><br>NHTSA Technical Reference Division<br>National Highway Traffic Safety Admin.<br>400 Seventh St., SW, Room 5111<br>Washington, DC 20590 |  |
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## SECTION 1

### PURPOSE AND SUMMARY OF TEST O85900

The purpose of this test was to obtain CRS performance data in a frontal impact NCAP condition. These data constitute part of the general consumer information collected by the New Car Assessment Program (NCAP).

The 55.84 kph NCAP frontal impact test was conducted in accordance with the Office of Crashworthiness Standards (OCS) NCAP Laboratory Test Procedure.

#### SUMMARY

Both child dummies were instrumented with head and chest triaxial accelerometers. In addition, redundant head z acceleration, upper six axial neck force and moment transducers were utilized.

The right rear (Position 3) child dummy (serial no. 102) and left rear (Position 4) child dummy (serial no. 103) were calibrated previous to this test. Child dummy certification information is found in section 5.

The right rear child dummy's HIC (15 ms) was 543.8, maximum chest deceleration over 3 ms was 65.0 g's. The left rear child dummy's HIC (15 ms) was 724.8, maximum chest deceleration over 3 ms was 58.5 g's.

**SECTION 2**  
**DATA SHEET NO. 1**  
**CRASH TEST SUMMARY**

TEST DUMMY INFORMATION:

| DESCRIPTION         | Position #3 CRS            | Position #4 CRS             |
|---------------------|----------------------------|-----------------------------|
| ATD Type/Serial No. | CRABI/102                  | CRABI /103                  |
| Restraint System:   | Graco SafeSeat Rear Facing | Evenflo Embrace Rear Facing |

Number of Data Channels 76  
Number of Cameras: 1 Real Time  
2 High Speed

POST TEST DOOR OPENING

| DESCRIPTION      | FRONT                               | REAR                                |
|------------------|-------------------------------------|-------------------------------------|
| Left Side Doors  | Closed/Operable – No tools required | Closed/Operable – No tools required |
| Right Side Doors | Closed/Operable – No tools required | Closed/Operable – No tools required |
| Hatch/Other Door | Closed/Operable – No tools required |                                     |

POST TEST SEAT DATA

| LOCATION         | SEAT MOVEMENT (mm) | SEAT BACK FAILURE |
|------------------|--------------------|-------------------|
| P1 (Left Front)  | 3 mm forward       | None              |
| P2 (Right Front) | 0                  | None              |
| P3 (Right Rear)  | 0                  | None              |
| P4 (Left Rear)   | 0                  | None              |

VISIBLE DUMMY CONTACT POINTS

|                      | Position #3 CRS              | Position #4 CRS              |
|----------------------|------------------------------|------------------------------|
| Head Contact:        | Back of Head with CRS Handle | Top of Head with P1 Seatback |
| Upper Torso Contact: | None                         | None                         |
| Lower Torso Contact: | None                         | None                         |
| Left Knee Contact:   | Feet with P3 Seat Back       | Feet with P4 Seat Back       |
| Right Knee Contact:  | Feet with P3 Seat Back       | Feet with P4 Seat Back       |

**DATA SHEET NO. 2**

**CRS PARAMETER DATA**

CRS: Graco SafeSeat Rear Facing and Evenflo Embrace Rear Facing

NHTSA No. O85900

CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

Delivered Weight of Vehicle with Maximum Fluids = 2171.0 kg (A)

AS TESTED WEIGHT OF VEHICLE (2 ATDs + 2 CRABI w/ CRS +CARGO + EQUIPMENT & INSTRUMENTATION):

|                     |   |               |    |            |   |               |    |
|---------------------|---|---------------|----|------------|---|---------------|----|
| Left Front          | = | <u>612.0</u>  | kg | Left Rear  | = | <u>599.5</u>  | kg |
| Right Front         | = | <u>604.0</u>  | kg | Right Rear | = | <u>573.0</u>  | kg |
| TOTAL FRONT         | = | <u>1216.0</u> | kg | TOTAL REAR | = | <u>1172.5</u> | kg |
| TOTAL TEST WEIGHT = |   | <u>2388.5</u> | kg |            |   |               |    |

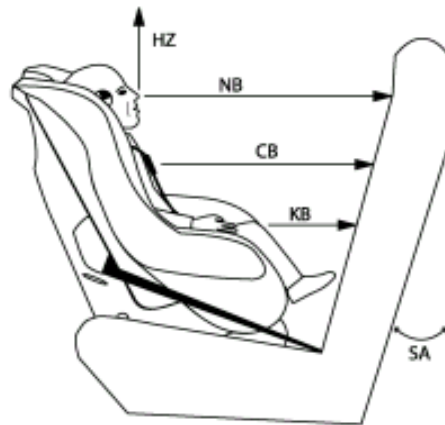
### DATA SHEET NO. 3

### CHILD DUMMY POSITIONING IN VEHICLE

CRS: Graco SafeSeat Rear Facing and Evenflo Embrace Rear Facing

NHTSA No. O85900

Dummy Measurements for Rear-facing CRS Passengers



X—Z View

|    |   |                             |
|----|---|-----------------------------|
| HZ | - | Head to Roof                |
| NB | - | Nose to Front of Back Seat  |
| CB | - | Chest to Front of Back Seat |
| KB | - | Knee to Front of Back Seat  |
| SA | - | Seat Back Angle             |

| Measurement | Millimeters unless noted |              |
|-------------|--------------------------|--------------|
|             | P3 CRS ( 102)            | P4 CRS (103) |
| SA          | 33°                      | 53°          |
| HZ          | 375                      | 435          |
| NB          | 567                      | 532          |
| CB          | 476                      | 423          |
| KB – LEFT   | 270                      | 210          |
| KB – RIGHT  | 272                      | 210          |

All dimensions in mm (unless noted)

P3 – Right Rear Passenger (CRS #1)

P4 – Left Rear Passenger (CRS #2)

## DATA SHEET 4

### CHILD DUMMY INJURY CRITERIA VALUES (CONTINUED)

CRS: Graco SafeSeat Rear Facing and Evenflo Embrace Rear Facing

NHTSA No. O85900

|                     | HEAD INJURY CRITERIA (HIC) |                          |                          |                                                             |        |                          |                          |                                                             |
|---------------------|----------------------------|--------------------------|--------------------------|-------------------------------------------------------------|--------|--------------------------|--------------------------|-------------------------------------------------------------|
|                     | HIC15                      |                          |                          |                                                             | HIC36  |                          |                          |                                                             |
|                     | HIC                        | t <sub>1</sub><br>(msec) | t <sub>2</sub><br>(msec) | Average<br>Acceleration<br>t <sub>1</sub> to t <sub>2</sub> | HIC    | t <sub>1</sub><br>(msec) | t <sub>2</sub><br>(msec) | Average<br>Acceleration<br>t <sub>1</sub> to t <sub>2</sub> |
| Position #3 - Right | 543.8                      | 52.0                     | 67.0                     | 66.6                                                        | 965.7  | 49.5                     | 85.5                     | 59.1                                                        |
| Position #4 - Left  | 724.8                      | 55.9                     | 70.8                     | 74.8                                                        | 1044.6 | 49.4                     | 85.4                     | 61.0                                                        |

|                     | CLIP SUMMARY* |                       |                       |       |
|---------------------|---------------|-----------------------|-----------------------|-------|
|                     | CLIP (g's)    | t <sub>1</sub> (msec) | t <sub>2</sub> (msec) | CSI   |
|                     |               |                       |                       |       |
| Position #3 - Right | 65.0          | 63.6                  | 66.6                  | 925.1 |
| Position #4 - Left  | 58.5          | 58.5                  | 61.5                  | 915.8 |

\* The maximum chest resultant acceleration is defined as the maximum acceleration which exceeds 0.003 seconds in duration.

**DATA SHEET NO. 5**

**CRS PERFORMANCE DATA**

CRS: Graco SafeSeat Rear Facing and Evenflo Embrace Rear Facing

NHTSA No. O85900

|                  |      | MAXIMUM VALUE |           |          |           |
|------------------|------|---------------|-----------|----------|-----------|
|                  |      |               |           |          |           |
| DESCRIPTION      | Unit | Positive      | Time (ms) | Negative | Time (ms) |
| P3 CRS X         | g    | 19.9          | 149.1     | -64.9    | 108       |
| P3 CRS Y         | g    | 50            | 130.3     | -168.2   | 103.3     |
| P3 CRS Z         | g    | 63.3          | 106.8     | -45.8    | 103       |
| P3 CRS Resultant | g    | 181.9         | 103.2     | 0        | -43.2     |
| P4 CRS X         | g    | 32.5          | 161.8     | -60      | 52.5      |
| P4 CRS Y         | g    | 6.7           | 139.3     | -10.2    | 167.7     |
| P4 CRS Z         | g    | 49.3          | 163.9     | -32.7    | 138.1     |
| P4 CRS Resultant | g    | 65.8          | 52.3      | 0        | -26.5     |

**DATA SHEET NO. 5**

**CRS PERFORMANCE DATA (CONTINUED)**

CRS: Graco SafeSeat Rear Facing and Evenflo Embrace Rear Facing

NHTSA No. O85900

**POSITION #3 CRS POST-TEST INSPECTION (Model No. JJ200706150580)**

| <b>LOCATION</b>                | <b>DAMAGE</b> | <b>REMARKS</b> |
|--------------------------------|---------------|----------------|
| Upper Tether Strap             | N/A           | N/A            |
| Upper Tether Buckle            | N/A           | N/A            |
| Upper Tether Hook              | N/A           | N/A            |
| Vehicle Upper Tether Anchor    | N/A           | N/A            |
| Lower Anchor Strap             | No            | None           |
| Lower Anchor Buckle            | No            | None           |
| Lower Anchor Hooks             | No            | None           |
| Vehicle Lower CRS Anchors      | No            | None           |
| Five 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           |
| Child Dummy                    | No            | None           |

**POSITION #4 CRS POST-TEST INSPECTION (Model No. 3971764 L1)**

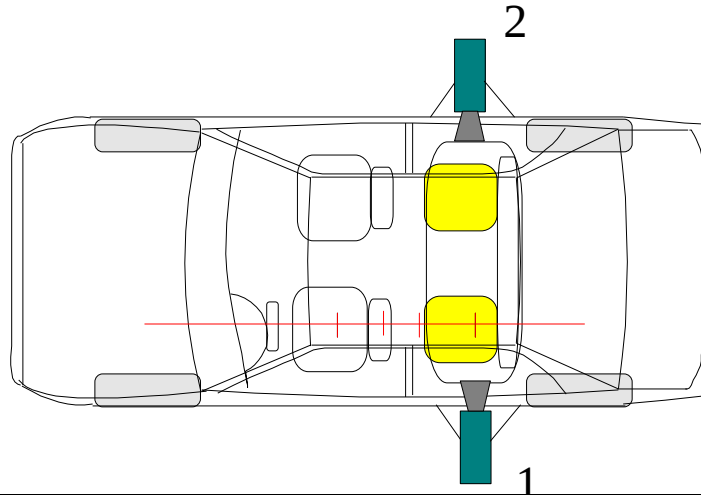
| <b>LOCATION</b>                | <b>DAMAGE</b> | <b>REMARKS</b>                    |
|--------------------------------|---------------|-----------------------------------|
| Upper Tether Strap             | N/A           | N/A                               |
| Upper Tether Buckle            | N/A           | N/A                               |
| Upper Tether Hook              | N/A           | N/A                               |
| Vehicle Upper Tether Anchor    | N/A           | N/A                               |
| Lower Anchor Strap             | No            | None                              |
| Lower Anchor Buckle            | No            | None                              |
| Lower Anchor Hooks             | No            | None                              |
| Vehicle Lower CRS Anchors      | No            | None                              |
| Five Point Harness Connections | No            | None                              |
| Cracks on CRS                  | No            | None                              |
| Fabric Tears on CRS            | No            | None                              |
| Vehicle Seat Structure         | No            | Several stress marks on Base unit |
| Vehicle Seat Fabric Tears      | No            | None                              |
| Child Dummy                    | No            | None                              |

## DATA SHEET NO. 6

### CRS CAMERA DATA

CRS: Graco SafeSeat Rear Facing and Evenflo Embrace Rear Facing

NHTSA No. O85900



| Camera No. | View                        | Coordinates (millimeters) |     |      | Angle (deg.) | Lens (mm) | Film Speed (fps) |
|------------|-----------------------------|---------------------------|-----|------|--------------|-----------|------------------|
|            |                             | X*                        | Y*  | Z*   |              |           |                  |
| 1          | Left side CRS lateral view  | 2804                      | 902 | 1353 | -12          | 12.5      | 1000             |
| 2          | Right side CRS lateral view | 2814                      | 902 | 1344 | -8           | 12.5      | 1000             |

\* Reference (from point of impact); all measurements accurate to within  $\pm 6$  mm.

X = + Forward

Y = + To Right

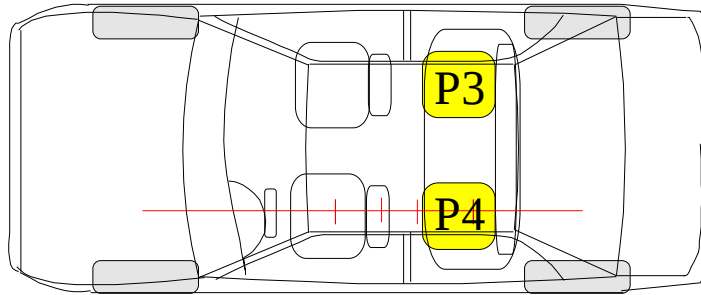
Z = + Up

## DATA SHEET NO. 7

### CRS ANCHIOR DATA

CRS: Graco SafeSeat Rear Facing and Evenflo Embrace Rear Facing

NHTSA No. O85900



| Description                    | P3   |       |       | P4   |        |       |
|--------------------------------|------|-------|-------|------|--------|-------|
|                                | X*   | Y*    | Z*    | X    | Y      | Z     |
| Outboard Seatbelt floor anchor | 1567 | 691   | 658.9 | 1579 | -676   | 611.2 |
| Inboard Seatbelt buckle anchor | 1658 | 216.4 | 703   | 1636 | -199.2 | 670.2 |
| D-Ring Anchor                  | 1299 | 683.8 | 1378  | 1367 | -676.4 | 1369  |
| Inboard LATCH anchor           | 1552 | 278.4 | 721.6 | 1554 | -277.5 | 713   |
| Outboard LATCH anchor          | 1559 | 569.4 | 734.9 | 1554 | -562.3 | 711.8 |
| Top Tether anchor              | 1442 | 431.5 | 822.8 | 1437 | -416.4 | 811.5 |

\* Reference (from rear bumper centerline); all measurements accurate to within  $\pm 6$  mm.

X = + Forward

Y = + To Right

Z = + Up

## **SECTION 3**

### **PHOTOGRAPHS**

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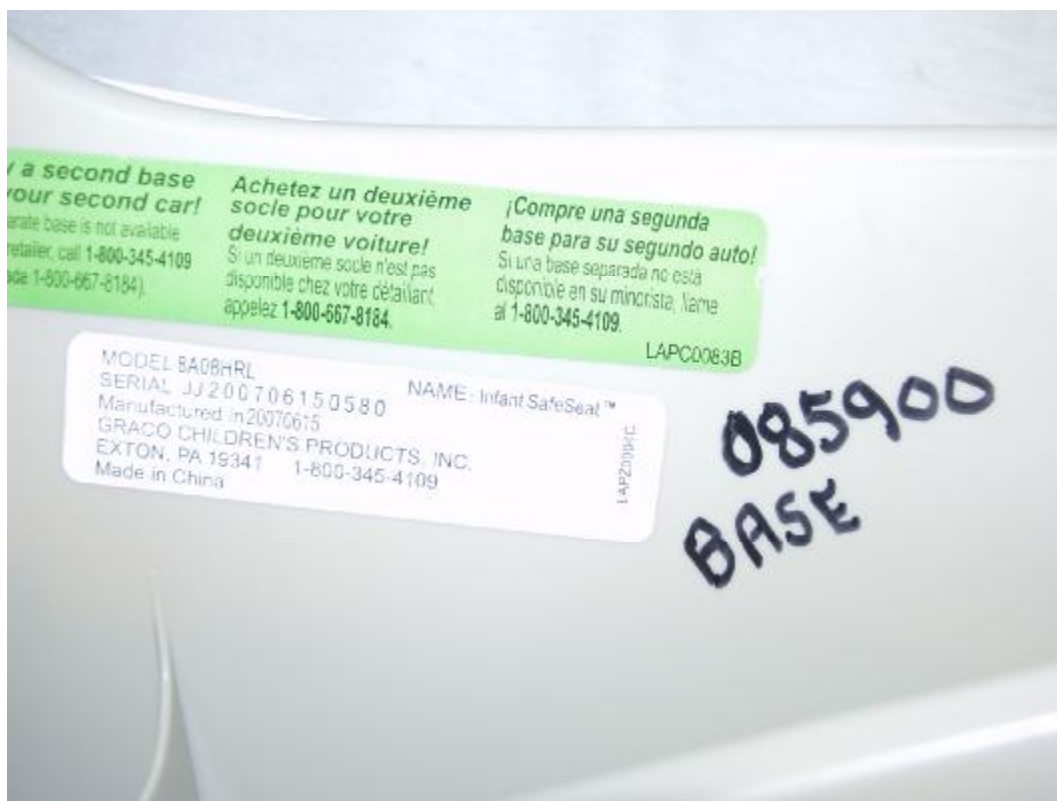


Figure 3-1: CLOSE-UP VIEW OF POSITION 3CRS BASE LABEL

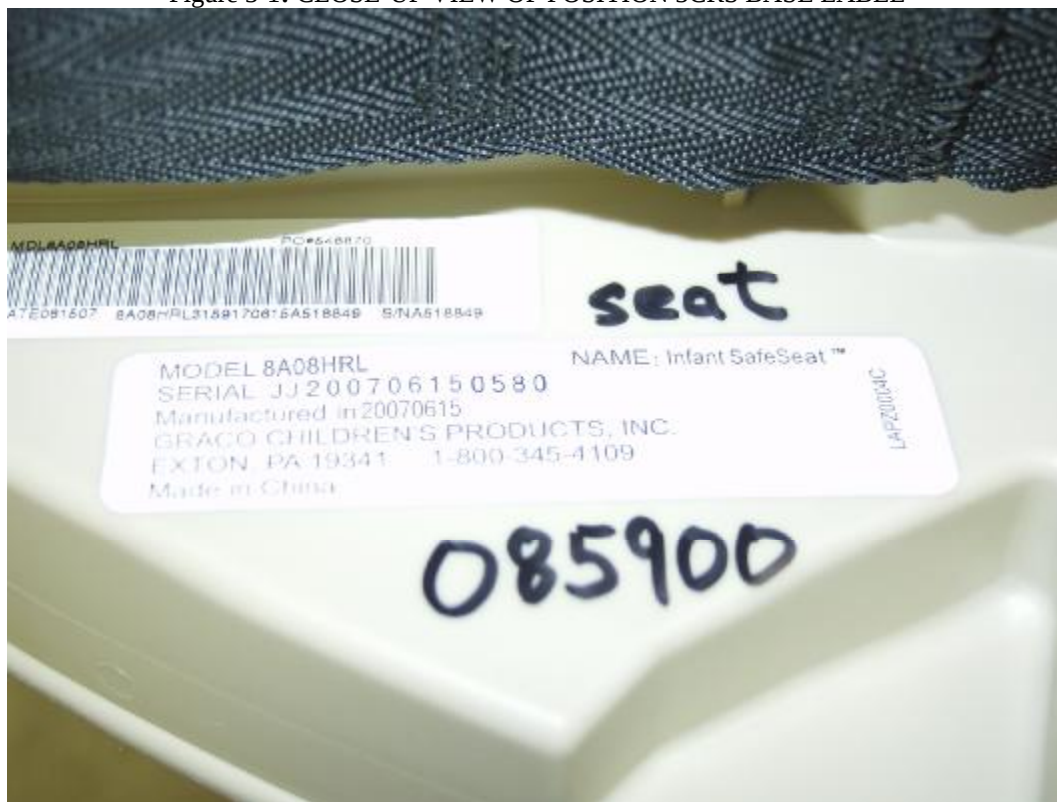


Figure 3-2: CLOSE-UP VIEW OF POSITION 3CRS CARRIER LABEL



Figure 3-3: PRE-TEST FRONTAL VIEW OF POSITION 3CRS



Figure 3-4: POST-TEST FRONTAL VIEW OF POSITION 3CRS



Figure 3-5: PRE-TEST REAR VIEW OF POSITION 3CRS



Figure 3-6: POST-TEST REAR VIEW OF POSITION 3CRS



Figure 3-7: PRE-TEST LEFT SIDE VIEW OF POSITION 3CRS



Figure 3-8: PRE-TEST LEFT SIDE VIEW OF POSITION 3CRS



Figure 3-9: PRE-TEST RIGHT SIDE VIEW OF POSITION 3 CRS



Figure 3-10: POST-TEST RIGHT SIDE VIEW OF POSITION 3 CRS

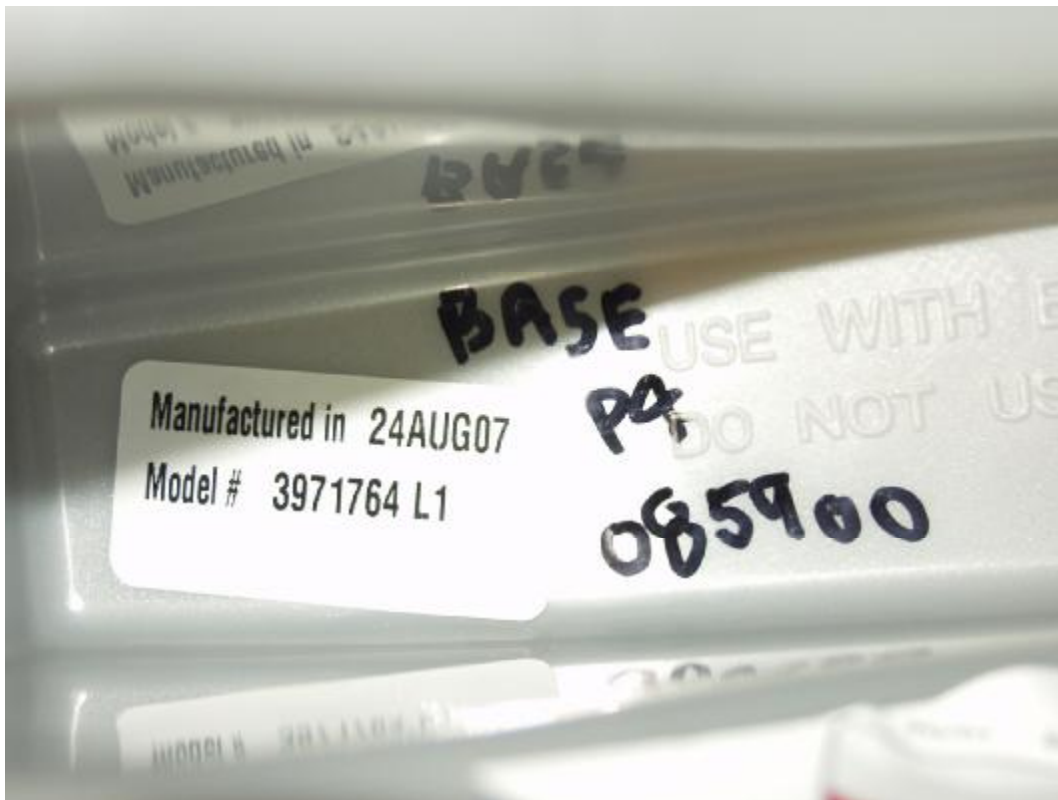


Figure 3-11: CLOSE-UP VIEW OF POSITION 4CRS BASE LABEL

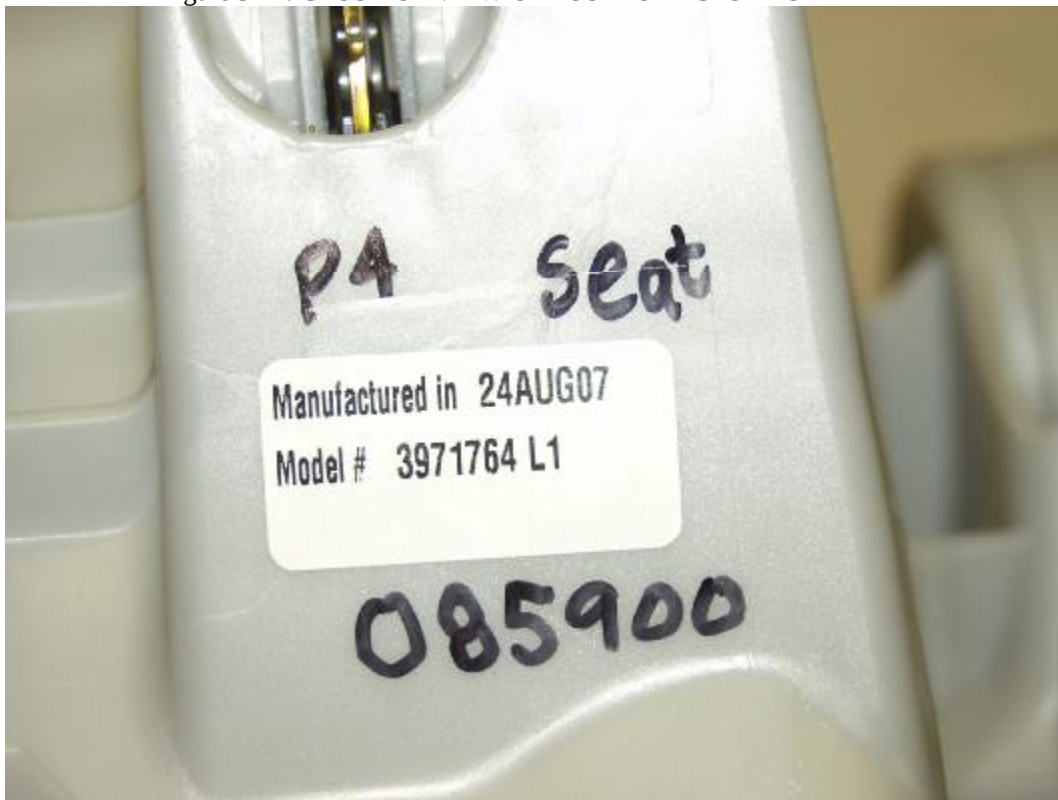


Figure 3-12: CLOSE-UP VIEW OF POSITION 4CRS CARRIER LABEL



Figure 3-13: PRE-TEST FRONTAL VIEW OF POSITION 4CRS



Figure 3-14: POST-TEST FRONTAL VIEW OF POSITION 4CRS



Figure 3-15: PRE-TEST REAR VIEW OF POSITION 4CRS



Figure 3-16: POST-TEST REAR VIEW OF POSITION 4CRS



Figure 3-17: PRE-TEST LEFT SIDE VIEW OF POSITION 4CRS



Figure 3-18: POST-TEST LEFT SIDE VIEW OF POSITION 4CRS



Figure 3-19: PRE-TEST RIGHT SIDE VIEW OF POSITION 4CRS



Figure 3-20: POST-TEST RIGHT SIDE VIEW OF POSITION 4CRS



Figure 3-21: PRE-TEST POSITION 3 LEFT SIDE VIEW



Figure 3-22: POST-TEST POSITION 3 LEFT SIDE VIEW



Figure 3-23: PRE-TEST POSITION 3 RIGHT SIDE VIEW



Figure 3-24: POST-TEST POSITION 3 RIGHT SIDE VIEW



Figure 3-25: PRE-TEST POSITION 3 REAR VIEW



Figure 3-26: POST-TEST POSITION 3 REAR VIEW



Figure 3-27: PRE-TEST POSITION 4 LEFT SIDE VIEW



Figure 3-28: POST-TEST POSITION 4 LEFT SIDE VIEW



Figure 3-29: PRE-TEST POSITION 4 RIGHT SIDE VIEW



Figure 3-30: POST-TEST POSITION 4 RIGHT SIDE VIEW



Figure 3-31: PRE-TEST POSITION 4 REAR VIEW



Figure 3-32: POST-TEST POSITION 4 REAR VIEW

## **SECTION 4**

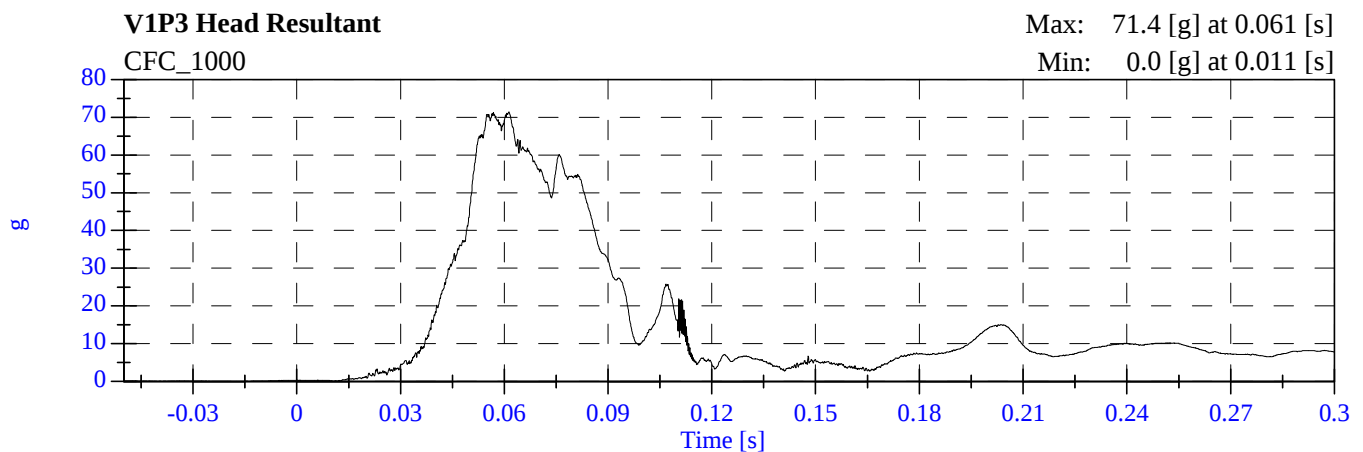
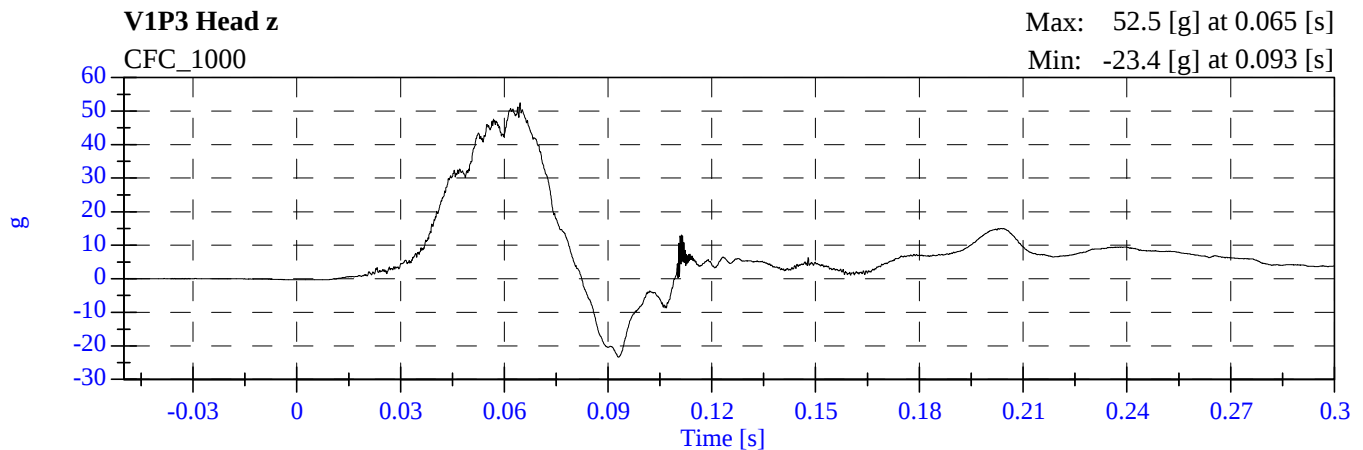
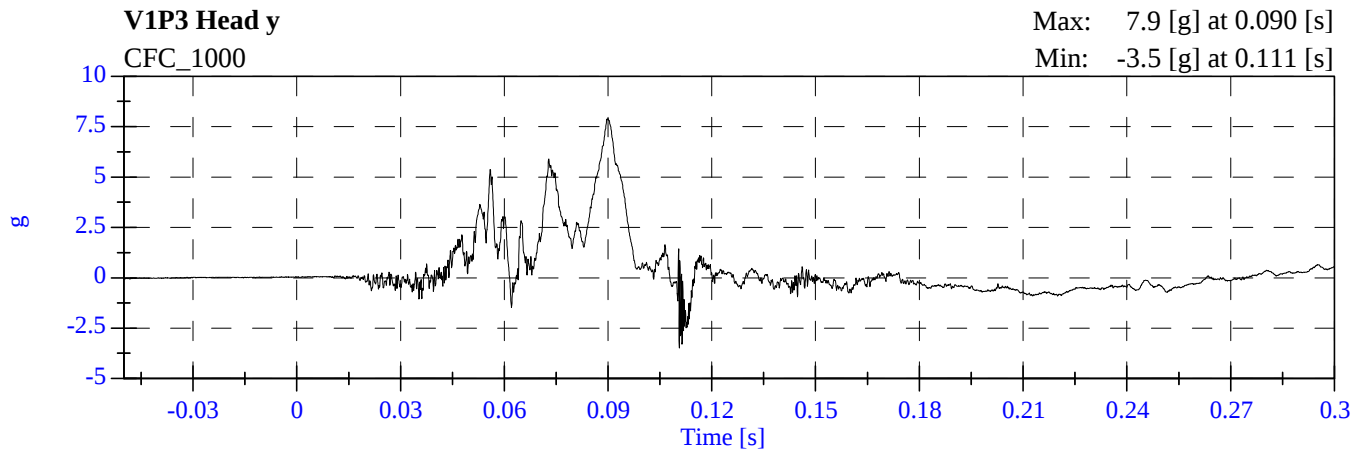
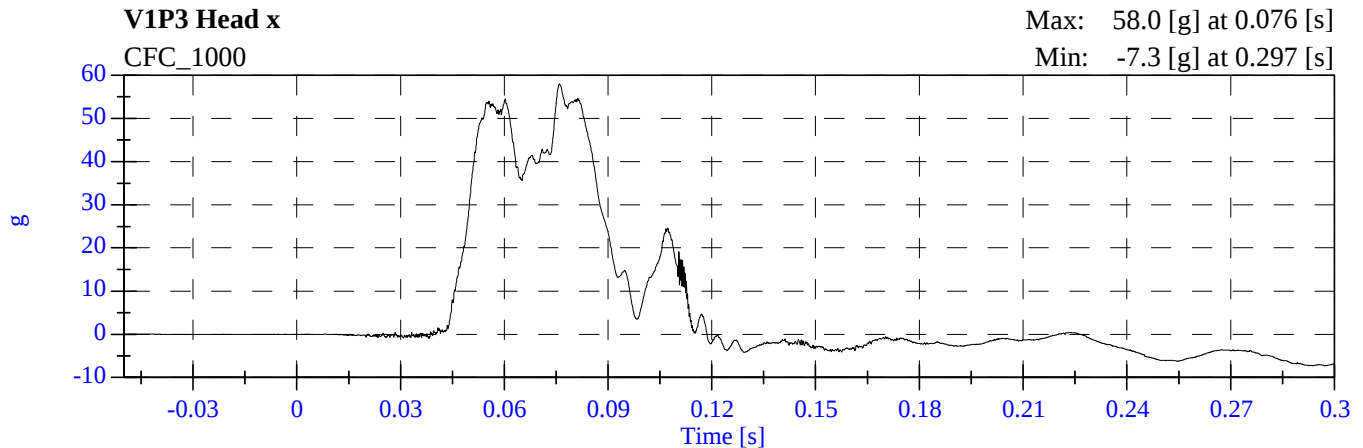
### **CHILD DUMMY RESPONSE AND CRS DATA TRACES**

## TABLE OF DATA PLOTS

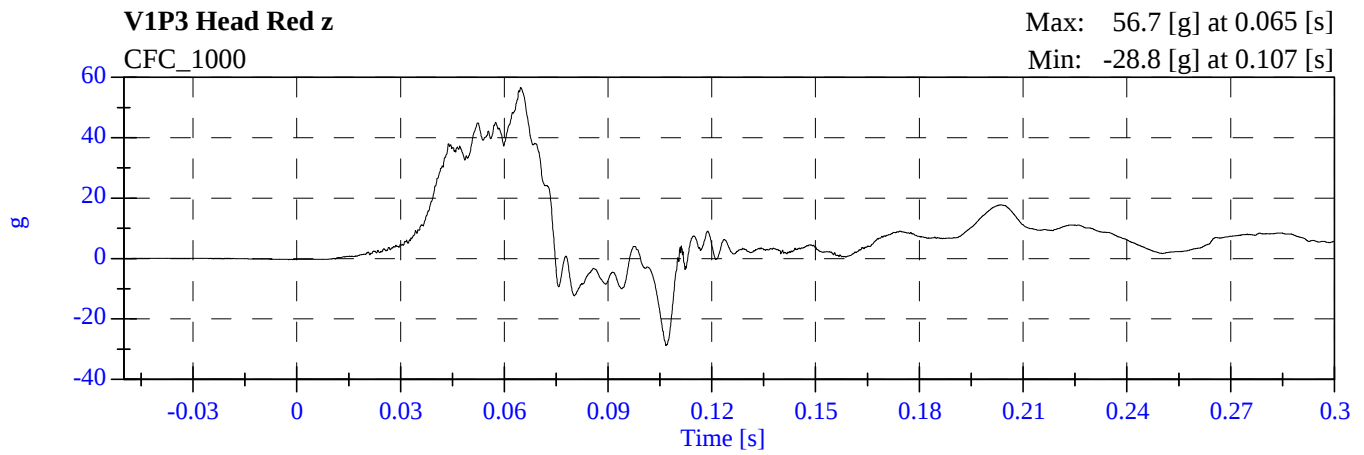
| <b>PLOT</b> | <b>PLOT NAME [UNITS, FILTER CLASS]</b> | <b>PAGE</b> |
|-------------|----------------------------------------|-------------|
| 1           | P3 Head x [g, CFC_1000]                | 4-3         |
| 2           | P3 Head y [g, CFC_1000]                | 4-3         |
| 3           | P3 Head z [g, CFC_1000]                | 4-3         |
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| 6           | P3 Chest x [g, CFC_180]                | 4-5         |
| 7           | P3 Chest y [g, CFC_180]                | 4-5         |
| 8           | P3 Chest z [g, CFC_180]                | 4-5         |
| 9           | P3 Chest Resultant [g, CFC_180]        | 4-5         |
| 11          | P3 Child Seat x [g, CFC_60]            | 4-6         |
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| 13          | P3 Child Seat z [g, CFC_60]            | 4-6         |
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| 15          | P4 Head x [g, CFC_1000]                | 4-7         |
| 16          | P4 Head y [g, CFC_1000]                | 4-7         |
| 17          | P4 Head z [g, CFC_1000]                | 4-7         |
| 18          | P4 Head Resultant [g, CFC_1000]        | 4-7         |
| 19          | P4 Head Red z [g, CFC_1000]            | 4-8         |
| 20          | P4 Chest x [g, CFC_180]                | 4-9         |
| 21          | P4 Chest y [g, CFC_180]                | 4-9         |
| 22          | P4 Chest z [g, CFC_180]                | 4-9         |
| 23          | P4 Chest Resultant [g, CFC_180]        | 4-9         |
| 24          | P4 Child Seat x [g, CFC_60]            | 4-10        |
| 25          | P4 Child Seat y [g, CFC_60]            | 4-10        |
| 26          | P4 Child Seat z [g, CFC_60]            | 4-10        |
| 27          | P4 Child Seat Resultant [g, CFC_60]    | 4-10        |

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## 085900 - October 11, 2007

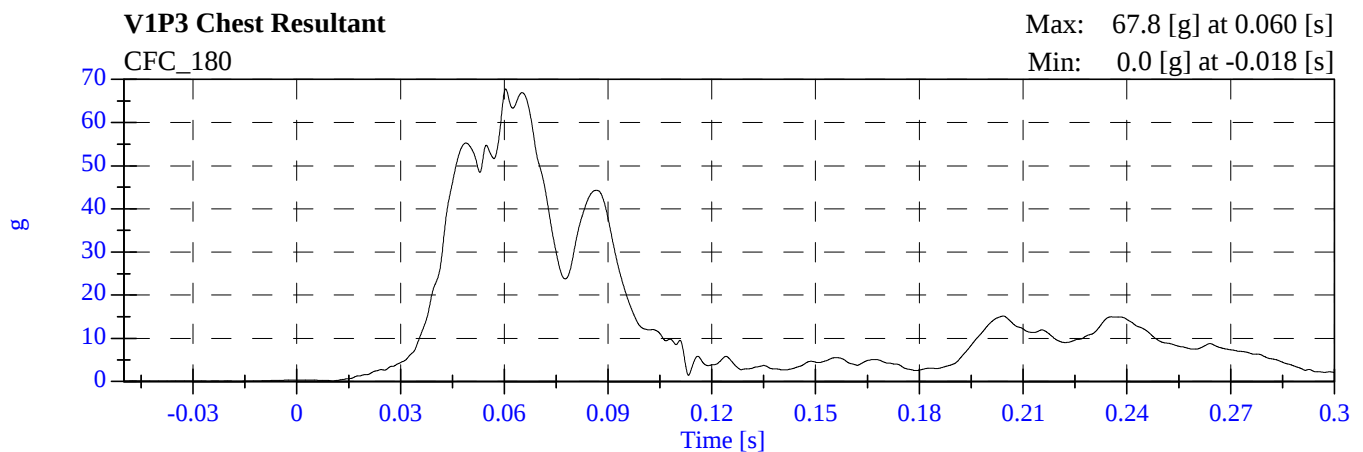
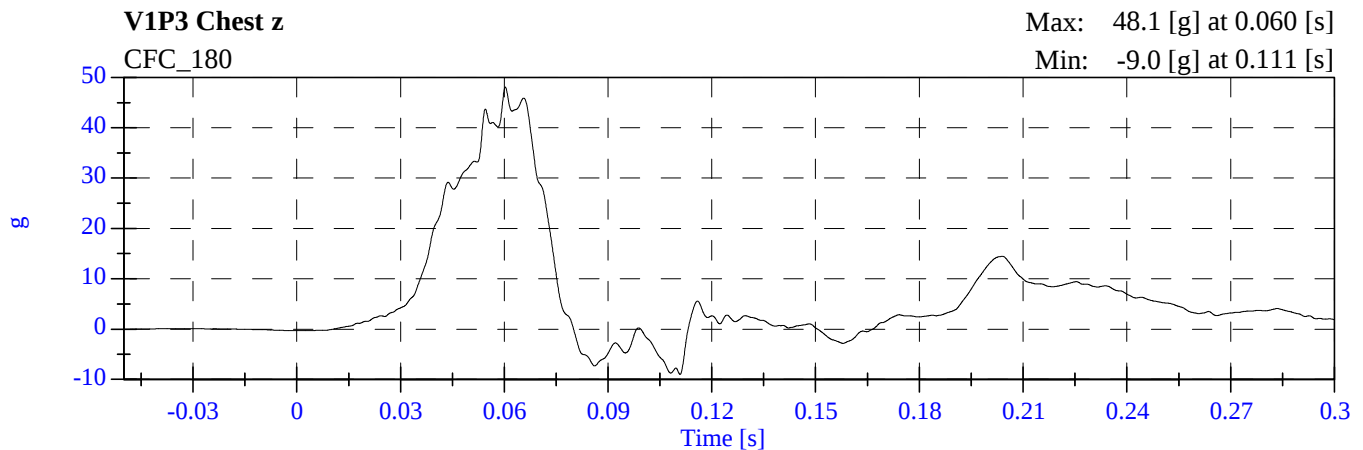
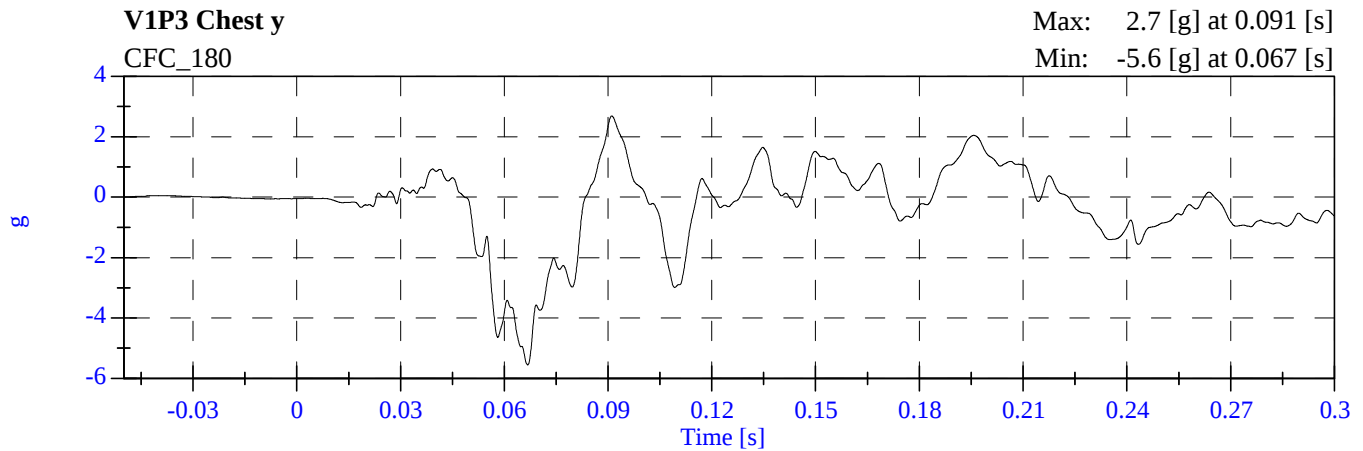
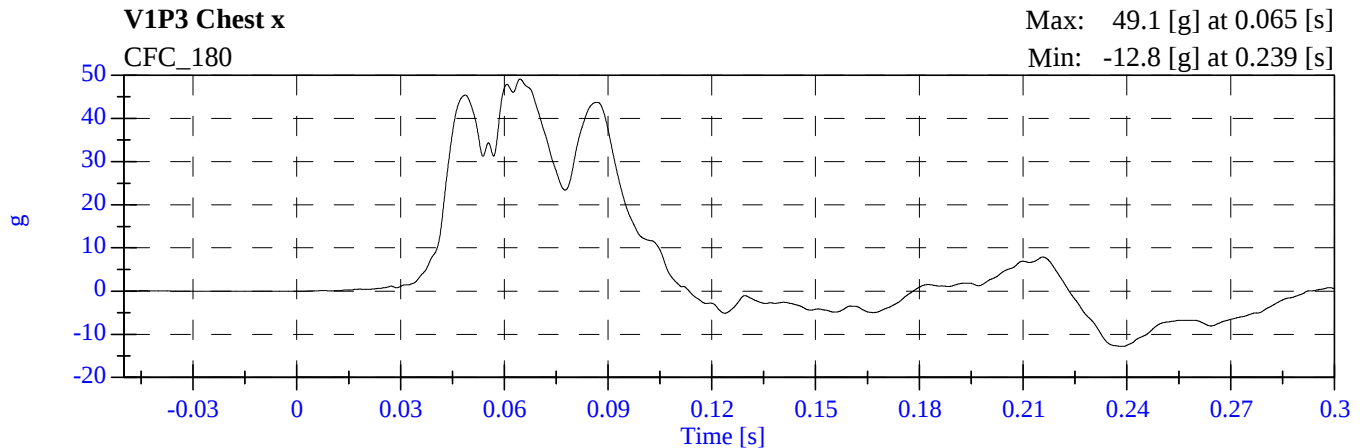


**2008 NCAP OPT Test 1 2008 Volvo XC90**  
**085900 - October 11, 2007**



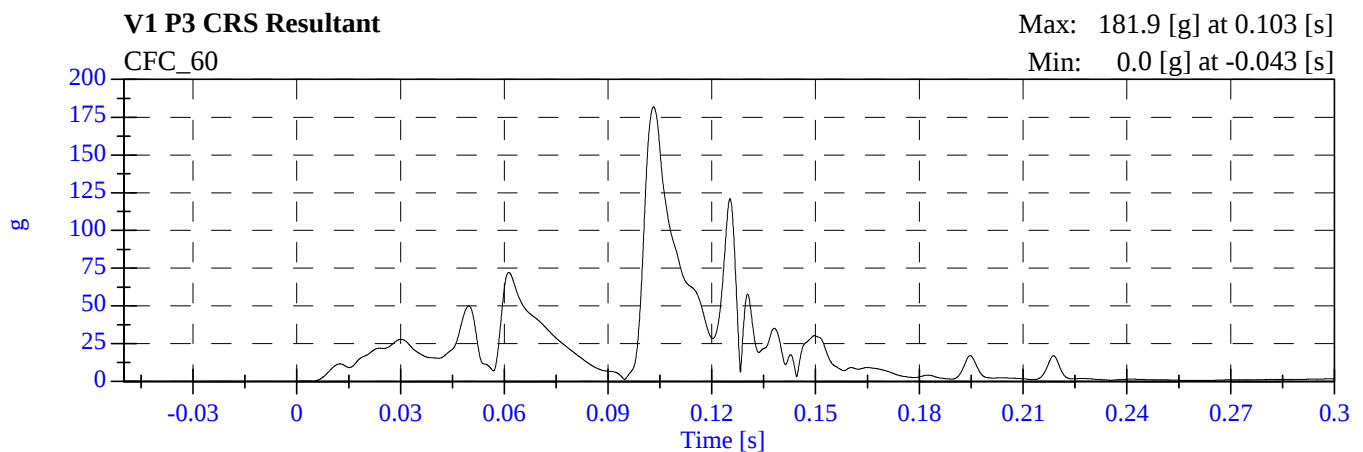
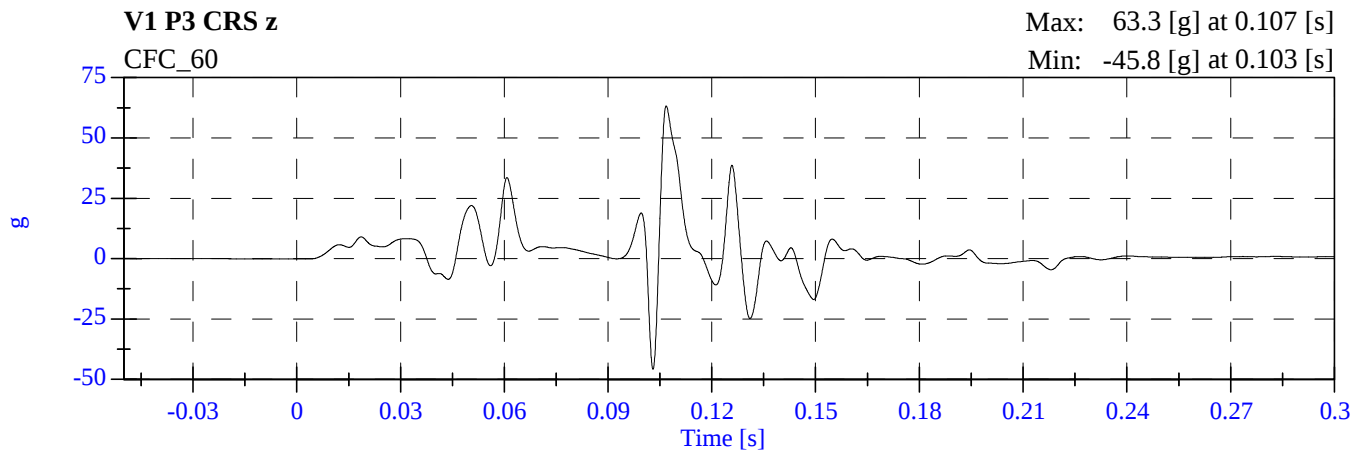
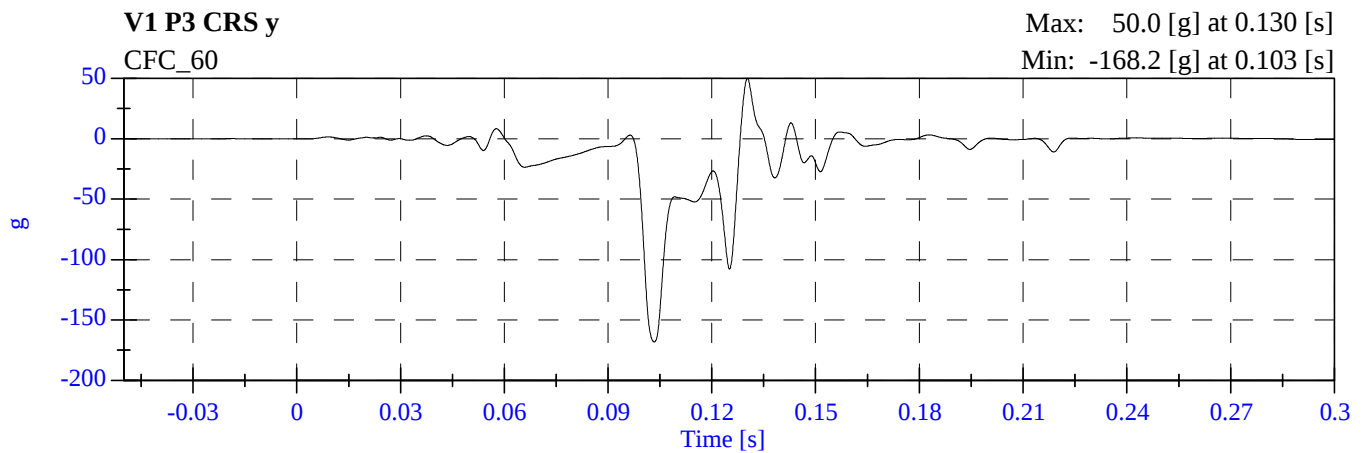
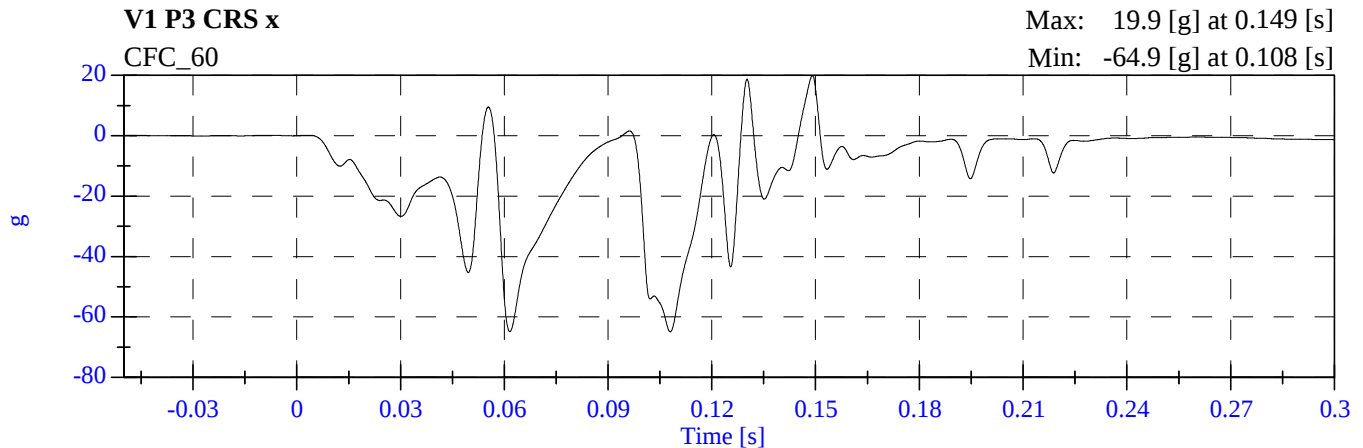
# 2008 NCAP OPT Test 1 2008 Volvo XC90

## 085900 - October 11, 2007



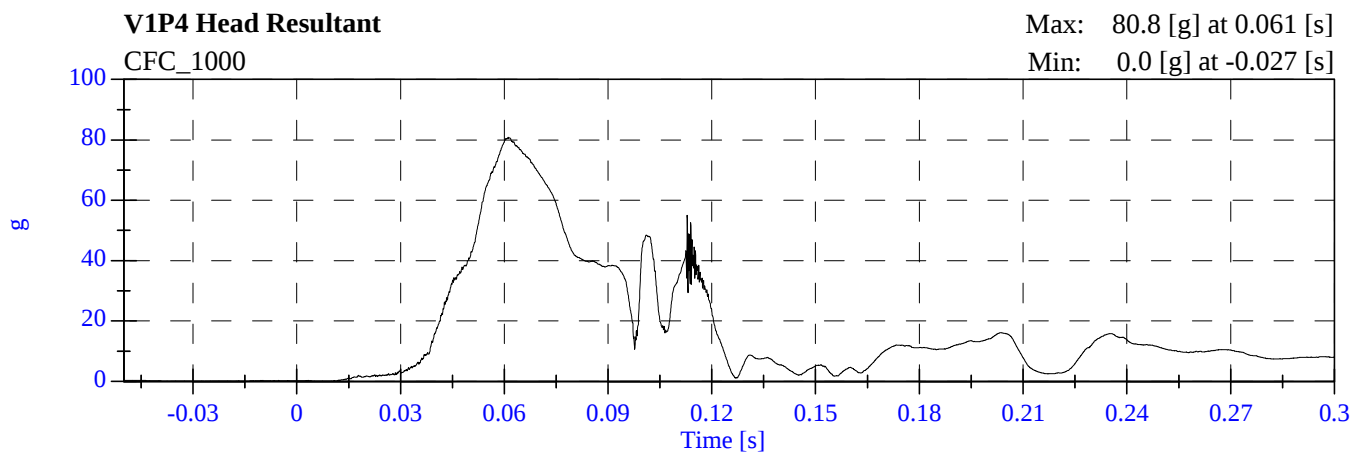
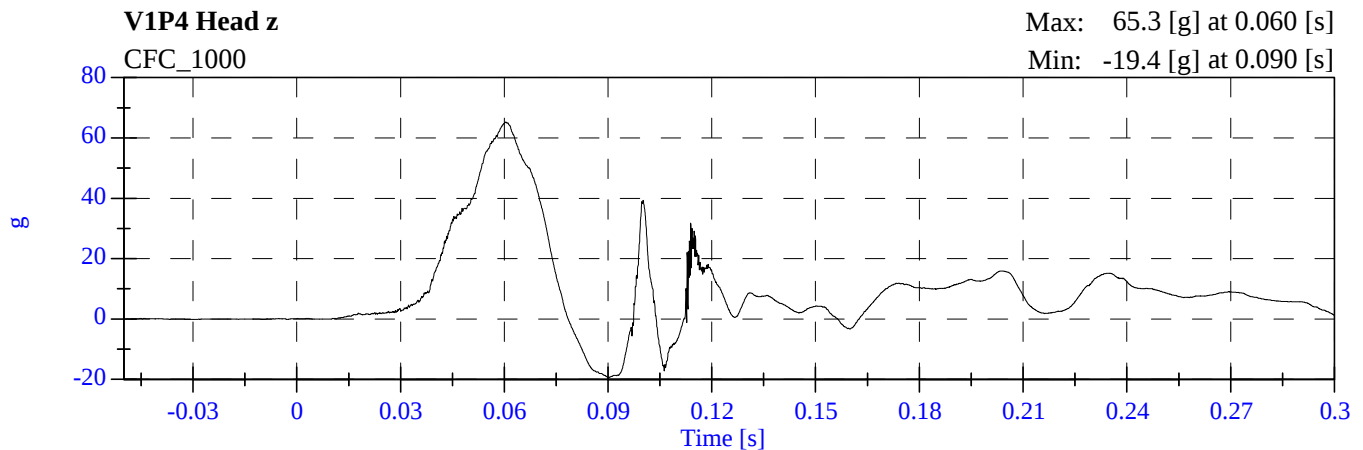
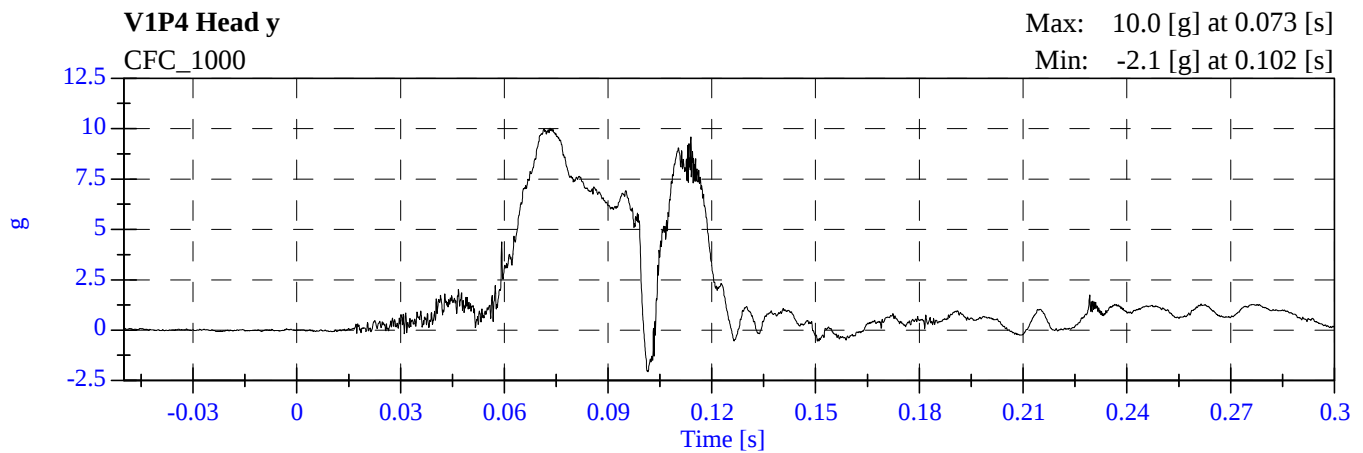
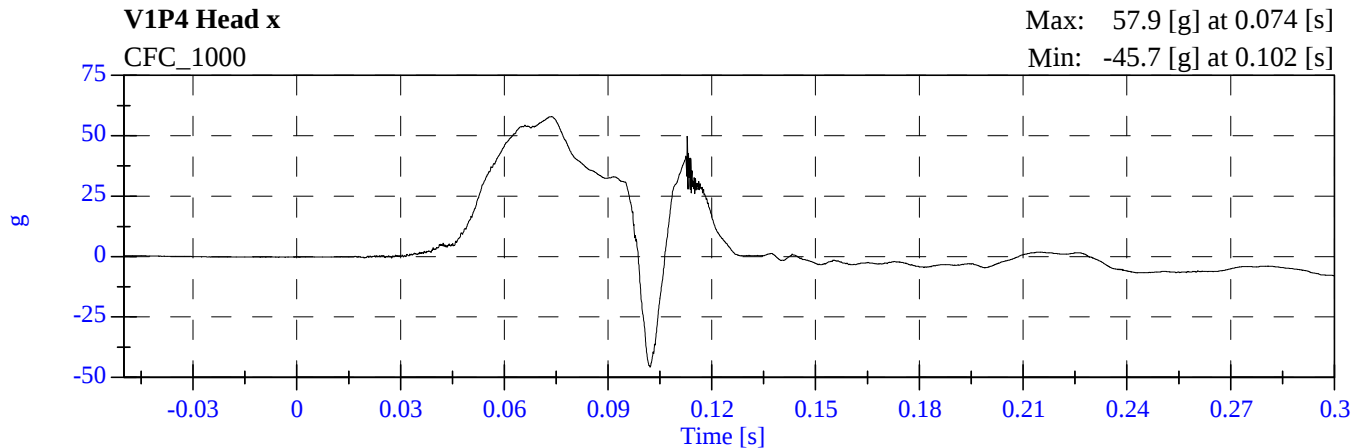
# 2008 NCAP OPT Test 1 2008 Volvo XC90

## 085900 - October 11, 2007

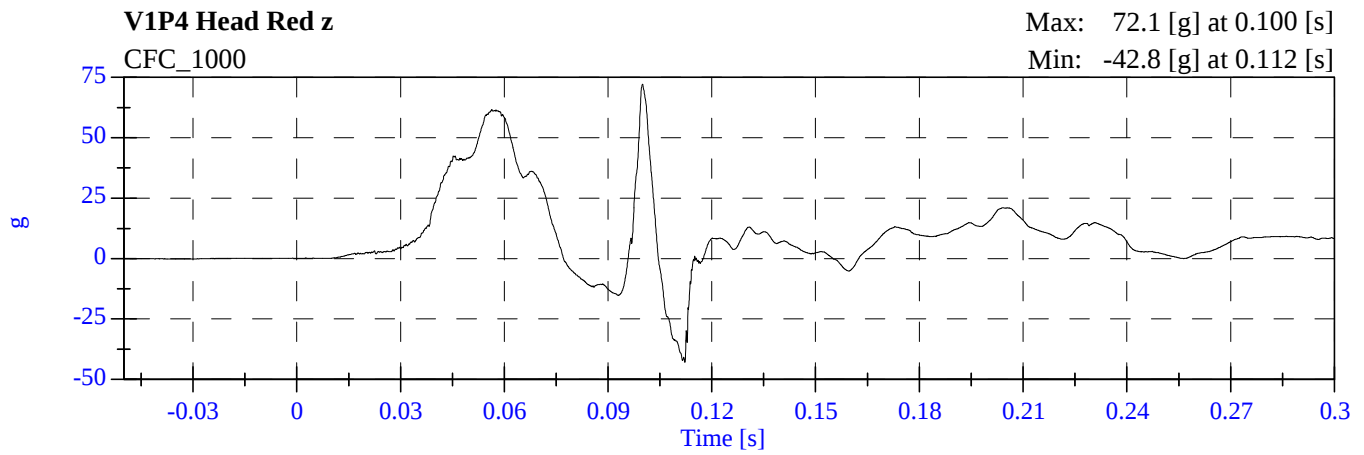


# 2008 NCAP OPT Test 1 2008 Volvo XC90

## 085900 - October 11, 2007

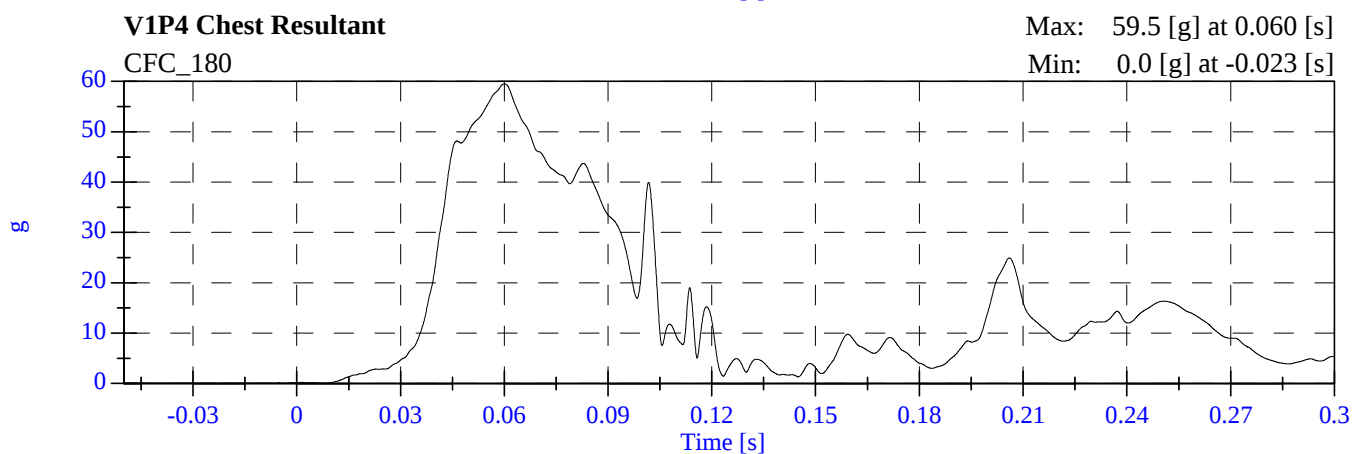
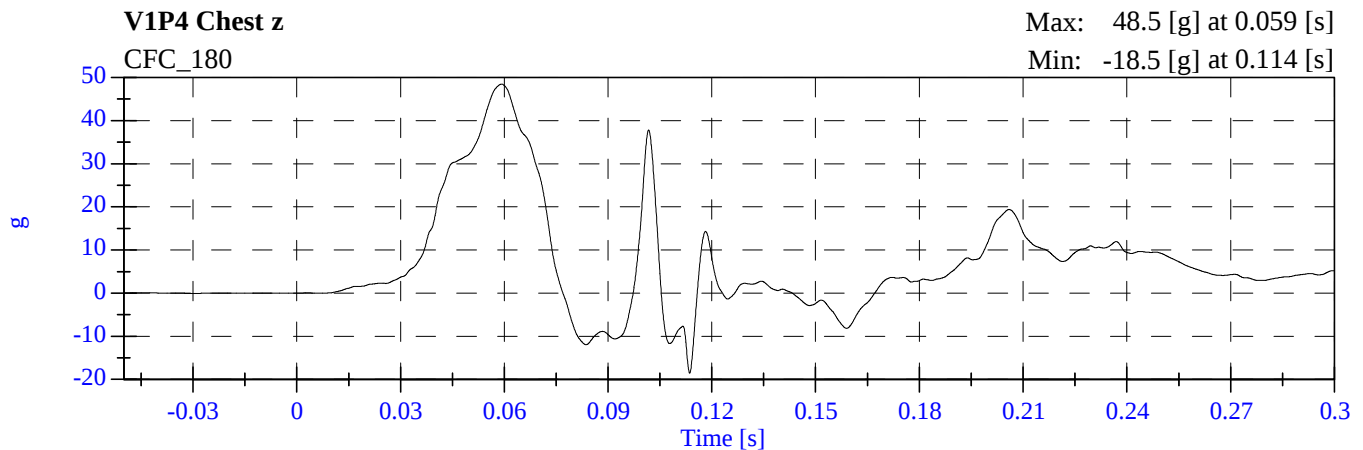
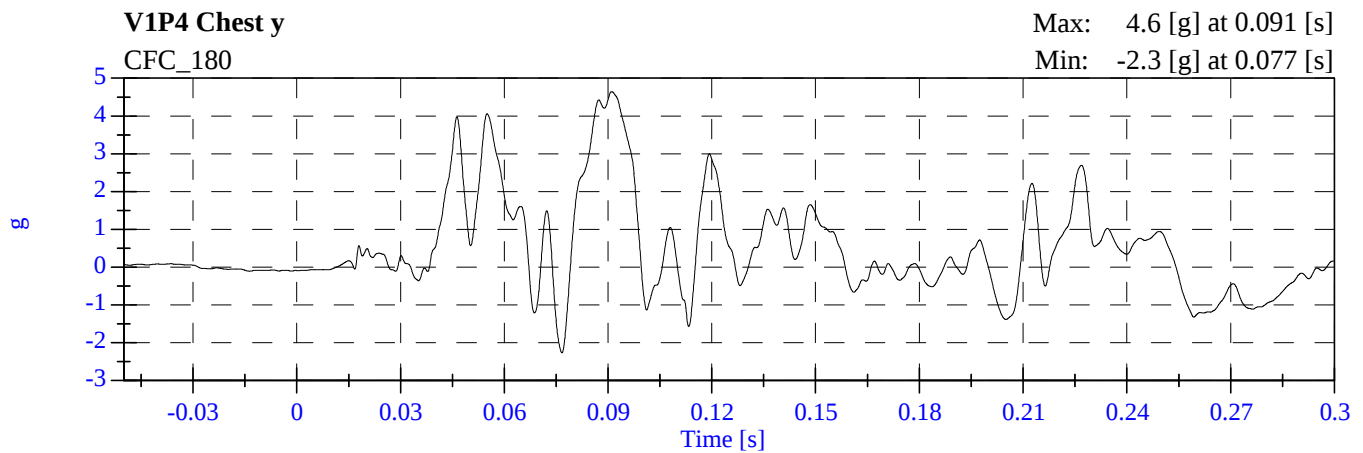
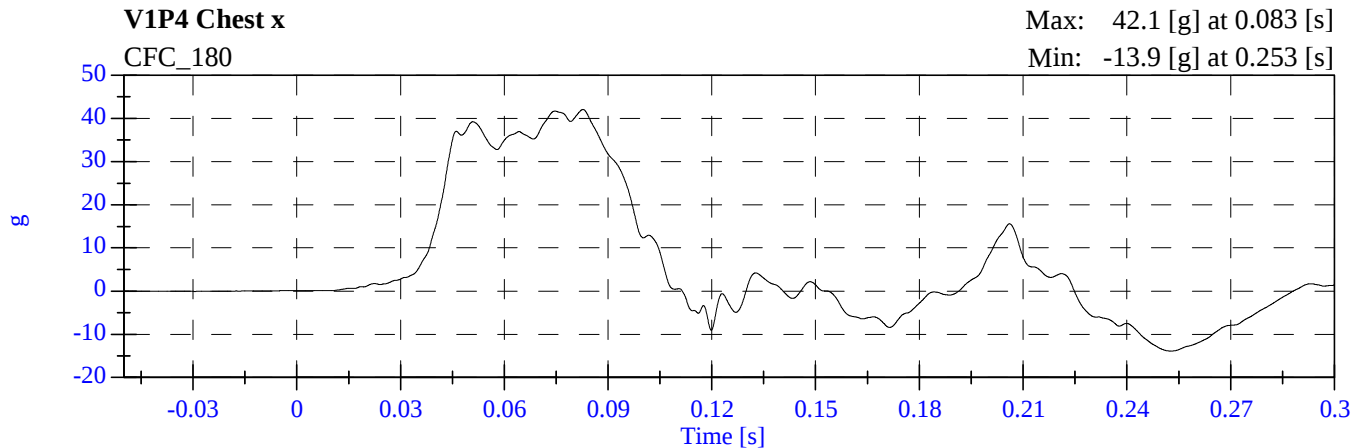


**2008 NCAP OPT Test 1 2008 Volvo XC90**  
**085900 - October 11, 2007**



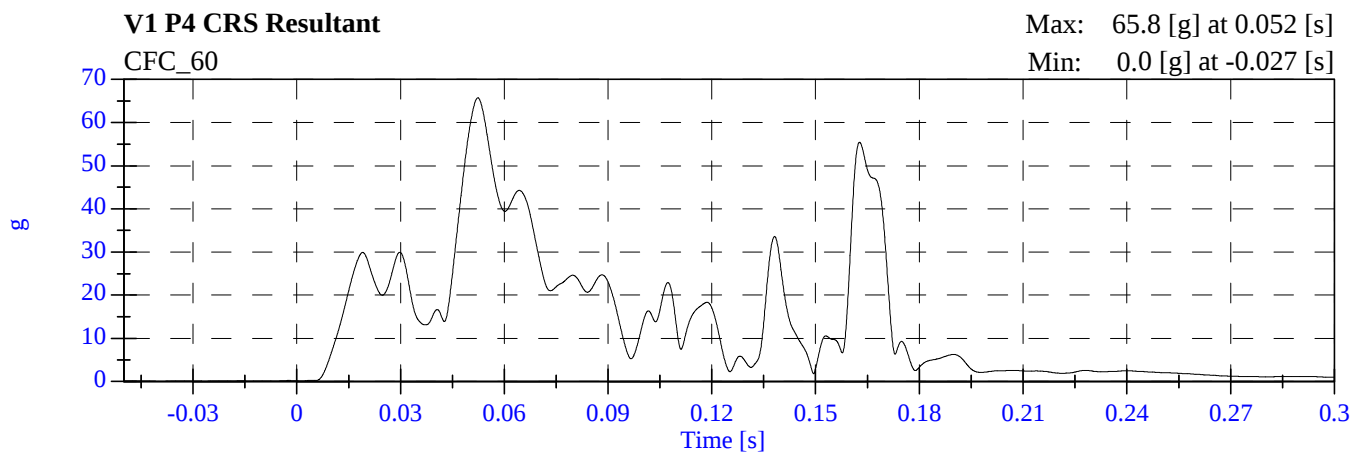
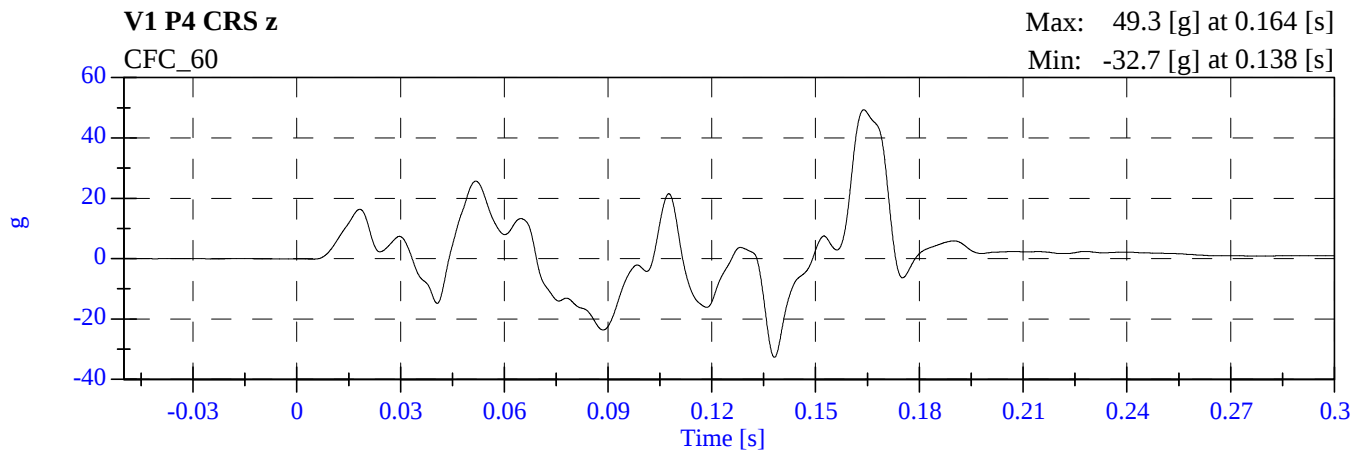
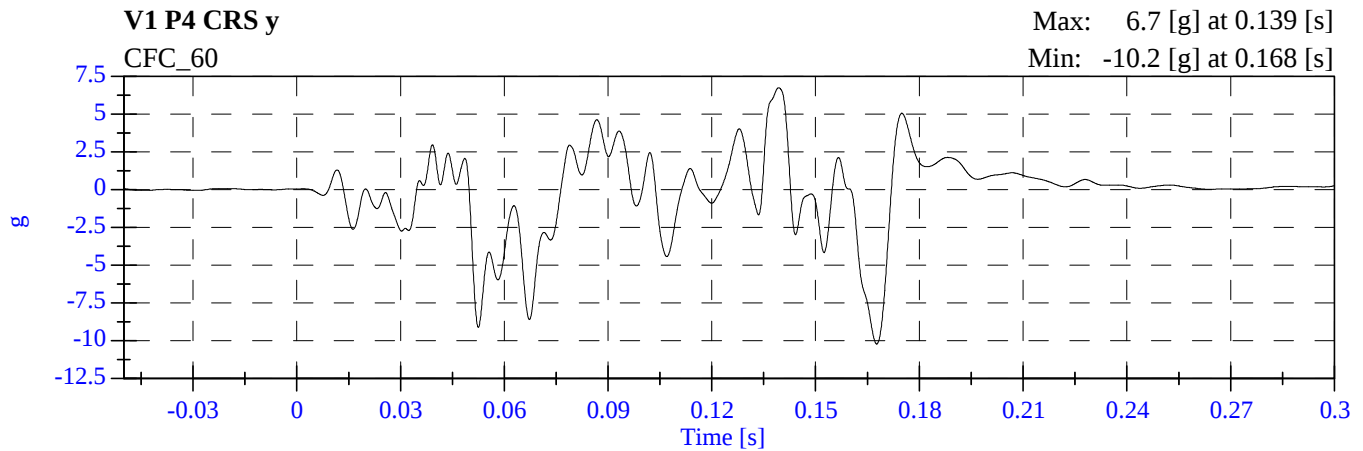
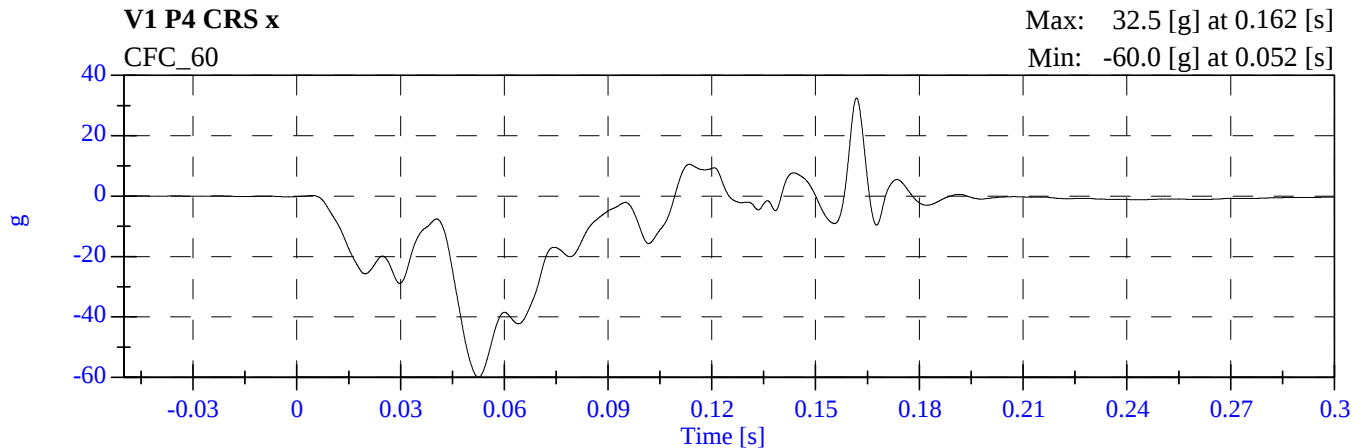
# 2008 NCAP OPT Test 1 2008 Volvo XC90

## 085900 - October 11, 2007



# 2008 NCAP OPT Test 1 2008 Volvo XC90

## 085900 - October 11, 2007



## **SECTION 5**

### **CHILD DUMMY CALIBRATION INFORMATION**

# Head Drop Frontal

Part 572R Frontal Head Drop

Calibration Date: 01-15-07

Serial No: 102

Work File: Crabi\_102\_HD1\_01-15-

## -----TEST RESULTS-----

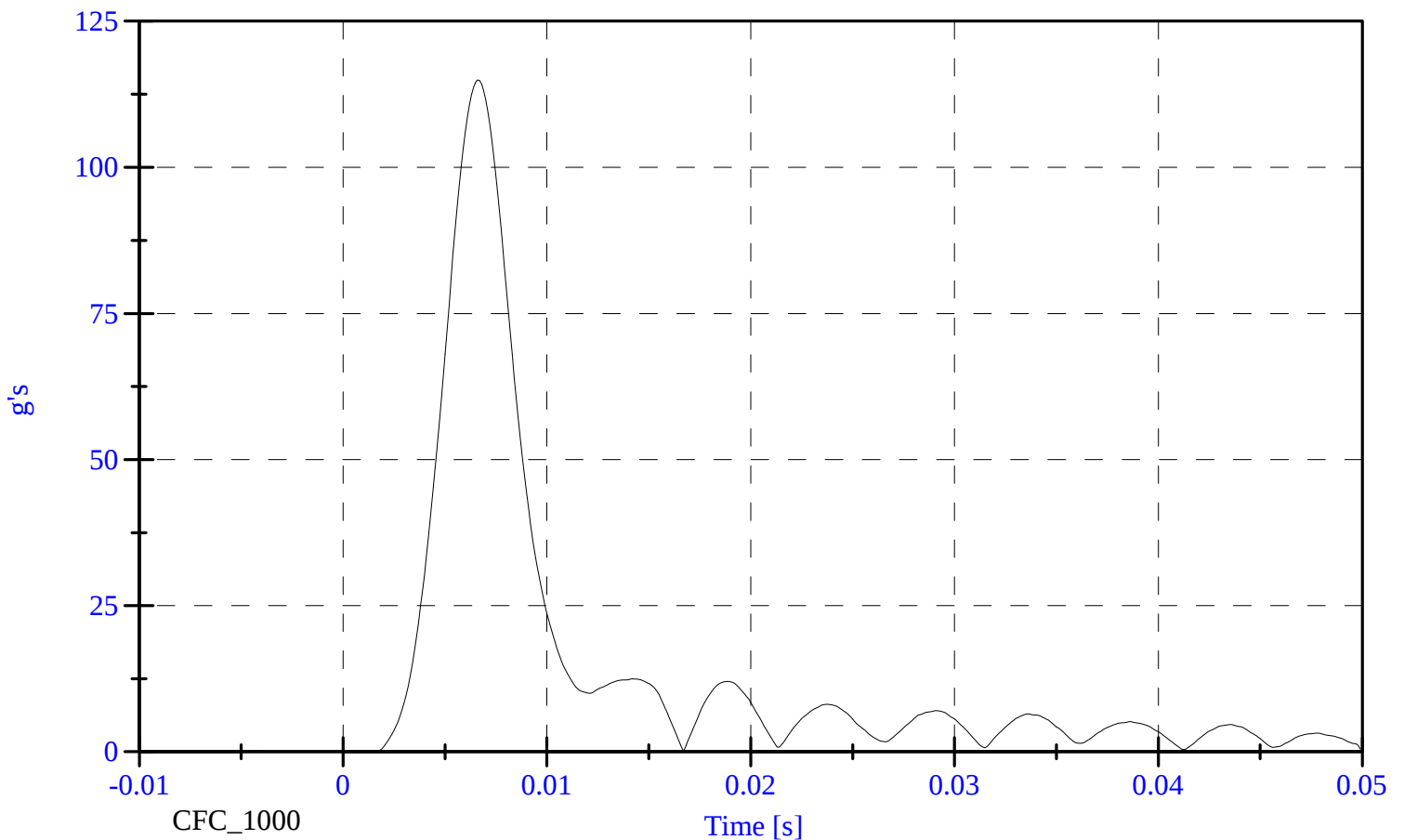
| <u>TEST CONDITION</u>   | <u>PARAMETERS</u> | <u>RESULTS</u> | <u>STATUS</u> |
|-------------------------|-------------------|----------------|---------------|
| Lab Temperature:        | 18.9-25.6 C       | 21.1 C         | Passed        |
| Lab Humidity:           | 10-70 %           | 36.00 %        | Passed        |
| Peak Resultant Accel.:  | 100-120 Gs        | 114.95 Gs      | Passed        |
| Peak Lateral Accel.:    | 15 Gs Max         | 13.62 Gs       | Passed        |
| Curve PerCent NonModal: | < 17%             | 10.85 %        | Passed        |

Head Drop Frontal

Head Resultant

Max: 114.9 [g's] at 0.007 [s]

Min: 0.0 [g's] at -0.010 [s]



# Head Drop Rear

Part 572R Rear Head Drop

Calibration Date: 01-15-07

Serial No: 102

Work File: Crabi\_102\_HD\_Rear\_01-15-07

## -----TEST RESULTS-----

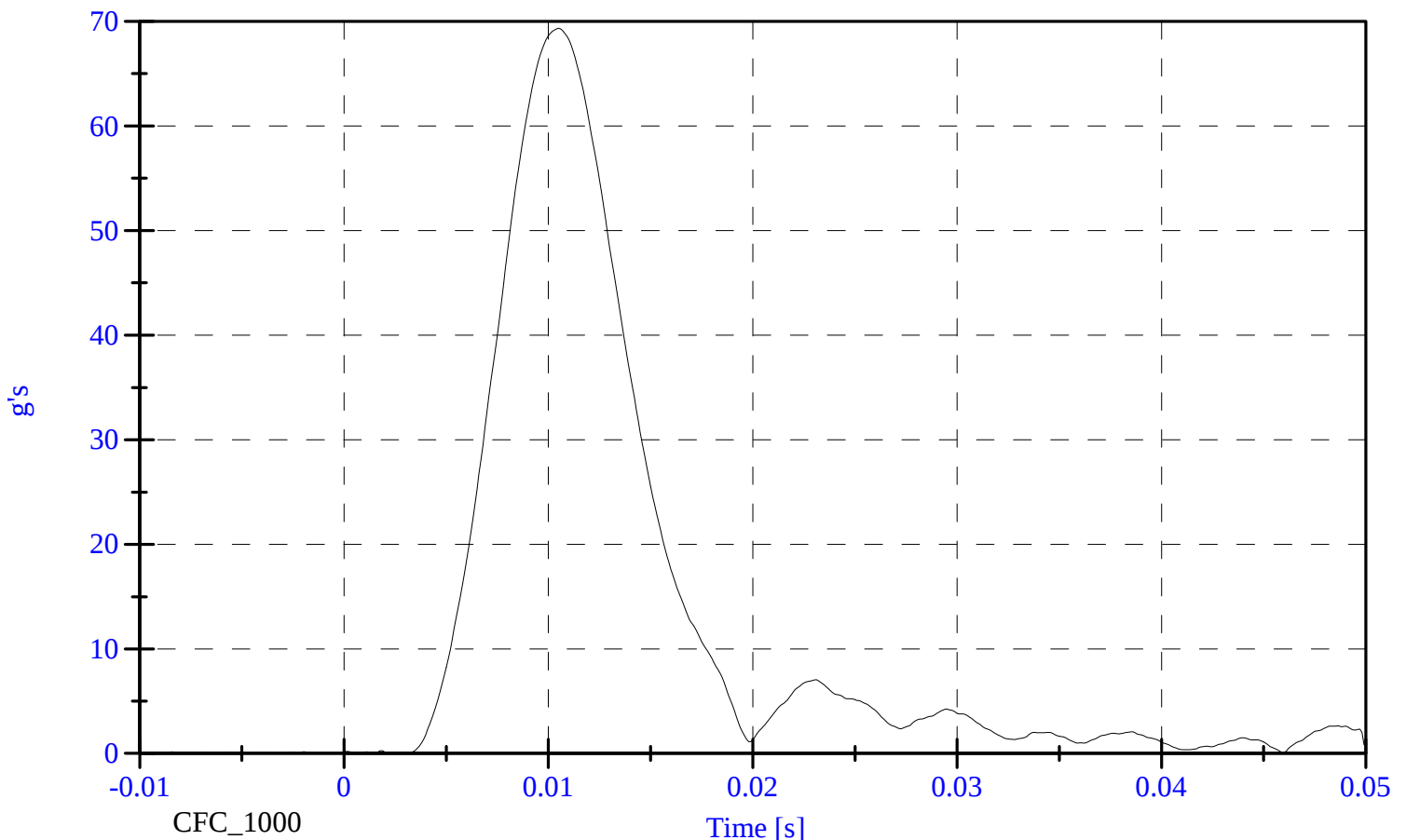
| <u>TEST CONDITION</u>   | <u>PARAMETERS</u> | <u>RESULTS</u> | <u>STATUS</u> |
|-------------------------|-------------------|----------------|---------------|
| Lab Temperature:        | 66.0-78.0 F       | 70.0 F         | Passed        |
| Lab Humidity:           | 10-70 %           | 36.00 %        | Passed        |
| Peak Resultant Accel.:  | 55-71 Gs          | 69.35 Gs       | Passed        |
| Peak Lateral Accel.:    | 15 Gs Max         | 7.02 Gs        | Passed        |
| Curve PerCent NonModal: | < 17%             | 10.15 %        | Passed        |

Head Drop Rear

Head Resultant

Max: 69.3 [g's] at 0.011 [s]

Min: 0.0 [g's] at 0.001 [s]



## Neck Flexion

|            |                   |                   |                      |
|------------|-------------------|-------------------|----------------------|
| Part 572R  | Neck Flexion Test | Calibration Date: | 01-15-07             |
| Serial No: | 102               | Work File:        | Crabi_102_NF1_01-15- |

### -----TEST RESULTS-----

| <u>TEST CONDITION</u> | <u>PARAMETERS</u> | <u>RESULTS</u> | <u>STATUS</u> |
|-----------------------|-------------------|----------------|---------------|
| Lab Temperature:      | 20.6-22.2 C       | 21.11 C        | Passed        |
| Lab Humidity:         | 10-70 %           | 36.00 %        | Passed        |
| Test Pendulum Speed:  | 5.10- 5.30 m/s    | 5.25 m/s       | Passed        |

### -----PENDULUM PULSE-----

|                 |                |          |        |
|-----------------|----------------|----------|--------|
| Pulse at 10 ms: | 1.60- 2.30 m/s | 1.79 m/s | Passed |
| Pulse at 20 ms: | 3.40- 4.20 m/s | 3.77 m/s | Passed |
| Pulse at 25 ms: | 4.30- 5.20 m/s | 4.58 m/s | Passed |

### -----D PLANE ROTATION-----

|                   |               |           |        |
|-------------------|---------------|-----------|--------|
| Maximum Rotation: | 75.0-86.0 Deg | 85.14 Deg | Passed |
|-------------------|---------------|-----------|--------|

### -----MOMENT ABOUT THE OCCIPITAL CONDYLE-----

|                         |                  |           |        |
|-------------------------|------------------|-----------|--------|
| Max Occipital Moment:   | 36.00- 45.00 N-m | 42.67 N-m | Passed |
| Occipital Moment Decay: | 60.0-80.0 ms     | 74.00 ms  | Passed |

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## Neck Extension

|            |                     |                   |                      |
|------------|---------------------|-------------------|----------------------|
| Part 572R  | Neck Extension Test | Calibration Date: | 01-15-07             |
| Serial No: | 102                 | Work File:        | Crabi_102_NE_01-15-0 |

### -----TEST RESULTS-----

| <u>TEST CONDITION</u> | <u>PARAMETERS</u> | <u>RESULTS</u> | <u>STATUS</u> |
|-----------------------|-------------------|----------------|---------------|
| Lab Temperature:      | 69.0-72.0 F       | 70.00 F        | Passed        |
| Lab Humidity:         | 10-70 %           | 36.00 %        | Passed        |
| Test Pendulum Speed:  | 7.90- 8.50 ft/s   | 7.95 ft/s      | Passed        |

### -----PENDULUM PULSE-----

|                 |                 |           |        |
|-----------------|-----------------|-----------|--------|
| Pulse at 6 ms:  | 2.60- 3.90 ft/s | 2.80 ft/s | Passed |
| Pulse at 10 ms: | 4.90- 6.90 ft/s | 5.28 ft/s | Passed |
| Pulse at 14 ms: | 7.20- 9.50 ft/s | 8.02 ft/s | Passed |

### -----D PLANE ROTATION-----

|                   |               |           |        |
|-------------------|---------------|-----------|--------|
| Maximum Rotation: | 80.0-92.0 Deg | 80.60 Deg | Passed |
|-------------------|---------------|-----------|--------|

### -----MOMENT ABOUT THE OCCIPITAL CONDYLE-----

|                         |                   |            |        |
|-------------------------|-------------------|------------|--------|
| Max Occipital Moment:   | -23.00--12.00 N-m | -12.85 N-m | Passed |
| Occipital Moment Decay: | 76.0-90.0 ms      | 86.10 ms   | Passed |

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# Thorax Impact

Part 572R Thorax Impact

Calibration Date:

01-16-07

Serial No: 102

Work File:

Crabi\_102\_T2\_01-16-0'

## -----TEST RESULTS-----

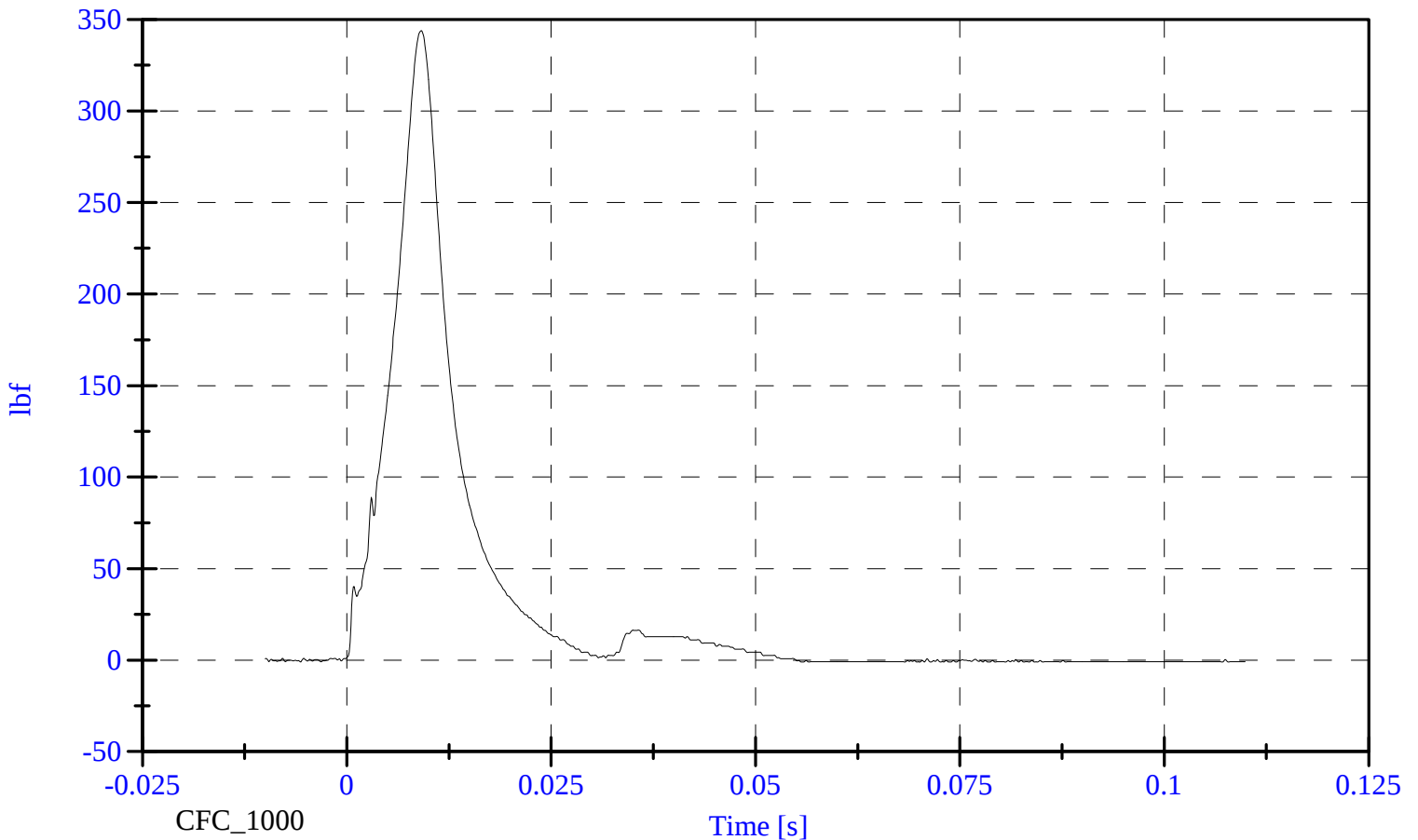
| <u>TEST CONDITION</u> | <u>PARAMETERS</u>  | <u>RESULTS</u> | <u>STATUS</u> |
|-----------------------|--------------------|----------------|---------------|
| Lab Temperature:      | 69.0-72.0 F        | 70.0 F         | Passed        |
| Lab Humidity:         | 10-70 %            | 35.00 %        | Passed        |
| Pendulum Velocity:    | 16.20-16.80 ft/s   | 16.42 ft/s     | Passed        |
| Maximum Res. Force:   | 340.70- 404.10 lbf | 344.01 lbf     | Passed        |

Thorax Impact

Probe Force vs. Time

Max: 344.0 [lbf] at 0.009 [s]

Min: -1.1 [lbf] at 0.082 [s]



# Head Drop Frontal

Part 572R Frontal Head Drop

Calibration Date: 01-15-07

Serial No: 103

Work File: Crabi\_103\_HD\_Front\_

## TEST RESULTS

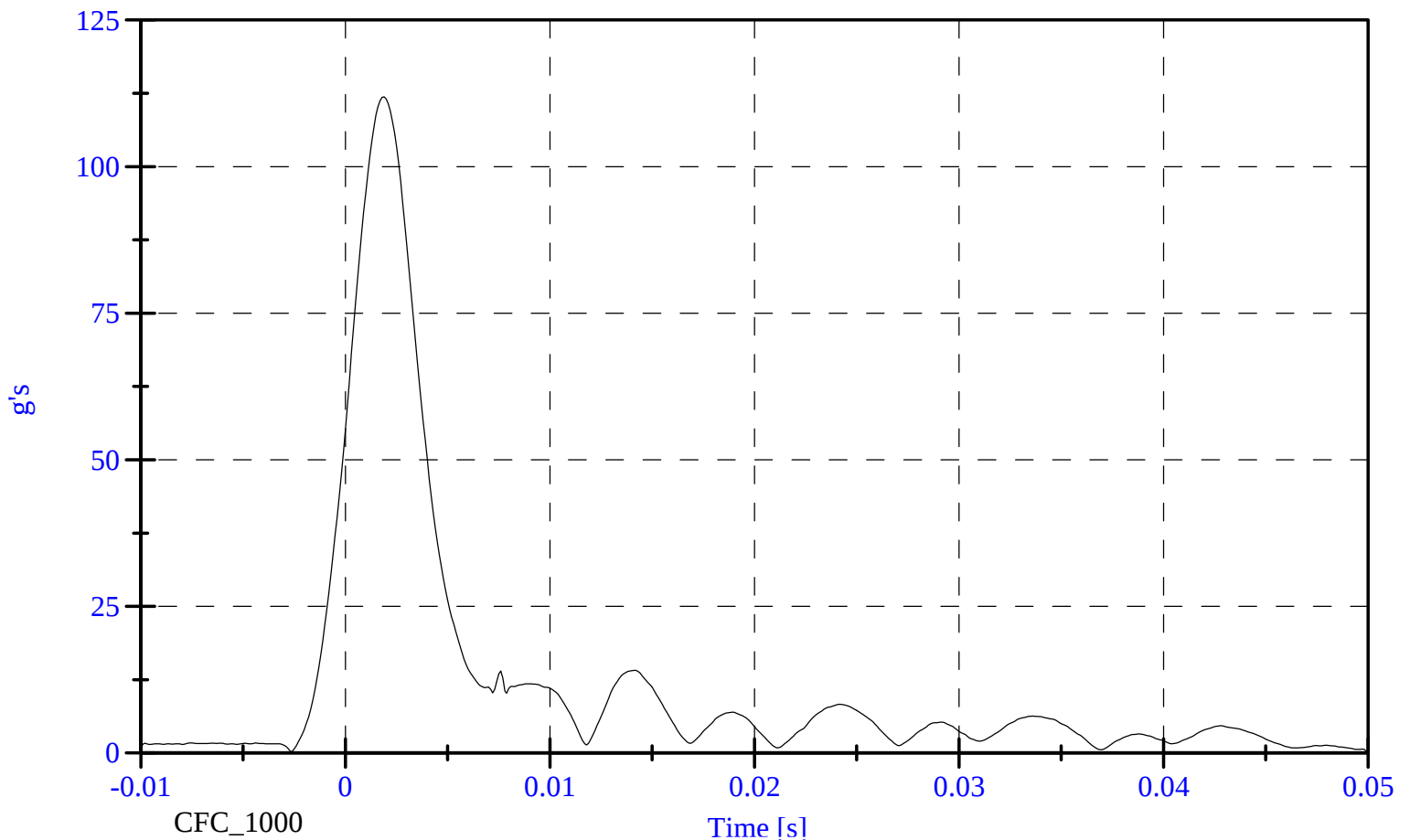
| <u>TEST CONDITION</u>   | <u>PARAMETERS</u> | <u>RESULTS</u> | <u>STATUS</u> |
|-------------------------|-------------------|----------------|---------------|
| Lab Temperature:        | 18.9-25.6 C       | 21.1 C         | Passed        |
| Lab Humidity:           | 10-70 %           | 36.00 %        | Passed        |
| Peak Resultant Accel.:  | 100-120 Gs        | 111.95 Gs      | Passed        |
| Peak Lateral Accel.:    | 15 Gs Max         | 13.03 Gs       | Passed        |
| Curve PerCent NonModal: | < 17%             | 12.59 %        | Passed        |

Head Drop Frontal

Head Resultant

Max: 112.0 [g's] at 0.002 [s]

Min: 0.2 [g's] at -0.003 [s]



# Head Drop Rear

Part 572R Rear Head Drop

Calibration Date: 01-15-07

Serial No: 103

Work File: Crabi\_103\_HD\_Rear\_01-15-07

## -----TEST RESULTS-----

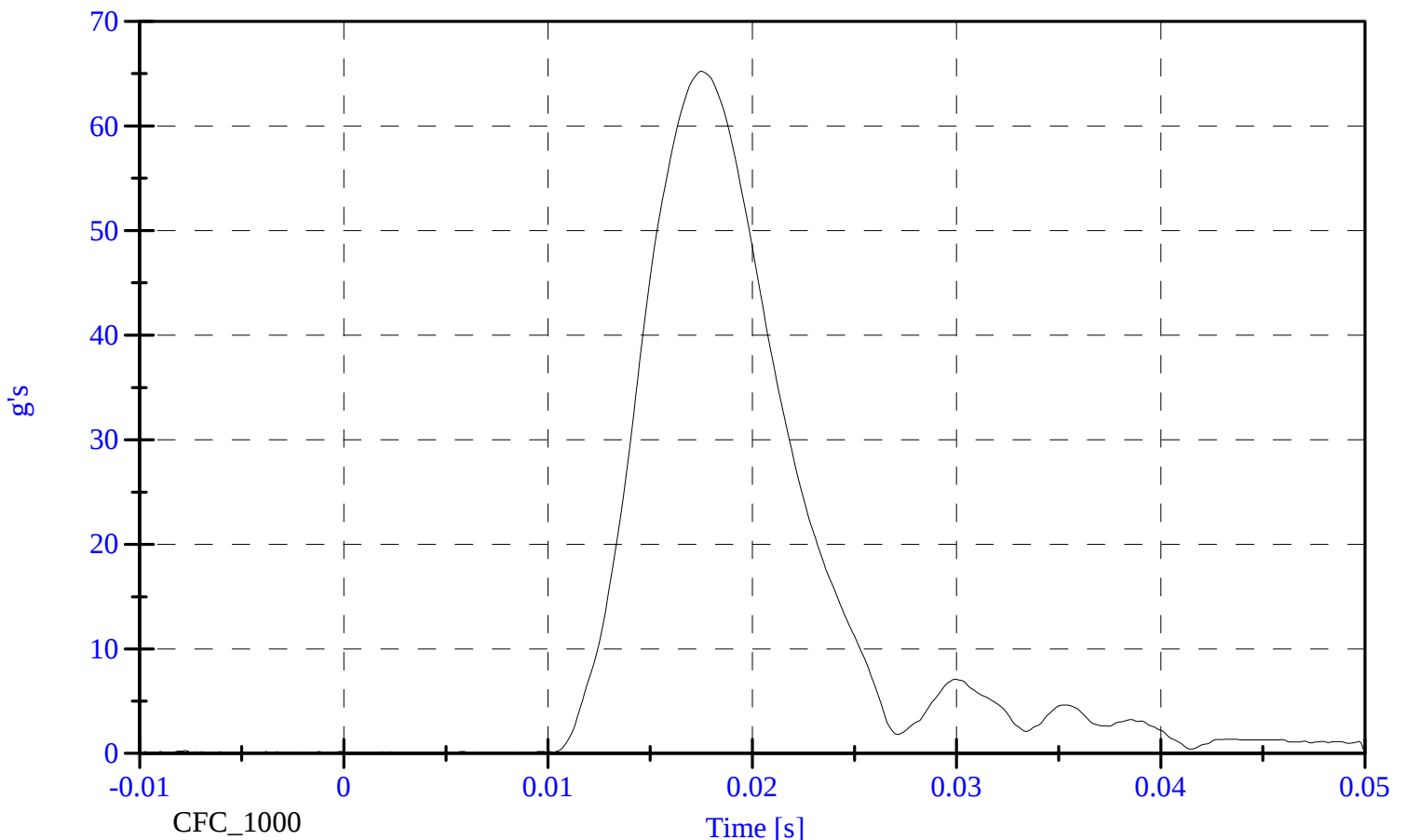
| <u>TEST CONDITION</u>   | <u>PARAMETERS</u> | <u>RESULTS</u> | <u>STATUS</u> |
|-------------------------|-------------------|----------------|---------------|
| Lab Temperature:        | 18.9-25.6 C       | 21.1 C         | Passed        |
| Lab Humidity:           | 10-70 %           | 36.00 %        | Passed        |
| Peak Resultant Accel.:  | 55-71 Gs          | 65.22 Gs       | Passed        |
| Peak Lateral Accel.:    | 15 Gs Max         | 2.91 Gs        | Passed        |
| Curve PerCent NonModal: | < 17%             | 10.88 %        | Passed        |

Head Drop Rear

Head Resultant

Max: 65.2 [g's] at 0.018 [s]

Min: 0.0 [g's] at -0.005 [s]



## Neck Flexion

Part 572R

Neck Flexion Test

Calibration Date:

01-15-07

Serial No:

103

Work File:

Crabi\_103\_NF\_01-15-0

### -----TEST RESULTS-----

| <u>TEST CONDITION</u> | <u>PARAMETERS</u> | <u>RESULTS</u> | <u>STATUS</u> |
|-----------------------|-------------------|----------------|---------------|
| Lab Temperature:      | 20.6-22.2 C       | 21.11 C        | Passed        |
| Lab Humidity:         | 10-70 %           | 37.00 %        | Passed        |
| Test Pendulum Speed:  | 5.10- 5.30 m/s    | 5.25 m/s       | Passed        |

### -----PENDULUM PULSE-----

|                 |                |          |        |
|-----------------|----------------|----------|--------|
| Pulse at 10 ms: | 1.60- 2.30 m/s | 1.78 m/s | Passed |
| Pulse at 20 ms: | 3.40- 4.20 m/s | 3.75 m/s | Passed |
| Pulse at 25 ms: | 4.30- 5.20 m/s | 4.59 m/s | Passed |

### -----D PLANE ROTATION-----

|                   |               |           |        |
|-------------------|---------------|-----------|--------|
| Maximum Rotation: | 75.0-86.0 Deg | 84.66 Deg | Passed |
|-------------------|---------------|-----------|--------|

### -----MOMENT ABOUT THE OCCIPITAL CONDYLE-----

|                         |                  |           |        |
|-------------------------|------------------|-----------|--------|
| Max Occipital Moment:   | 36.00- 45.00 N-m | 39.67 N-m | Passed |
| Occipital Moment Decay: | 60.0-80.0 ms     | 76.00 ms  | Passed |

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## Neck Extension

|            |                     |                   |                      |
|------------|---------------------|-------------------|----------------------|
| Part 572R  | Neck Extension Test | Calibration Date: | 01-15-07             |
| Serial No: | 103                 | Work File:        | Crabi_103_NE1_01-15- |

### -----TEST RESULTS-----

| <u>TEST CONDITION</u> | <u>PARAMETERS</u> | <u>RESULTS</u> | <u>STATUS</u> |
|-----------------------|-------------------|----------------|---------------|
| Lab Temperature:      | 20.6-22.2 C       | 21.11 C        | Passed        |
| Lab Humidity:         | 10-70 %           | 37.00 %        | Passed        |
| Test Pendulum Speed:  | 2.40- 2.60 m/s    | 2.43 m/s       | Passed        |

### -----PENDULUM PULSE-----

|                 |                |          |        |
|-----------------|----------------|----------|--------|
| Pulse at 6 ms:  | 0.80- 1.20 m/s | 0.83 m/s | Passed |
| Pulse at 10 ms: | 1.50- 2.10 m/s | 1.62 m/s | Passed |
| Pulse at 14 ms: | 2.20- 2.90 m/s | 2.50 m/s | Passed |

### -----D PLANE ROTATION-----

|                   |               |           |        |
|-------------------|---------------|-----------|--------|
| Maximum Rotation: | 80.0-92.0 Deg | 80.83 Deg | Passed |
|-------------------|---------------|-----------|--------|

### -----MOMENT ABOUT THE OCCIPITAL CONDYLE-----

|                         |                   |            |        |
|-------------------------|-------------------|------------|--------|
| Max Occipital Moment:   | -23.00--12.00 N-m | -15.61 N-m | Passed |
| Occipital Moment Decay: | 76.0-90.0 ms      | 83.10 ms   | Passed |

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# Thorax Impact

Part 572R Thorax Impact

Calibration Date:

01-16-07

Serial No: 103

Work File:

Crabi\_103\_T3\_01-16-07

## -----TEST RESULTS-----

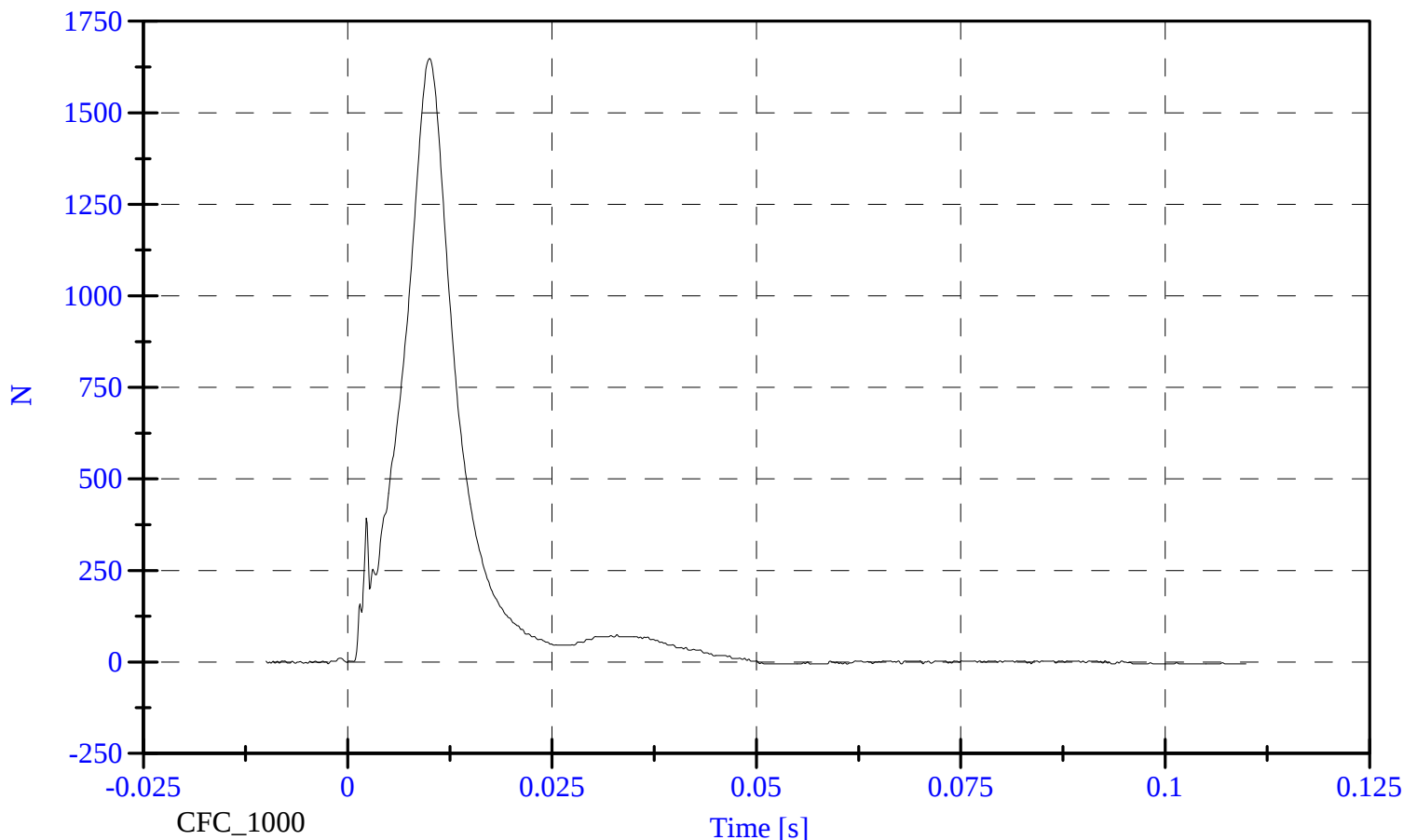
| <u>TEST CONDITION</u> | <u>PARAMETERS</u> | <u>RESULTS</u> | <u>STATUS</u> |
|-----------------------|-------------------|----------------|---------------|
| Lab Temperature:      | 20.6-22.2 C       | 21.1 C         | Passed        |
| Lab Humidity:         | 10-70 %           | 35.00 %        | Passed        |
| Pendulum Velocity:    | 4.90- 5.10 m/s    | 5.01 m/s       | Passed        |
| Maximum Res. Force:   | 1514.00-1796.00 N | 1648.54 N      | Passed        |

Thorax Impact

Probe Force vs. Time

Max: 1648.5 [N] at 0.010 [s]

Min: -5.5 [N] at 0.061 [s]



## **SECTION 6**

### **TEST EQUIPMENT LIST AND CALIBRATION INFORMATION**

# TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

## P572C INSTRUMENTATION

|               | POSITION #3 (RIGHT) SERIAL NO.: 102 |              |                  |
|---------------|-------------------------------------|--------------|------------------|
|               | SERIAL NUMBER                       | MANUFACTURER | CALIBRATION DATE |
| HEAD AX       | AC-P51288                           | ENDEVCO      | 24-Jul-07        |
| HEAD AY       | AC-P51295                           | ENDEVCO      | 24-Jul-07        |
| HEAD AZ       | AC-P51282                           | ENDEVCO      | 24-Jul-07        |
| HEAD RAZ      | AC-P51298                           | ENDEVCO      | 24-Jul-07        |
| UPPER NECK FX | LC-231Fx                            | DENTON       | 24-Jul-07        |
| UPPER NECK FY | LC-231Fy                            | DENTON       | 24-Jul-07        |
| UPPER NECK FZ | LC-231Fz                            | DENTON       | 24-Jul-07        |
| UPPER NECK MX | LC-231Mx                            | DENTON       | 24-Jul-07        |
| UPPER NECK MY | LC-231My                            | DENTON       | 24-Jul-07        |
| UPPER NECK MZ | LC-231Mz                            | DENTON       | 24-Jul-07        |
| CHEST AX      | AC-B02A18-N21                       | ENTRAN       | 24-Jul-07        |
| CHEST AY      | AC-99H30-Z14                        | ENTRAN       | 24-Jul-07        |
| CHEST AZ      | AC-00L13-F39                        | ENTRAN       | 24-Jul-07        |

# TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

## P572C INSTRUMENTATION

|               | POSITION #4 (LEFT) SERIAL NO.: 103 |              |                  |
|---------------|------------------------------------|--------------|------------------|
|               | SERIAL NUMBER                      | MANUFACTURER | CALIBRATION DATE |
| HEAD AX       | AC-03E03E20-N04                    | ENTRAN       | 25-Jul-07        |
| HEAD AY       | AC-02A18-N01                       | ENTRAN       | 25-Jul-07        |
| HEAD AZ       | AC-B02A25-N01                      | ENTRAN       | 25-Jul-07        |
| HEAD RAZ      | AC-03D03D09-N08                    | ENTRAN       | 25-Jul-07        |
| UPPER NECK FX | LC-211Fx                           | DENTON       | 26-Jul-07        |
| UPPER NECK FY | LC-211Fy                           | DENTON       | 26-Jul-07        |
| UPPER NECK FZ | LC-211Fz                           | DENTON       | 26-Jul-07        |
| UPPER NECK MX | LC-211Mx                           | DENTON       | 26-Jul-07        |
| UPPER NECK MY | LC-211My                           | DENTON       | 26-Jul-07        |
| UPPER NECK MZ | LC-211Mz                           | DENTON       | 26-Jul-07        |
| CHEST AX      | AC-98H14-K15                       | ENTRAN       | 25-Jul-07        |
| CHEST AY      | AC-98H10-F02                       | ENTRAN       | 25-Jul-07        |
| CHEST AZ      | AC-98H14-K13                       | ENTRAN       | 25-Jul-07        |

## TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

### VEHICLE AND MDB INSTRUMENTATION

|            | VEHICLE AND CRS INSTRUMENTS |              |                  |
|------------|-----------------------------|--------------|------------------|
|            | SERIAL NUMBER               | MANUFACTURER | CALIBRATION DATE |
| P3 CRS (X) | AC-P14965                   | ENDEVCO      | 09-Aug-07        |
| P3 CRS (Y) | AC-P17563                   | ENDEVCO      | 09-Aug-07        |
| P3 CRS (Z) | AC-P18948                   | ENDEVCO      | 09-Aug-07        |
| P4 CRS (X) | AC-P32218                   | ENDEVCO      | 09-Aug-07        |
| P4 CRS (Y) | AC-P18785                   | ENDEVCO      | 09-Aug-07        |
| P4 CRS (Z) | AC-P23926                   | ENDEVCO      | 09-Aug-07        |

**REMARKS:** None