REPORT NUMBER: TWG-TRC-20-03

# NEW CAR ASSESSMENT PROGRAM (NCAP)
# Side Airbag Out-of-Position Test

FCA ITALY S.P.A.
2020 Jeep Renegade SUV

NHTSA NUMBER: M20200309TWG2
TRC TEST NUMBER: 200723-2

PREPARED BY:
TRANSPORTATION RESEARCH CENTER INC.
10820 State Route 347
P.O. BOX B-67
East Liberty, OH 43319

Test Date: July 23, 2020

FINAL REPORT

U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crashworthiness Standards
Mail Code: NRM- 110
1200 New Jersey Ave, SE
Room W43- 410
Washington, DC 20590

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Prepared By: ILO Projects Operations Group

Approved By: 

John Shultz
Project Manager

Approval Date: May 19, 2021

FINAL REPORT ACCEPTANCE BY OCWS:

Division Chief, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

COR, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

## TECHNICAL REPORT DOCUMENTATION PAGE

| | | |
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| 1. REPORT NO.<br>TWG-TRC-20-03 | 2. GOVERNMENT ACCESSION NO. | 3. RECIPIENT'S CATALOG NO. |
| 4. TITLE AND SUBTITLE<br>Final Report of New Car Assessment Program<br>Side Air Bag Out-of-Position Testing of<br>2020 Jeep Renegade SUV<br>NHTSA No. M20200309TWG2 | | 5. Report Date<br>May 19, 2021<br>6. PERFORMING ORGANIZATION CODE<br>TRC |
| 7. AUTHOR(S)<br>John Shultz, Project Manager | | 8. PERFORMING ORGANIZATION REPORT NO.<br>200723-2 |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS<br>Transportation Research Center Inc.<br>10820 State Route 347<br>East Liberty, OH 43319 | | 10. WORK UNIT NO.<br>11. CONTRACT OR GRANT NO.<br>693JJ919D000007 |
| 12. SPONSORING AGENCY NAME AND ADDRESS<br>United States Department of Transportation<br>National Highway Traffic Safety Administration<br>Office of Crashworthiness Standards (NRM-110)<br>1200 New Jersey Ave., SE, Room W43-410<br>Washington, DC 20590 | | 13. TYPE OF REPORT AND PERIOD COVERED<br>Final Test Report<br>July 23, 2020 – May 19, 2021<br>14. SPONSORING AGENCY CODE<br>NRM-110 |
| 15. SUPPLEMENTARY NOTES | | |

16. ABSTRACT

A side air bag out of position test was conducted on the subject 2020 Jeep Renegade SUV in accordance with the specifications of the Office of Crashworthiness Standards SAB OOP NCAP Laboratory Test Procedure for the generation of consumer information on vehicle side air bag protection. The test was conducted at the Transportation Research Center Inc. in East Liberty, Ohio, on July 23, 2020.

The curtain and torso side air bags were deployed and responses were measured on a Hybrid III 3-Year-Old. One real-time camera and three high speed cameras recorded the event. The ambient temperature at the time of air bag deployment was 21.4°C.

**Section 3.3.3.2 – Hybrid III 3-Year-Old – Position 2**

| Measurement Description | Units | IARV | Result |
|---|---|---|---|
| Head Injury Criteria (HIC15) | N/A | 570 | 116 |
| Nij | N/A | 1 | 1.06[1] |
| Upper Neck Tension | Newton | 1130 | 1085.5 |
| Upper Neck Compression | Newton | 1380 | -123.7 |
| Maximum Chest Compression | mm | 36 | -49.8 |
| Maximum Chest Compression rate | m/sec | 8.0 | -7.1 |

| | |
|---|---|
| 17. KEY WORDS<br>New Car Assessment Program<br>Side Air Bag<br>Out-of-position (OOP)<br>Technical Working Group (TWG) | 18. DISTRIBUTION STATEMENT<br>Copies of this report are available from the following:<br>National Highway Traffic Safety Administration<br>Technical Information Services<br>1200 New Jersey Ave, SE<br>Washington, DC 20590<br>Email: tis@nhtsa.dot.gov<br>FAX: 202-493-2833 |

| | | | |
|---|---|---|---|
| 19. SECURITY CLASSIFICATION OF REPORT<br>Unclassified | 20. SECURITY CLASSIFICATION OF PAGE<br>Unclassified | 21. NO. OF PAGES<br>68 | 22. PRICE |

[1] NIJ exceeded the limit

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## SECTION 1 – TEST PURPOSE AND PROCEDURE

This side air bag out-of-position test is part of the MY20 New Car Assessment Program (NCAP), sponsored by the National Highway Traffic Safety Administration (NHTSA), under contract number 693JJ919D000007. The purpose of this test is to obtain data on the performance of side air bags with an out-of-position occupant in a 2020 Jeep Renegade SUV. The air bag test was conducted in accordance with the Office of Crashworthiness Standard's Laboratory Test Procedure, dated November 2019.

## SECTION 2 – SUMMARY OF TEST RESULTS

The effects of both a seat-mounted side air bag and a curtain air bag deployment in a 2020 Jeep Renegade SUV on an out-of-position Hybrid III 3-Year-Old were evaluated. The test was performed by TRC on July 23, 2020. Pre and post-test photographs of the vehicle and ATD can be found in Appendix A.

The vehicle had previously undergone crash testing as part of the NCAP. After conducting the crash test and before conducting the air bag deployment test, the vehicle was inspected for damage. The vehicle was found to be in good condition to undergo the air bag deployment test.

One real-time camera and three high-speed cameras were used to record the air bag deployment event. High speed images were recorded at rates of 1,000 frames per second. Cameras were placed relative to the position 2 and were positioned to capture the deployment event from the side, the front, and the oblique views.

The Hybrid III 3-Year-Old was placed in the right front (passenger) seat situated rearward facing. This placement followed the ATD placement instructions in the NCAP Laboratory Test Procedure as well as the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags as prepared by the Side Airbag Out-of-Position Injury Technical Working Group (TWG). The specific test section was section 3.3.3.2.

The 3-Year-Old was instrumented with head X, Y, and Z accelerometers, a six-axis upper neck load cell and a six-axis lower neck load cell, chest deflection potentiometer, and thorax accelerometers. During the air bag deployment, a total of twenty-five channels of data were recorded using an on-board data acquisition system. Appendix B contains the ATD response data traces and Appendix C contains the instrumentation list and calibration information. Appendix D contains the dummy's pre-test qualification performance verification data.

The upper neck tension and Nij NTE injury values exceeded during the test, but upper neck tension (1085.5) did not exceed the IARV of 1130. The thorax compression recorded questionable data throughout the event. The occupant data is summarized below:

| Measurement Description | Units | Passenger ATD Hybrid III 3-Year-Old | |
|---|---|---|---|
| | | IARV | Result |
| Head Injury Criteria (HIC15) | N/A | 570 | 116 |
| Nij | N/A | 1 | 1.06 |
| Upper Neck Tension | N | 1130 | 1085.5 |
| Upper Neck Compression | N | 1380 | -123.7 |
| Thorax Compression | mm | 36 | -49.8 |
| Thorax Compression rate | m/sec | 8.0 | -7.1 |

## SECTION 3 DATA SHEET

### DATA SHEET NO. 1
### TEST SUMMARY

| | | | |
|---|---|---|---|
| Test Vehicle: | 2020 Jeep Renegade SUV | NHTSA No.: | M20200309TWG2 |
| Test Program: | Side Air Bag Out-of-Position Test | Test Date: | 7/23/2020 |

### TEST SUMMARY

### TEST CONFIGURATION INFORMATION

| | | |
|---|---|---|
| Seating Position: | P2 | Right Front Seating Position |
| Test Section: | 3.3.3.2 | Seat-Mounted, Rearward Facing |
| Airbag 1: | Seat | Seat mounted – outside seam |
| Airbag 2: | Side Rail | Side curtain airbag |
| Booster Block: | N/A | N/A |
| ATD Type/Serial No.: | Hybrid III 3-Year-Old | 040 |
| Vehicle | Jeep | Renegade |
| Previous Crash Test | MDB | 191210 and M20200309 |

### EQUIPMENT INFORMATION

| | |
|---|---|
| Number of Data Channels | 25 |
| Number of High Speed Video Cameras | 3 |
| Number of Real Time Video Cameras | 1 |

### VISIBLE DUMMY CONTACT POINTS

| | |
|---|---|
| Head | Curtain Airbag and Seat Mounted Airbag |
| Upper Torso | Seat Mounted Airbag |
| Lower Torso | Seat Mounted Airbag |
| Knee | None Visible |

## DATA SHEET NO. 2
## GENERAL TEST AND VEHICLE PARAMETER DATA

| | | | |
|---|---|---|---|
| Test Vehicle: | 2020 Jeep Renegade SUV | NHTSA No.: | M20200309TWG2 |
| Test Program: | Side Air Bag Out-of-Position Test | Test Date: | 7/23/2020 |

### TEST CONFIGURATION INFORMATION

| | |
|---|---|
| NHTSA No. | M20200309 |
| Model Year | 2020 |
| Make | Jeep |
| Model | Renegade |
| Body Style | MPV |
| VIN | ZACNJAB13LPK99039 |
| Body Color | Glacier Metallic |
| Odometer Reading (km/mi) | 175 mi |
| Engine Displacement (L) | 1.3 |
| Type/No. Cylinders | Inline/4 |
| Engine Placement | Front Transverse |
| Transmission Type | Automatic |
| Transmission Speeds | 9 |
| Overdrive | Yes |
| Final Drive | FWD |
| Roof Rack | No |
| Sunroof/T-Top | No |
| Running Boards | No |
| Tilt Steering Wheel | Yes |
| Power Seats | Driver Only |
| Anti-Lock Brakes (ABS) | Yes |

| | |
|---|---|
| Traction Control System (TCS) | Yes |
| Auto-Leveling System | No |
| Automatic Door Locks (ADL) | Yes |
| Power Window Auto-Reverse | Yes |
| Other Optional Feature | No |
| Driver Front Airbag | Yes |
| Driver Curtain Airbag | Yes |
| Driver Head/Torso Airbag | No |
| Driver Torso Airbag | No |
| Driver Torso/Pelvis Airbag | Yes |
| Driver Pelvis Airbag | No |
| Driver Knee Airbag | Yes |
| Rear Pass. Curtain Airbag | |
| Rear Pass. Head/Torso Airbag | No |
| Rear Pass. Torso Airbag | No |
| Rear Pass. Torso/Pelvis Airbag | No |
| Rear Passenger Pelvis Airbag | No |
| Driver Seat Belt Pretensioner | Yes |
| Rear Pass. Seat Belt Pretensioner | No |
| Driver Load Limiter | Yes |
| Rear Passenger Load Limiter | No |
| Other Safety Restraint | No |

### DATA FROM CERTIFICATION LABEL

| | |
|---|---|
| Manufactured By | FCA ITALY S.P.A. |
| Date of Manufacture | 09/19 |
| Vehicle Type | MPV |

| | |
|---|---|
| GVWR (kg) | 1945 |
| GAWR Front (kg) | 1050 |
| GAWR Rear (kg) | 960 |

### VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

| Measured Parameter | Front | Rear | Third | Total | |
|---|---|---|---|---|---|
| Designated Seating Capacity DSC) | 2 | 3 | N/A | 5 | |
| Capacity Weight (VCW) (kg) | | | | 390.0 | (A) |
| DSC x 68.04 (kg) | | | | 340.2 | (B) |
| Cargo Weight (RCLW) (kg) | | | | 49.8 | (A-B) |

### VEHICLE SEAT TYPE

| Seating Location | Type of Seat Pan | | | | Type of Seat Back | | |
|---|---|---|---|---|---|---|---|
| | Bucket | Bench | Split Bench | Contoured | Fixed | Adjustable | |
| | | | | | | w/ Lever | w/ Knob |
| Front Seat | Yes | N/A | N/A | | N/A | N/A | Yes |
| Rear or Second Row Seat | N/A | N/A | Yes | Yes | Yes | N/A | N/A |
| Third Row Seat | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

**DATA SHEET NO. 3**

**SEAT ADJUSTMENT DATA**

Test Vehicle: 2020 Jeep Renegade SUV NHTSA No.: M20200309TWG2

Test Program: Side Air Bag Out-of-Position Test Test Date: 7/23/2020

**VEHICLE SEAT FORE/AFT POSITION**

| Seat Location | Total Fore/Aft Travel | | Test Position from Forwardmost Position | |
|---|---|---|---|---|
| | mm | # Detents | mm | # Detents |
| Front Right | 250 | 26 | 140 | 14 |
| Rear Right | Fixed | Fixed | Fixed | Fixed |

| | |
|---|---|
| Seat Fore/Aft Position Per TWG Guidelines | Start full rear and move to reduce dummy head to B-pillar contact. |
| Reason for Deviation from TWG Guidelines | Moved seat to 140mm from full forward to avoid contact. |

**VEHICLE SEAT BACK ANGLE ADJUSTMENT**

| Seat Location | Total Seat Back Angle Range | | Test Position from Most Upright (Vertical) | |
|---|---|---|---|---|
| | Degrees | # Detents | Degrees | # Detents |
| Front Right | 81.5 | 57 | 3.8 | 2 |
| Rear Right | 0 | Fixed | 23.2 | Fixed |

| | |
|---|---|
| OEM Back Angle Design Position | 4.1 Degrees |
| Method of Measuring Back Angle Position | At headrest post |
| Seat Back Angle Position Per TWG Guidelines | Manufacturer's design angle |
| Reason for Deviation from TWG Guidelines | N/A |

**VEHICLE SEAT HEIGHT ADJUSTMENT**

| Seat Location | Total Height Adjustment Range | | Test Position from Lowest Position | |
|---|---|---|---|---|
| | mm | # Detents | mm | # Detents |
| Front Right | Fixed | Fixed | Fixed | Fixed |
| Rear Right | Fixed | Fixed | Fixed | Fixed |

| | |
|---|---|
| Seat Height Adjustment Per TWG Guidelines | Adjust to full down position |
| Reason for Deviation from TWG Guidelines | Seat height is non-adjustable |

**DATA SHEET NO. 4**
**DUMMY SETUP AND POSITIONING DATA**

| | | | |
|---|---|---|---|
| Test Vehicle: | 2020 Jeep Renegade SUV | NHTSA No.: | M20200309TWG2 |
| Test Program: | Side Air Bag Out-of-Position Test | Test Date: | 7/23/2020 |

**DUMMY INFORMATION**

| | |
|---|---|
| ATD Type | Hybrid III 3 Year Old |
| Serial Number | 040 |
| Qualification Date | 7/16/2020 |
| Qualification Type | Full Cal |
| Clothing | Cotton shirt and pants |
| Other ATD Prep | Electrical tape on skull cap seam, baby power on head |

**DUMMY POSITIONING INFORMATION**

| | |
|---|---|
| TWG Setup Instructions | As specified in the 3.3.3.2 Test Procedure; Seat is adjusted to its highest position; ATD positioned to 3.3.3.2.1. |
| Actual Setup | The seat back angle is set to the manufacturer's specification.<br><br>The seat was initially set to the full rear position and the height is not adjustable. In order to align the vertical centerline of the dummy's sternum as close as possible with the leading edge of the seat back bolster, the seat track was moved to 140mm rear of the full-forward position.<br><br>The dummy is placed along the outboard edge of the seat cushion, kneeling and facing rearward, with the sternum contacting the seat. The dummy's head is in between the seat bolster and pillar/side trim and is not forced into flexion or extension.<br><br>The outboard leg is set at the outboard edge of the seat cushion bolster and parallel to the seat centerline. The outboard knee and lower leg are slid toward the seat bight to bring the top edge of the upper rib as close as possible with the top edge of the airbag module. The inboard leg is parallel to the centerline of the seat cushion.<br><br>The inboard knee and lower leg are slid in towards the seat bight to achieve a line perpendicular to the vehicle centerline through both shoulder bolts. The inboard thumb is contacting the seat back. The outboard arm and hand are hanging down as close to vertical as possible. |

**DATA SHEET NO. 5**
**DUMMY INJURY CRITERIA DATA**

Test Vehicle: 2020 Jeep Renegade SUV NHTSA No.: M20200309TWG2
Test Program: Side Air Bag Out-of-Position Test Test Date: 7/23/2020

**RECORDED DATA - MINIMUMS AND MAXIMUMS**

| Channel | Unit | CFC | Maximum | Time (ms) | Minimum | Time (ms) |
|---|---|---|---|---|---|---|
| Head X | G | 1000 | 36.21 | 14.72 | -23.89 | 16.96 |
| Head Y | G | 1000 | 47.57 | 9.20 | -33.95 | 233.04 |
| Head Z | G | 1000 | 31.01 | 11.76 | -13.61 | 16.40 |
| Head Resultant | G | 1000 | 59.09 | 14.72 | | |
| Head Red X | G | 1000 | 34.49 | 14.72 | -25.39 | 16.08 |
| Head Red Y | G | 1000 | 47.22 | 9.20 | -33.09 | 233.04 |
| Head Red Z | G | 1000 | 30.06 | 11.76 | -13.24 | 16.40 |
| Head Red Resultant | G | 1000 | 58.71 | 14.72 | | |
| Upper Neck X | N | 1000 | 241.98 | 234.88 | -597.45 | 15.28 |
| Upper Neck Y | N | 1000 | 313.40 | 221.52 | -679.74 | 12.24 |
| Upper Neck Z | N | 1000 | 1,085.47 | 12.16 | -123.72 | 231.60 |
| Upper Neck Resultant | N | 1000 | 1,303.07 | 12.24 | | |
| Upper Neck X | Nm | 600 | 34.23 | 12.24 | -15.10 | 222.24 |
| Upper Neck Y | Nm | 600 | 8.39 | 63.52 | -22.32 | 15.36 |
| Upper Neck Z | Nm | 600 | 7.56 | 288.96 | -19.78 | 27.60 |
| Upper Neck Resultant | Nm | 600 | 37.47 | 12.48 | | |
| Lower Neck X | N | 1000 | 192.22 | 6.64 | -474.41 | 18.32 |
| Lower Neck Y | N | 1000 | 477.52 | 237.60 | -754.16 | 11.52 |
| Lower Neck Z | N | 1000 | 1,253.14 | 11.92 | -138.64 | 39.92 |
| Lower Neck Resultant | N | 1000 | 1,467.94 | 11.92 | | |
| Lower Neck X | Nm | 600 | 19.12 | 237.28 | -31.94 | 11.68 |
| Lower Neck Y | Nm | 600 | 29.02 | 17.36 | -9.98 | 247.04 |
| Lower Neck Z | Nm | 600 | 7.48 | 289.12 | -26.16 | 22.32 |
| Lower Neck Resultant | Nm | 600 | 39.76 | 12.96 | | |
| Dummy Chest Deflection X | MM | 600 | 0.15 | 4.88 | -49.84 | 145.68 |
| Dummy Upper Sternum X | G | 1000 | 464.37 | 10.08 | -635.09 | 6.72 |
| Dummy Lower Sternum X | G | 1000 | 552.59 | 11.52 | -313.97 | 5.20 |

**HEAD INJURY SUMMARY**

| HIC15 | T1 (ms) | T2 (ms) | HIC36 | T1 (ms) | T2 (ms) |
|---|---|---|---|---|---|
| 116 | 8.32 | 23.36 | 135 | 8.08 | 31.12 |

**DATA SHEET NO. 5**
**DUMMY INJURY CRITERIA DATA (CONTINUED)**

Test Vehicle: 2020 Jeep Renegade SUV NHTSA No.: M20200309TWG2
Test Program: Side Air Bag Out-of-Position Test Test Date: 7/23/2020

**NECK INJURY SUMMARY**

| Injury Criteria | Value | Time (ms) |
|---|---|---|
| Upper Neck NTF | 0.31 | 10.24 |
| Upper Neck NTE | 1.06 | 13.60 |
| Upper Neck NCF | 0.09 | 300.00 |
| Upper Neck NCE | 0.34 | 224.00 |
| Peak Tension | 1085.47 | 12.16 |
| Peak Compression | -123.72 | 231.60 |

**CHEST INJURY SUMMARY**

| Injury Criteria | Value | Time (ms) |
|---|---|---|
| Chest Deflection[2] | N/A | N/A |
| Deflection Rate[1] | N/A | N/A |

[1] Deflection Rate was assessed by measuring compression from a rotary potentiometer
[2] Chest Deflection recorded questionable data throughout the event

**RESEARCH INJURY SUMMARY**

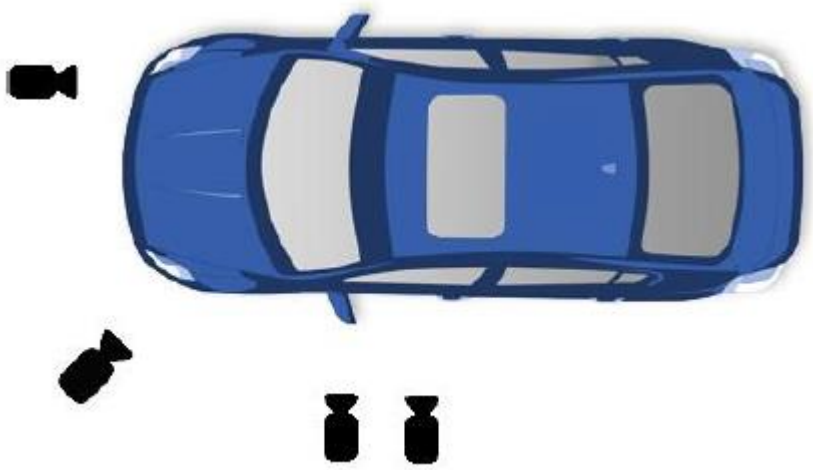
| Research Injury Criteria[1] | Value | Time (ms) |
|---|---|---|
| Upper Neck Lateral Moment | | |
| Upper Neck Twist Moment | | |
| Lower Neck Flexion Moment | | |
| Lower Neck Extension Moment | | |
| Lower Neck Lateral Moment | | |
| Lower Neck Twist Moment | | |
| Lower Neck Tension | | |
| Lower Neck Compression | | |
| Spine Acceleration | | |

[1]These injury criteria are only monitored and not considered pass/fail

**DATA SHEET NO. 6**
**CAMERA SETUP AND DESCRIPTION**

| | | | |
|---|---|---|---|
| Test Vehicle: | 2020 Jeep Renegade SUV | NHTSA No.: | M20200309TWG2 |
| Test Program: | Side Air Bag Out-of-Position Test | Test Date: | 7/23/2020 |

**CAMERA SETUP DIAGRAM FOR SAB OOP TESTS**



| No. | Camera View | Location (mm)[1] | | | Lens (mm) | Speed (fps) |
|---|---|---|---|---|---|---|
| | | X | Y | Z | | |
| 1 | Left View | -1995 | -3111 | -1240 | 25 | 1000 |
| 2 | Oblique View | 2298 | -1324 | -1525 | 25 | 1000 |
| 3 | Front View | 2293 | 260 | -1404 | 28 | 1000 |
| 4 | Real Time (optional) | -1763 | -3040 | -1165 | Zoom | 30 |

[1] +X forward of vehicle, +Y right of vehicle, +Z into ground

# APPENDIX A

# PHOTOGRAPHS

## TABLE OF PHOTOGRAPHS


**Figure A-1 Right Front ¾ View of Test Vehicle as Delivered**


**Figure A-2 Vehicle Certification Label**


**Figure A-3 Pre-Test Vehicle Left Side View**


**Figure A-4 Post-Test Vehicle Left Side View**


**Figure A-5 Pre-Test Vehicle Location of Air Bag 1**


**Figure A-6 Pre-Test Vehicle Location of Air Bag 2**


**Figure A-7 Pre-Test Vehicle Location of Air Bag 3**

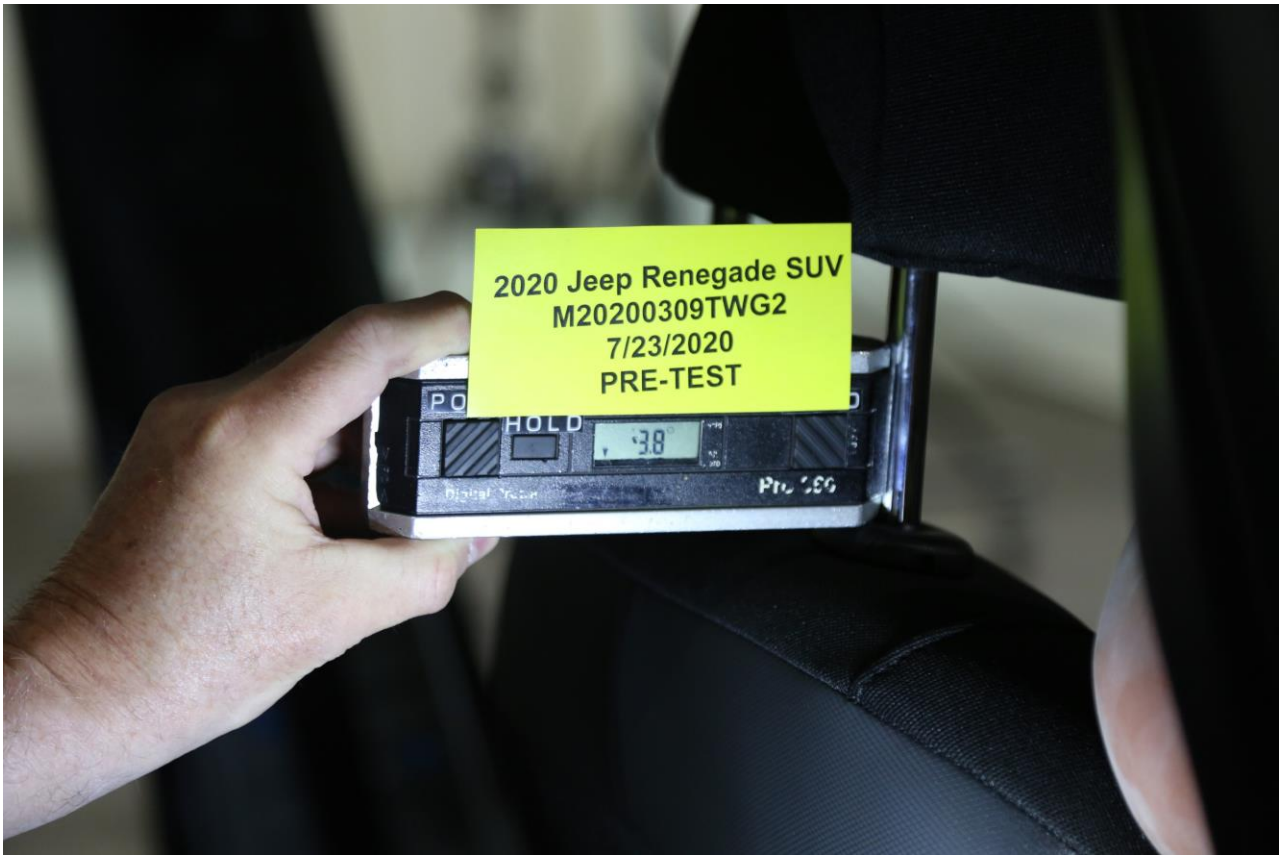



**Figure A-8 Pre-Test Vehicle Seat Back Angle**


**Figure A-9 Pre-Test Dummy Left Side View**

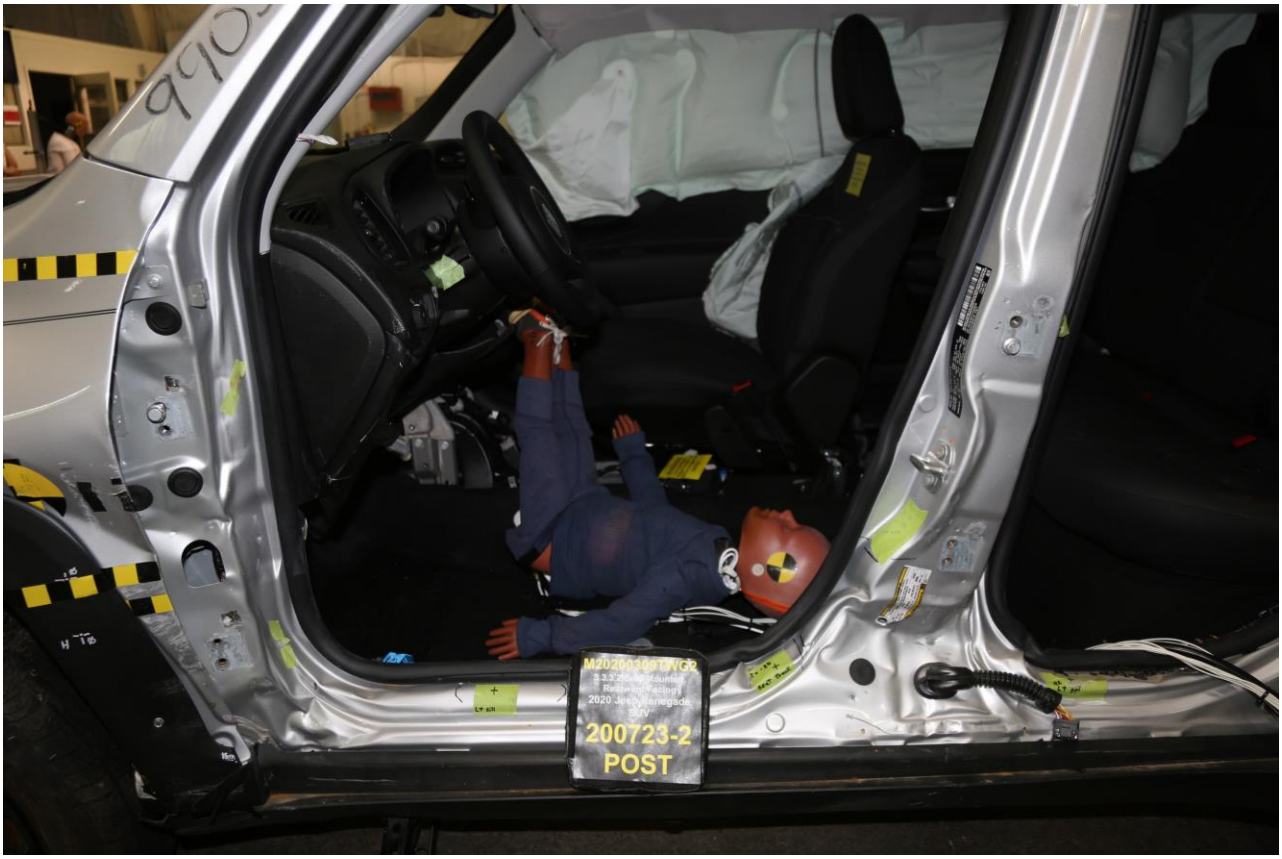



**Figure A-10 Post-Test Dummy Left Side View**


**Figure A-11 Pre-Test Dummy Left Side Close-up View**


**Figure A-12 Post-Test Dummy Left Side Close-up View**

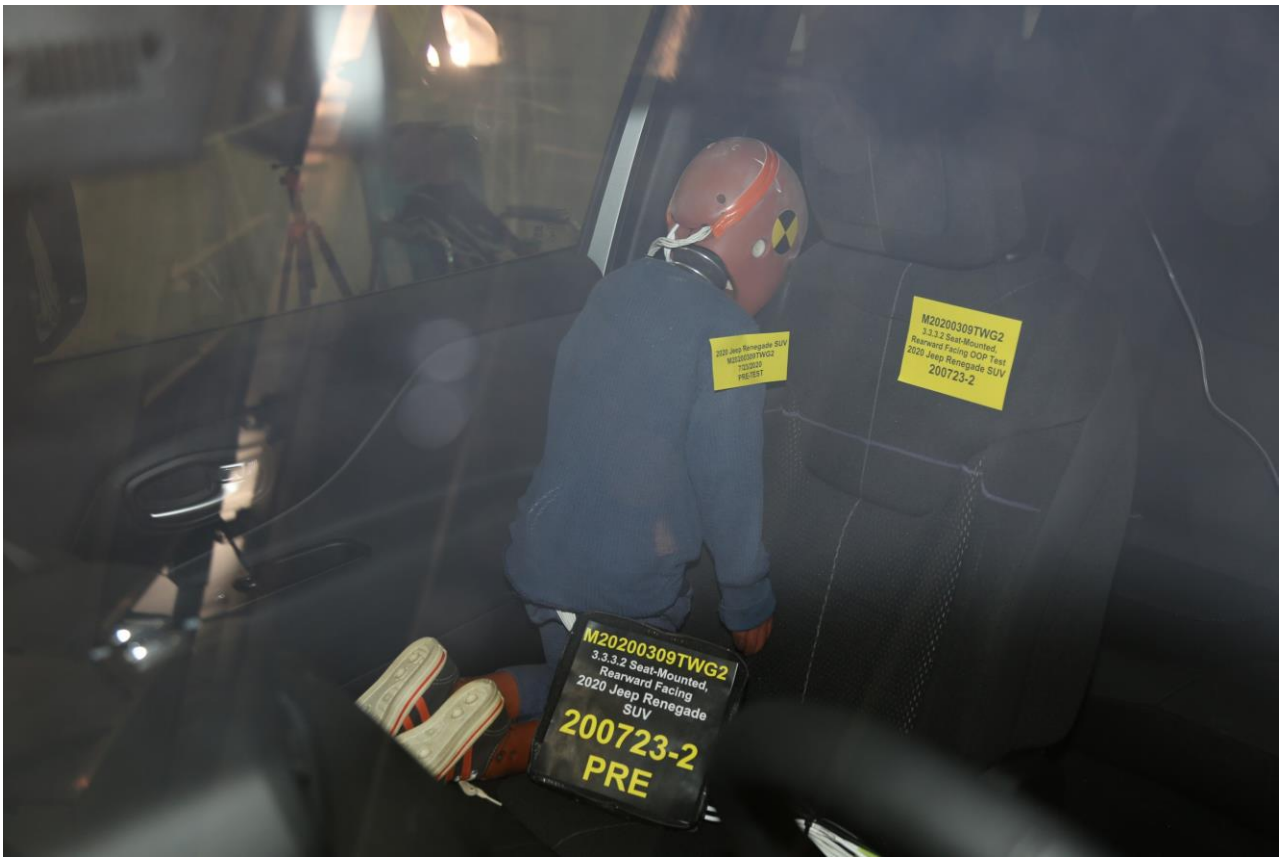



**Figure A-13 Pre-Test Dummy Left ¾ Front View**


**Figure A-14 Post-Test Dummy Left ¾ Front View**

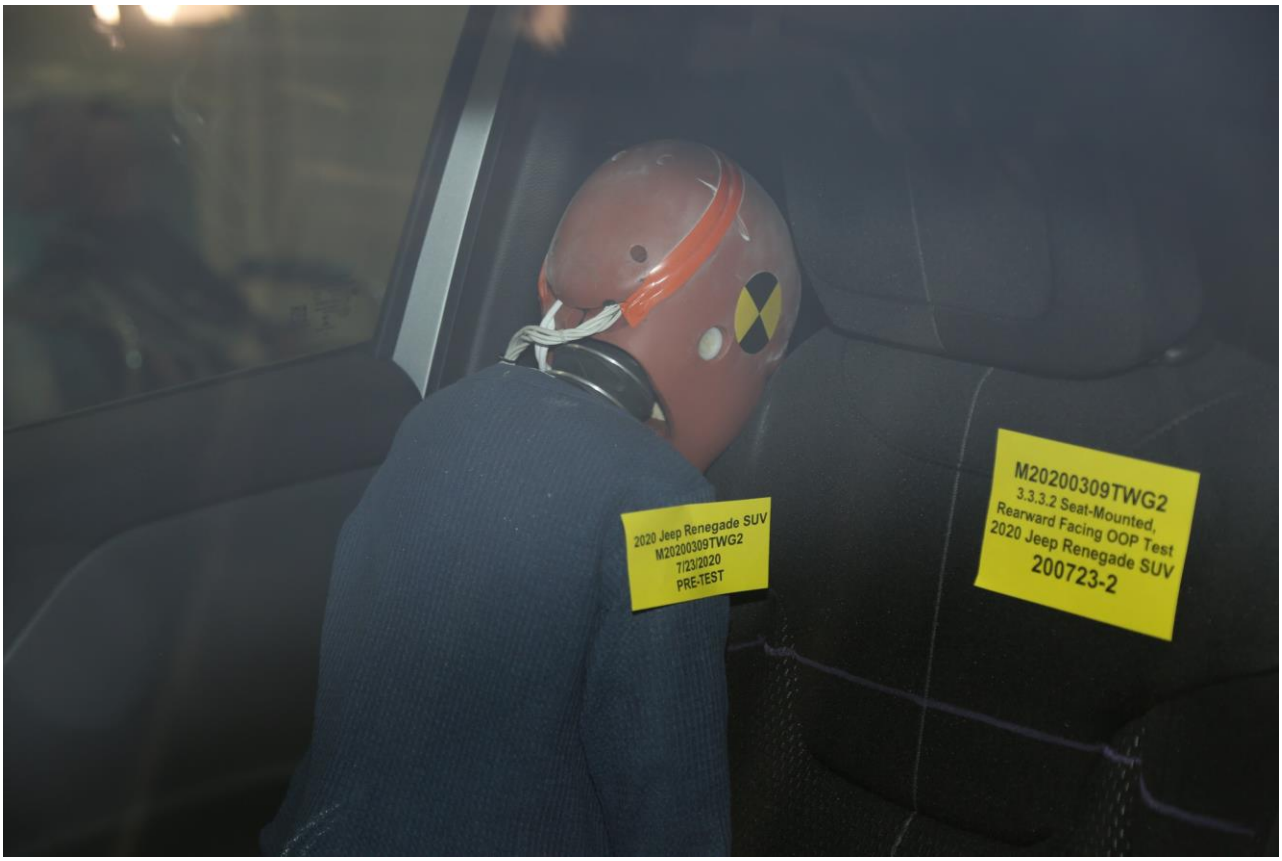



**Figure A-15 Pre-Test Dummy Left ¾ Front Close-up View**

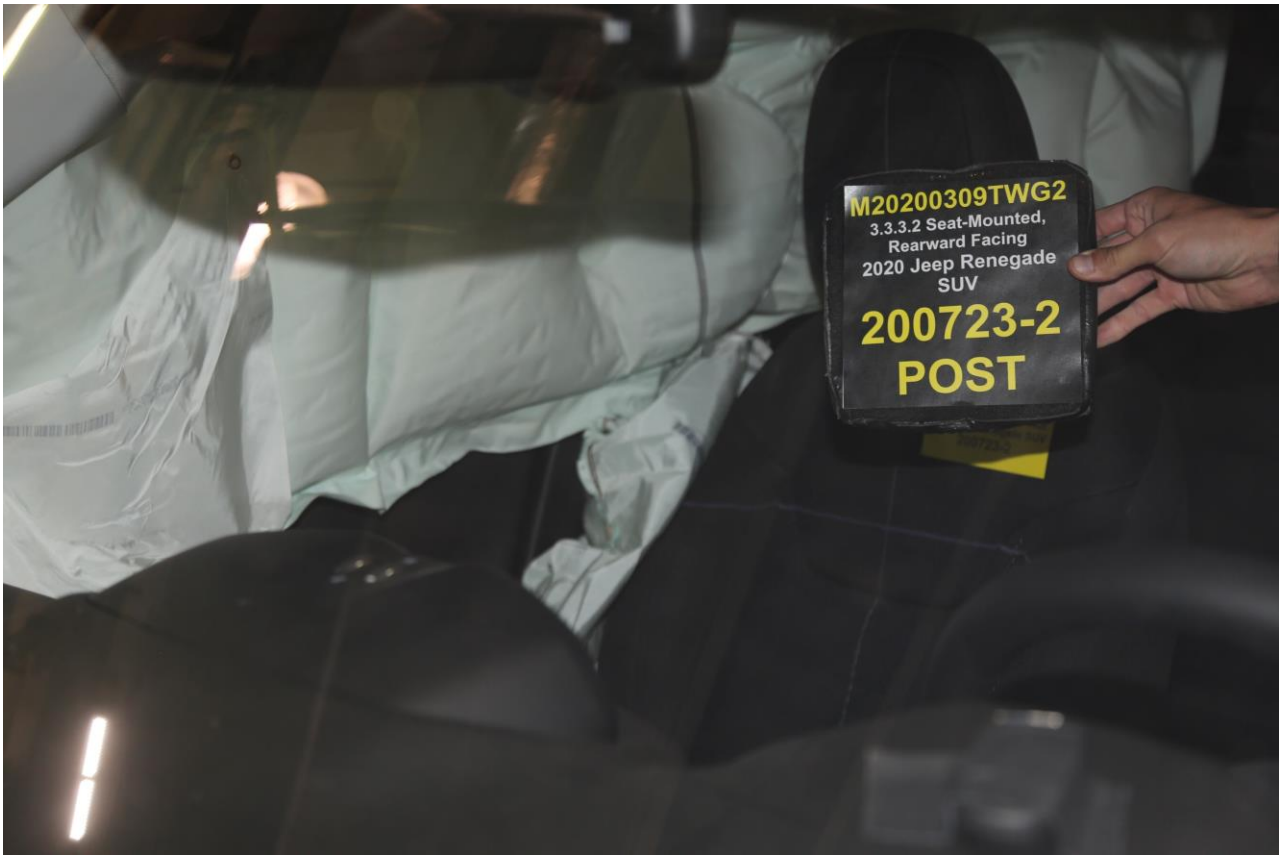



**Figure A-16 Post-Test Dummy Left ¾ Front Close-up View**

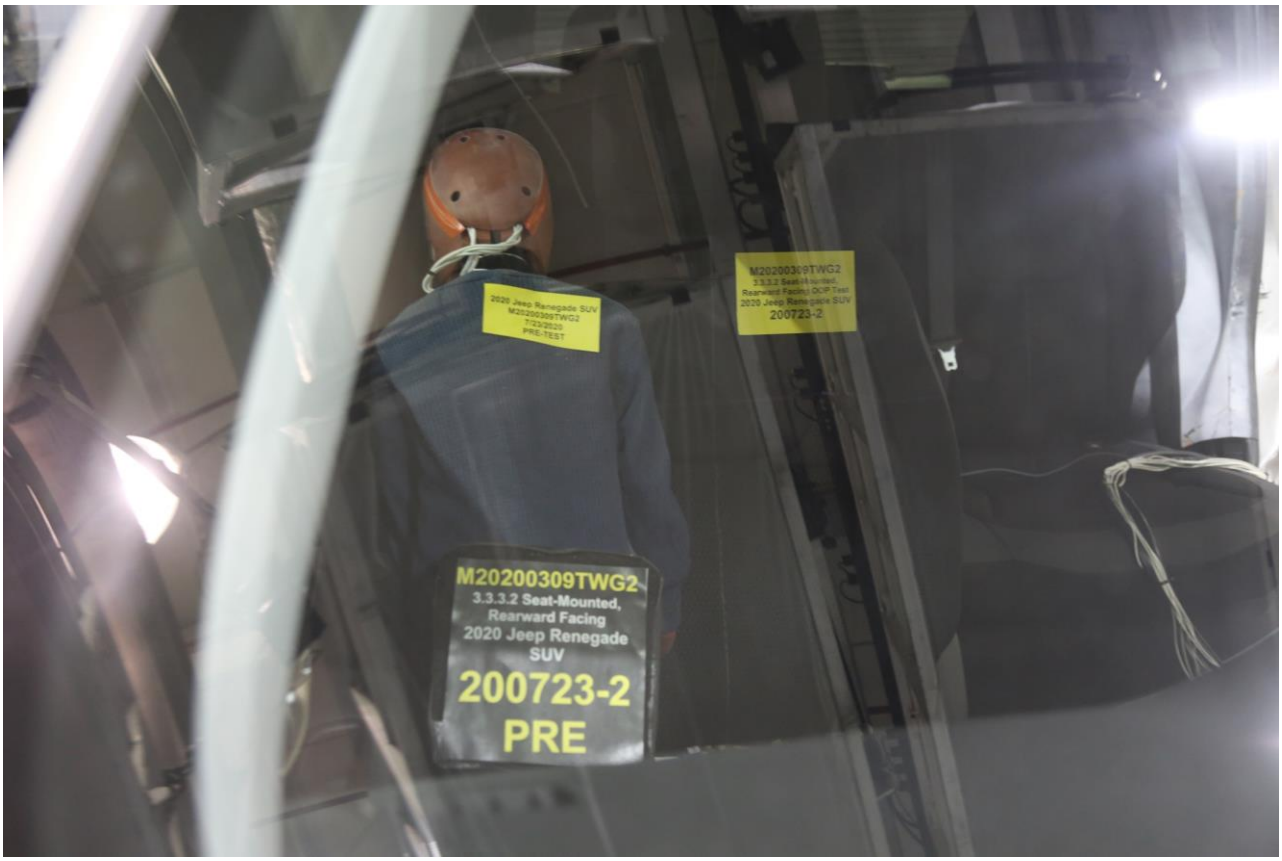



**Figure A-17 Pre-Test Dummy Front View**


**Figure A-18 Post-Test Dummy Front View**

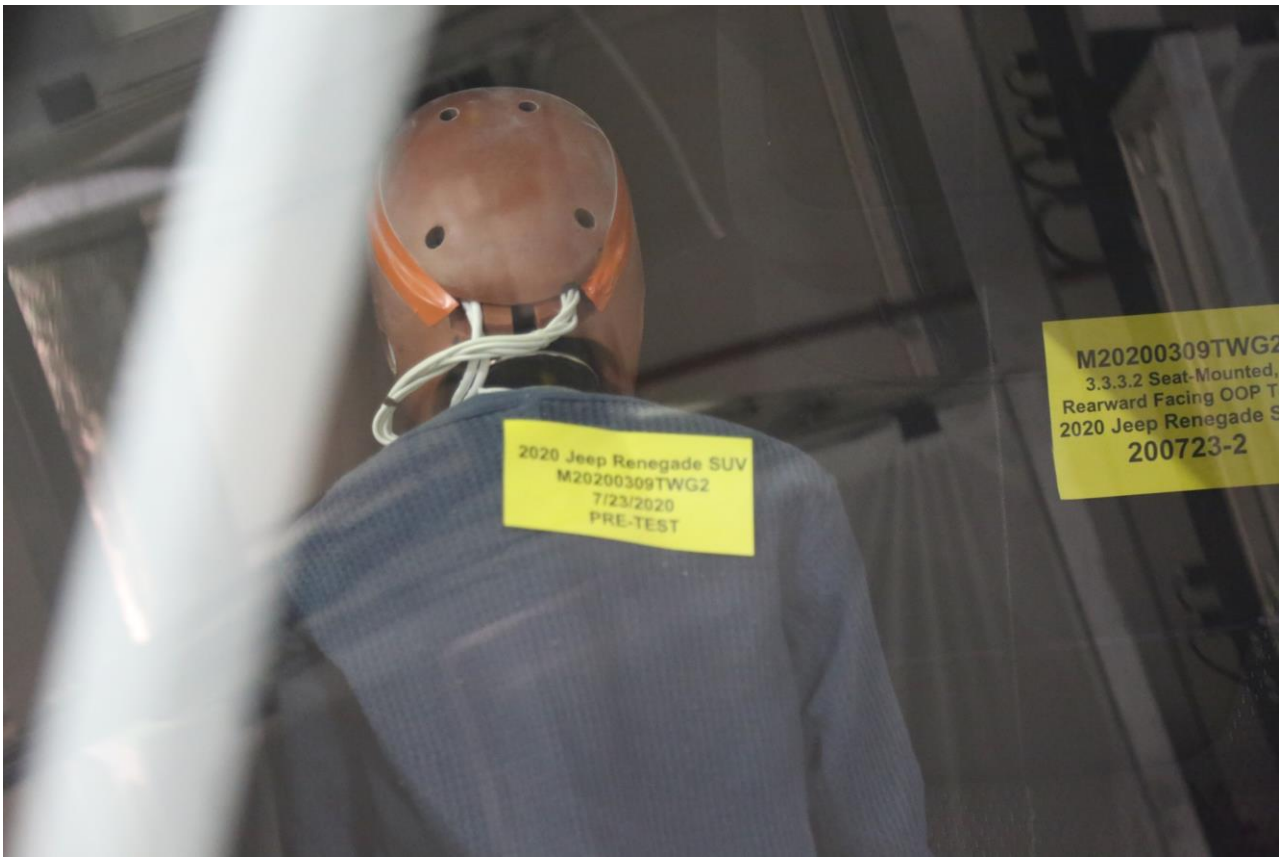



**Figure A-19 Pre-Test Dummy Front Close-up View**


**Figure A-20 Post-Test Dummy Front Close-up View**


**Figure A-21 Pre-Test Dummy Right ¾ Front View**


**Figure A-22 Post-Test Dummy Right ¾ Front View**


**Figure A-23 Pre-Test Dummy Right Side View**


**Figure A-24 Post-Test Dummy Right Side View**


**Figure A-25 Post-Test Dummy Right Side View**


**Figure A-26 Post-Test Curtain Air Bag Left Side View**


**Figure A-27 Post-Test Curtain Air Bag Left ¾ Front View**


**Figure A-28 Post-Test Curtain Air Bag Front View**


**Figure A-29 Post-Test Curtain Air Bag Right Side View**

# APPENDIX B

# DUMMY RESPONSE DATA PLOTS

**NHTSA**

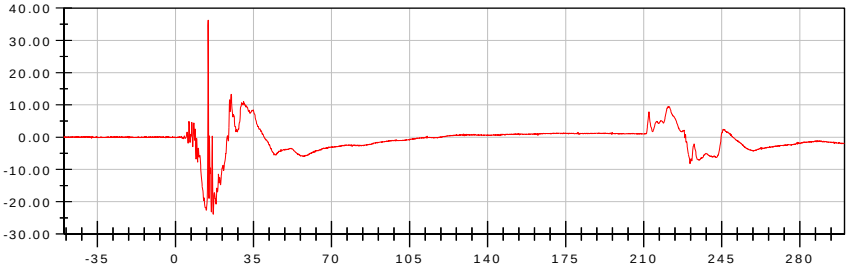
Test Date: 07/23/2020

Position #2 Hybrid III 3 year old Dummy (Part 572 P) (13Y6)

Test Lab: CTF

Test Number: 200723-2 (M20200309TWG2)

Dummy Head Acceleration X (g) vs. Time [ms]




**<Max>**

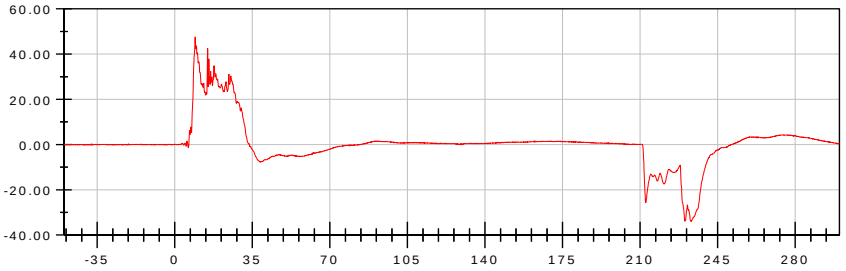
36.21 g at 14.72 ms

**<Min>**

-23.89 g at 16.96 ms

CFC_1000

Dummy Head Acceleration Y (g) vs. Time [ms]




**<Max>**

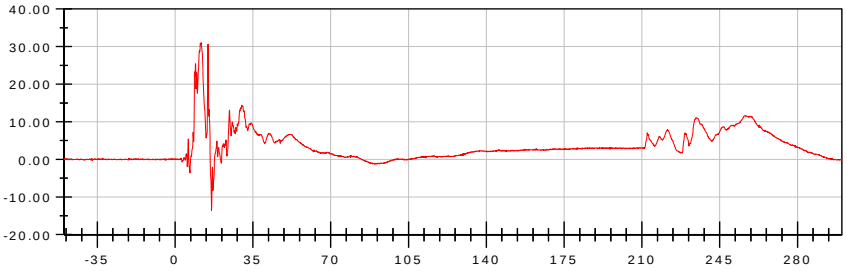
47.57 g at 9.20 ms

**<Min>**

-33.94 g at 233.04 ms

CFC_1000

Dummy Head Acceleration Z (g) vs. Time [ms]




**<Max>**

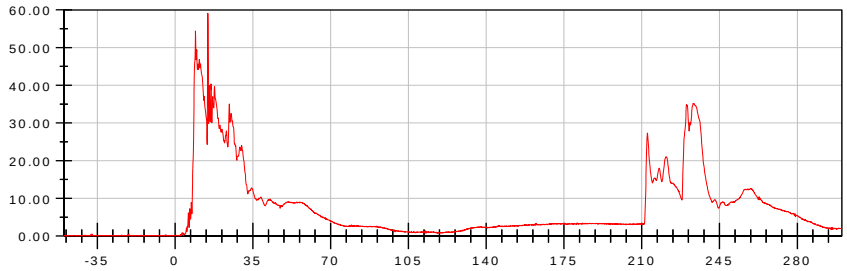
31.01 g at 11.76 ms

**<Min>**

-13.61 g at 16.40 ms

CFC_1000

Dummy Head Acceleration Resultant (g) vs. Time [ms]




**<Max>**

59.09 g at 14.72 ms

**<Min>**

0.02 g at -49.28 ms

CFC_1000

**NHTSA**

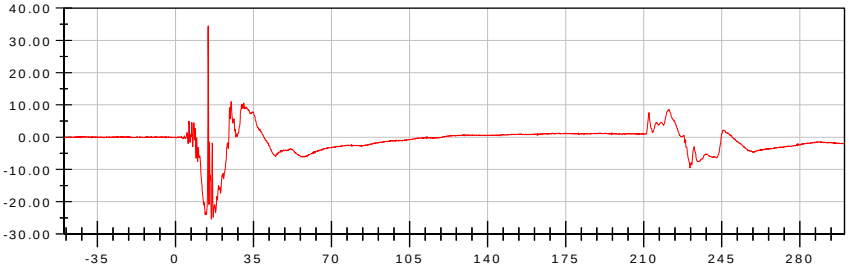
Test Date: 07/23/2020

Position #2 Hybrid III 3 year old Dummy (Part 572 P) (13Y6)

Test Lab: CTF

Test Number: 200723-2 (M20200309TWG2)

Dummy Head Acceleration Redundant X (g) vs. Time [ms]




**<Max>**

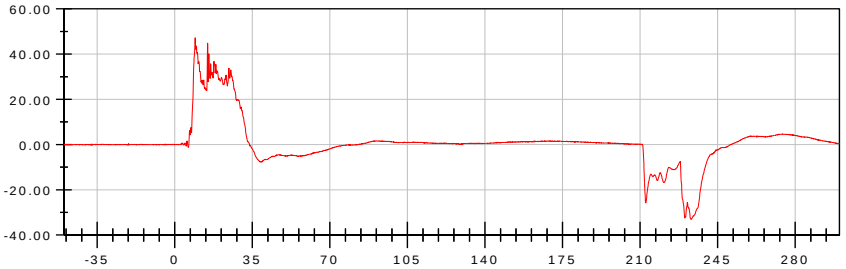
34.49 g at 14.72 ms

**<Min>**

-25.39 g at 16.08 ms

CFC_1000

Dummy Head Acceleration Redundant Y (g) vs. Time [ms]




**<Max>**

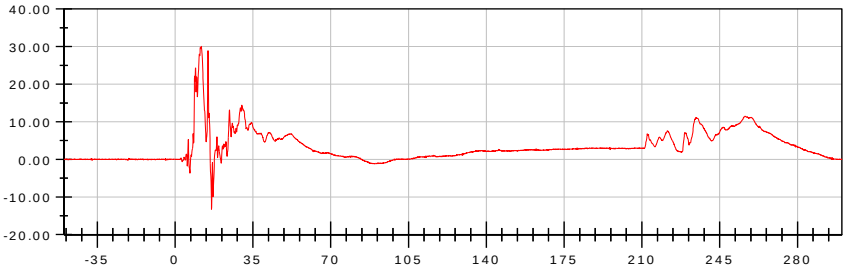
47.22 g at 9.20 ms

**<Min>**

-33.09 g at 233.04 ms

CFC_1000

Dummy Head Acceleration Redundant Z (g) vs. Time [ms]




**<Max>**

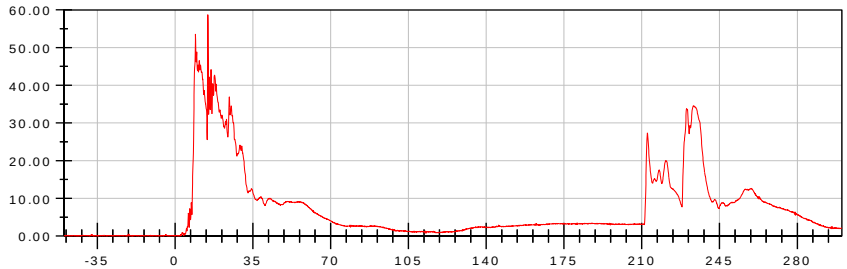
30.06 g at 11.76 ms

**<Min>**

-13.24 g at 16.40 ms

CFC_1000

Dummy Head Acceleration Redundant Resultant (g) vs. Time [ms]




**<Max>**

58.71 g at 14.72 ms

**<Min>**

0.03 g at -49.28 ms

CFC_1000

**NHTSA**

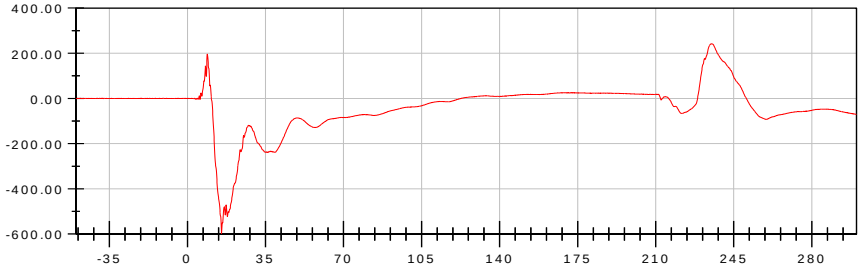
Test Date: 07/23/2020

Position #2 Hybrid III 3 year old Dummy (Part 572 P) (13Y6)

Test Lab: CTF

Test Number: 200723-2 (M20200309TWG2)

Dummy Upper Neck Force X (N) vs. Time [ms]




**<Max>**

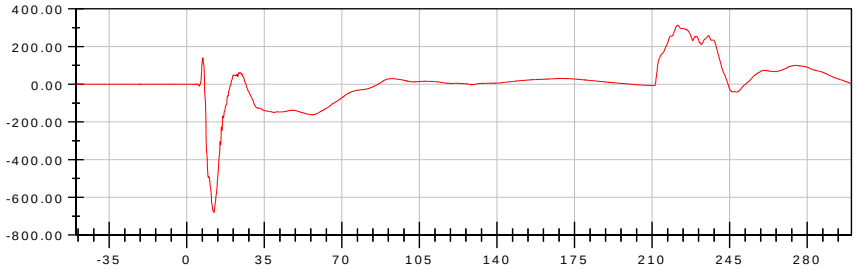
241.98 N at 234.88 ms

**<Min>**

-597.45 N at 15.28 ms

CFC_1000

Dummy Upper Neck Force Y (N) vs. Time [ms]




**<Max>**

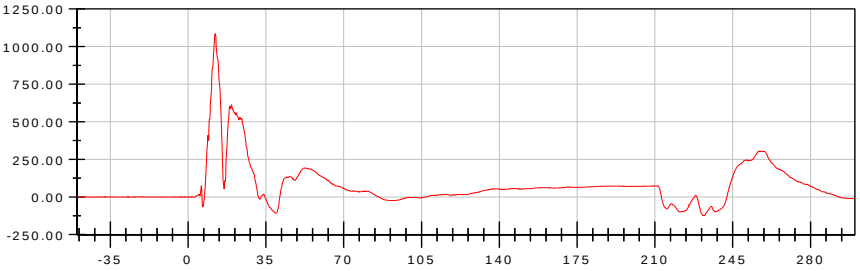
313.40 N at 221.52 ms

**<Min>**

-679.74 N at 12.24 ms

CFC_1000

Dummy Upper Neck Force Z (N) vs. Time [ms]




**<Max>**

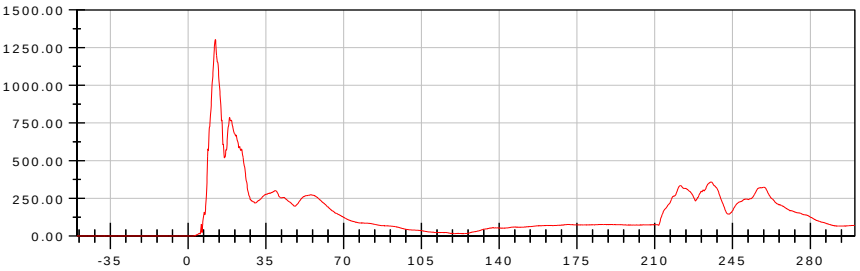
1,085.47 N at 12.16 ms

**<Min>**

-123.72 N at 231.60 ms

CFC_1000

Dummy Upper Neck Force Resultant (N) vs. Time [ms]




**<Max>**

1,303.07 N at 12.24 ms

**<Min>**

0.09 N at -49.20 ms

CFC_1000

**NHTSA**

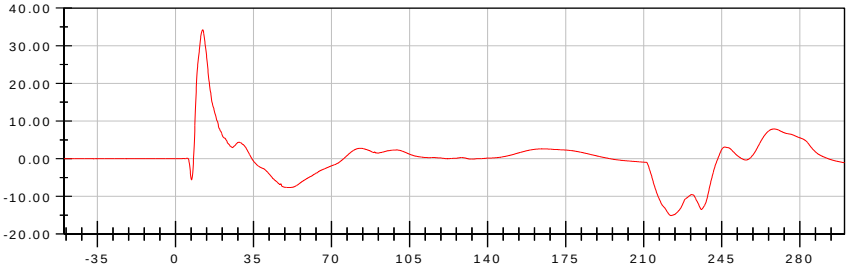
Test Date: 07/23/2020

Position #2 Hybrid III 3 year old Dummy (Part 572 P) (13Y6)

Test Lab: CTF

Test Number: 200723-2 (M20200309TWG2)

Dummy Upper Neck Moment X (Nm) vs. Time [ms]




**<Max>**

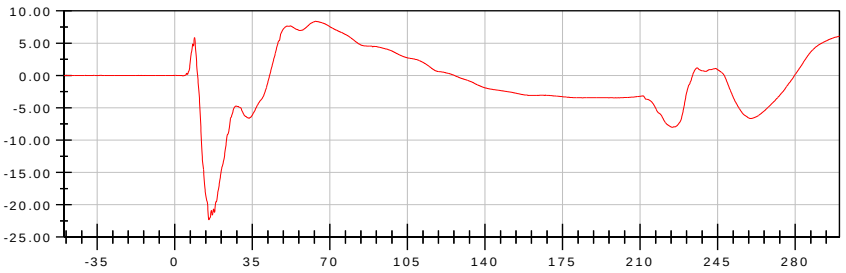
34.23 Nm at 12.24 ms

**<Min>**

-15.10 Nm at 222.24 ms

CFC_600

Dummy Upper Neck Moment Y (Nm) vs. Time [ms]




**<Max>**

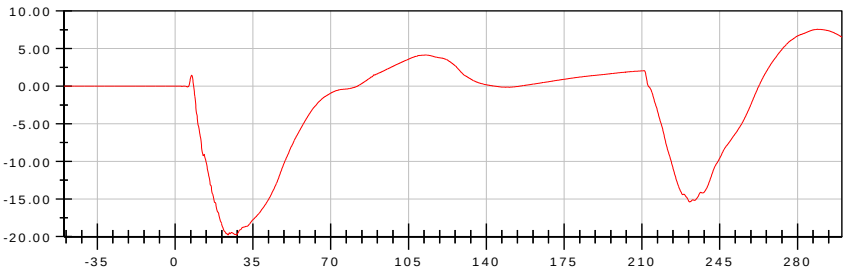
8.39 Nm at 63.52 ms

**<Min>**

-22.32 Nm at 15.36 ms

CFC_600

Dummy Upper Neck Moment Z (Nm) vs. Time [ms]




**<Max>**

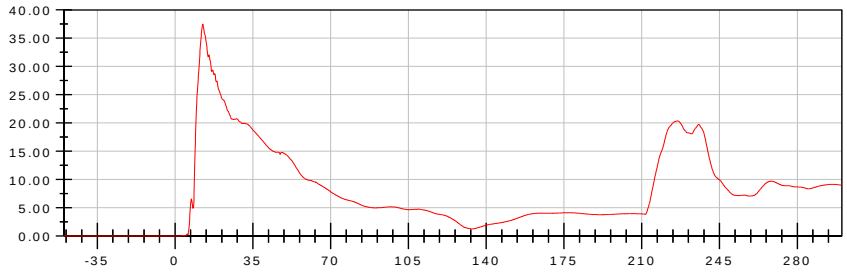
7.56 Nm at 288.96 ms

**<Min>**

-19.78 Nm at 27.60 ms

CFC_600

Dummy Upper Neck Moment Resultant (Nm) vs. Time [ms]




**<Max>**

37.47 Nm at 12.48 ms

**<Min>**

0.00 Nm at -28.24 ms

CFC_600

**NHTSA**

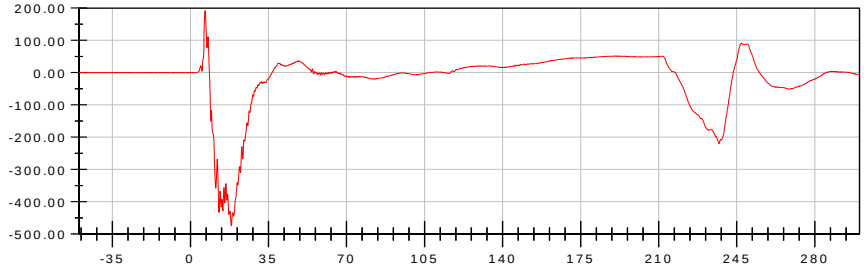
Test Date: 07/23/2020

Position #2 Hybrid III 3 year old Dummy (Part 572 P) (13Y6)

Test Lab: CTF

Test Number: 200723-2 (M20200309TWG2)

Dummy Lower Neck Force X (N) vs. Time [ms]




**<Max>**

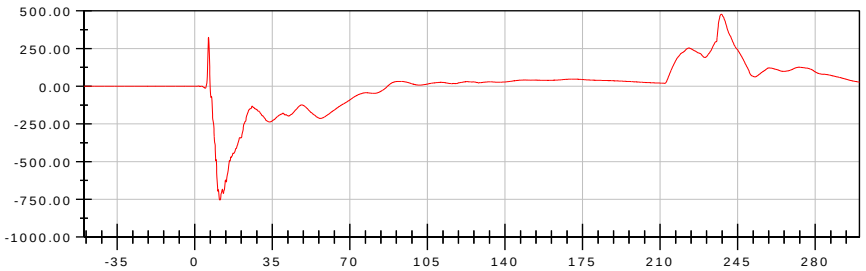
192.22 N at 6.64 ms

**<Min>**

-474.40 N at 18.32 ms

CFC_1000

Dummy Lower Neck Force Y (N) vs. Time [ms]




**<Max>**

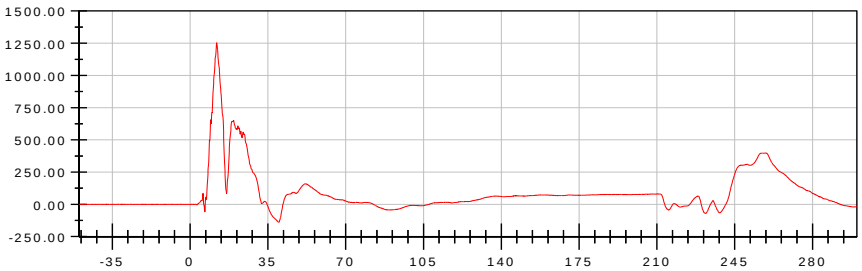
477.52 N at 237.60 ms

**<Min>**

-754.16 N at 11.52 ms

CFC_1000

Dummy Lower Neck Force Z (N) vs. Time [ms]




**<Max>**

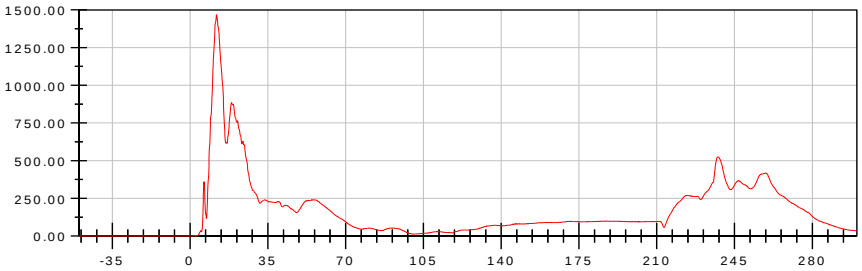
1,253.14 N at 11.92 ms

**<Min>**

-138.64 N at 39.92 ms

CFC_1000

Dummy Lower Neck Force Resultant (N) vs. Time [ms]




**<Max>**

1,467.94 N at 11.92 ms

**<Min>**

0.07 N at -49.76 ms

CFC_1000

**NHTSA**

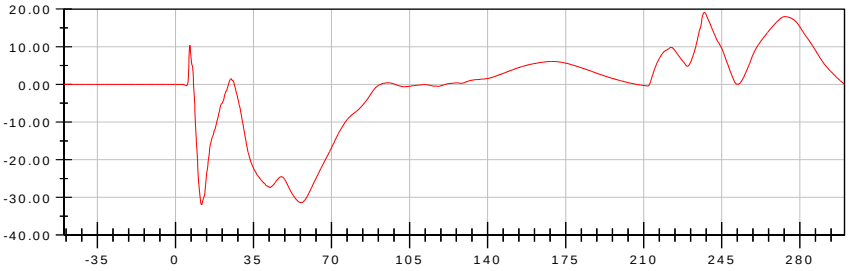
Test Date: 07/23/2020

Position #2 Hybrid III 3 year old Dummy (Part 572 P) (13Y6)

Test Lab: CTF

Test Number: 200723-2 (M20200309TWG2)

Dummy Lower Neck Moment X (Nm) vs. Time [ms]




**<Max>**

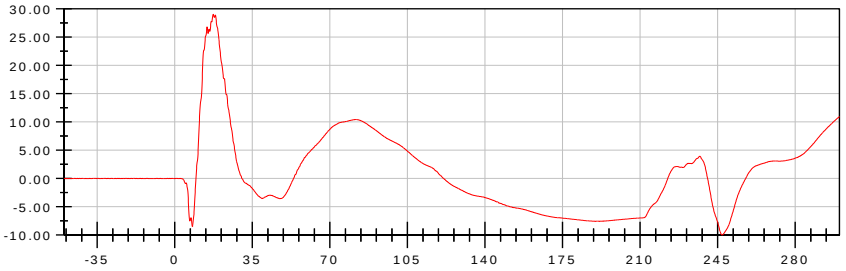
19.12 Nm at 237.28 ms

**<Min>**

-31.93 Nm at 11.68 ms

CFC_600

Dummy Lower Neck Moment Y (Nm) vs. Time [ms]




**<Max>**

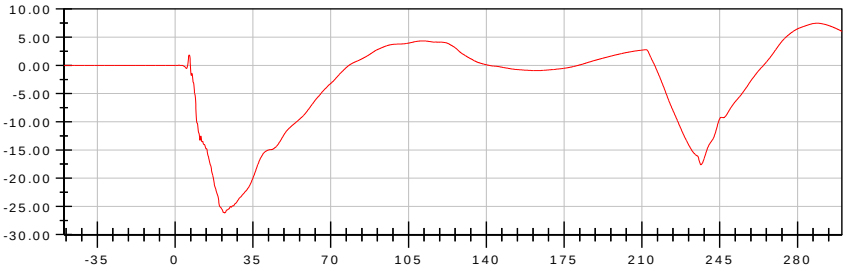
29.02 Nm at 17.36 ms

**<Min>**

-9.98 Nm at 247.04 ms

CFC_600

Dummy Lower Neck Moment Z (Nm) vs. Time [ms]




**<Max>**

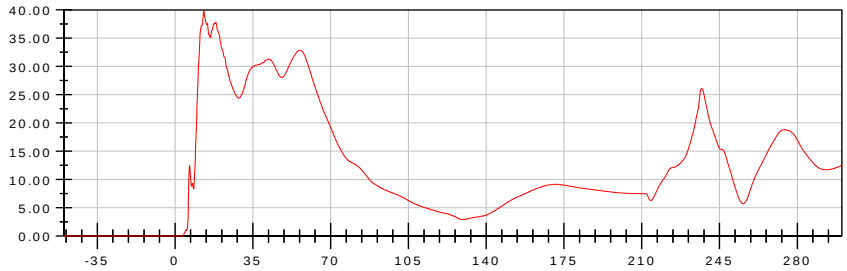
7.48 Nm at 289.12 ms

**<Min>**

-26.16 Nm at 22.32 ms

CFC_600

Dummy Lower Neck Moment Resultant (Nm) vs. Time [ms]




**<Max>**

39.76 Nm at 12.96 ms

**<Min>**

0.00 Nm at -45.52 ms

CFC_600

# 2020 Jeep Renegade SUV SAB OOP Test 3.3.3.2

## Neck Injury Predictor (NIJ)

Date: 07/23/2020
Time: 15:31

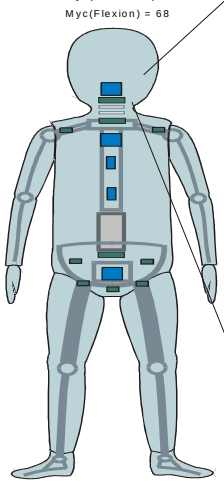
**Customer: NHTSA**

**Test Number: M20200309TWG2**

**TRC Inc. Test Lab: CTF**

**Test Number: 200723-2**

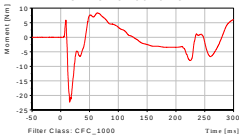
Test Orientation = Frontal
Fzc(Tension) = 2120
Fzc(Compression) = 2120
Myc(Extension) = 27
Myc(Flexion) = 68



Dummy:HIII 3 Year Old
Seating Position:
Right Front Passenger

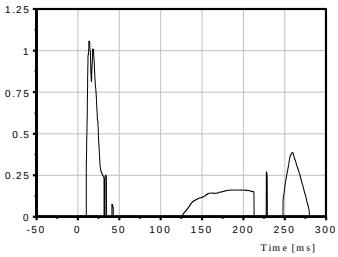
NIJ Source Code: (Fz/Fzc)+(My/Myc)

13TMONUP00Y6MOYX



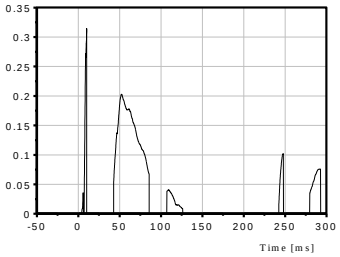

13NECKUP00Y6FOZA


13NIJCUPTEY600YX



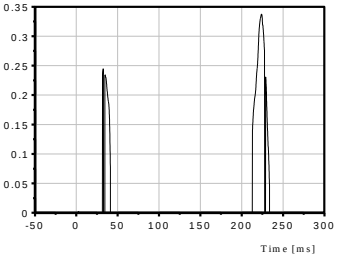

**Max [NTE] 1.0572 at 13.60 ms**

13NIJCUPTFY600YX



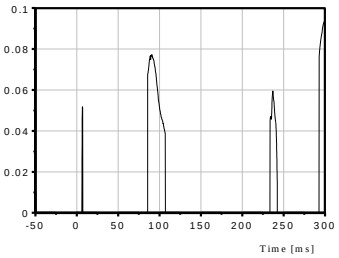

**Max [NTF] 0.3143 at 10.24 ms**

13NIJCUPCEY600YX




**Max [NCE] 0.3373 at 224.00 ms**

13NIJCUPCFY600YX




**Max [NCF] 0.0941 at 300.00 ms**

# 2020 Jeep Renegade SUV SAB OOP Test 3.3.3.2

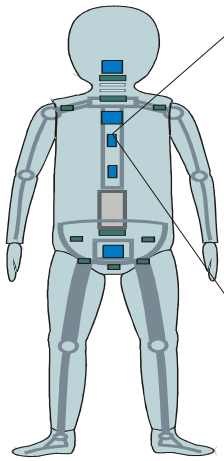
Chest Compression Speed

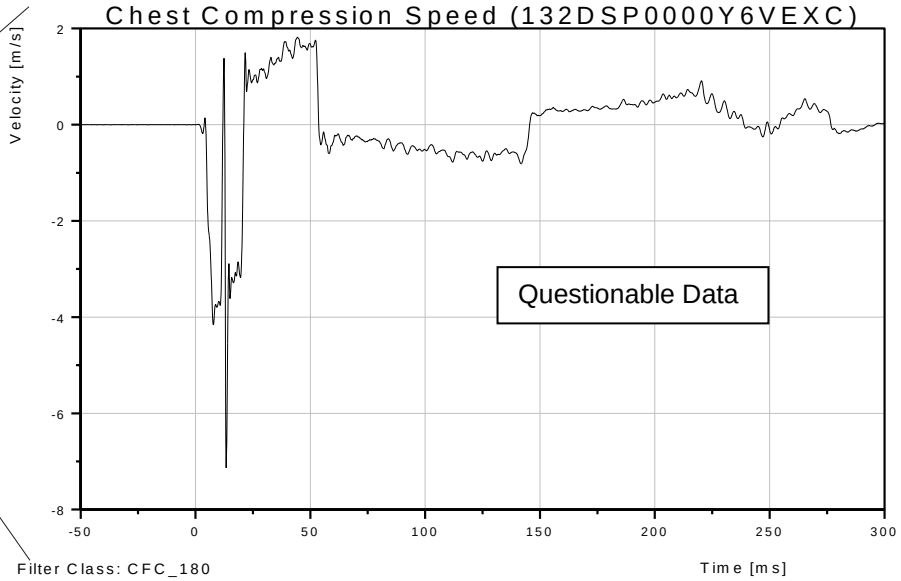
Date: 07/23/2020
Time: 15:31

**Customer: NHTSA**
**Test Number: M20200309TWG2**

**TRC Inc. Test Lab: CTF**
**Test Number: 200723-2**

Test Orientation = Frontal






Dummy:HIII 3 Year Old
Seating Position:
Right Front Passenger

[Max.] 1.82 m/s at 44.40 ms
[Min.] -7.13 m/s at 13.36 ms

Chest Compression Speed Source Code : Derivation of X-Axis Chest Displacement

**NHTSA**

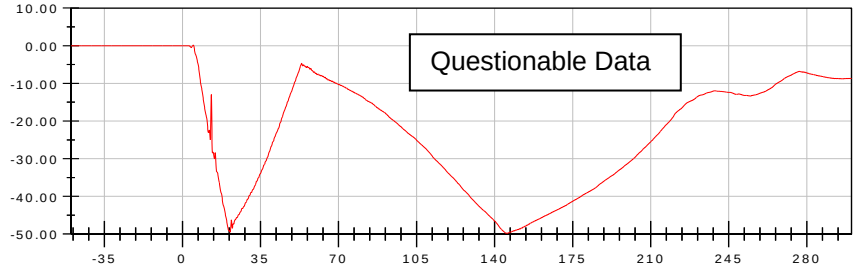
Test Date: 07/23/2020

Position #2 Hybrid III 3 year old Dummy (Part 572 P) (13Y6)

Test Lab: CTF

Test Number: 200723-2 (M20200309TWG2)

Dummy Chest Deflection X (mm) vs. Time [ms]




**<Max>**

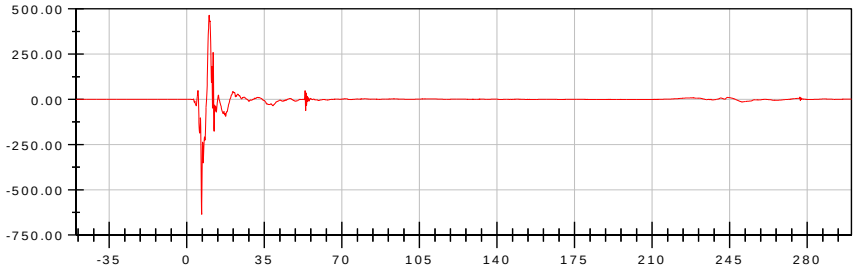
0.15 mm at 4.88 ms

**<Min>**

-49.84 mm at 145.68 ms

CFC_600

Dummy Upper Sternum Acceleration X (g) vs. Time [ms]




**<Max>**

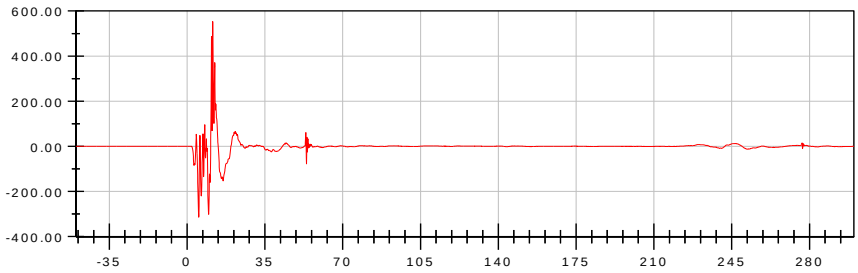
464.37 g at 10.08 ms

**<Min>**

-635.09 g at 6.72 ms

CFC_1000

Dummy Lower Sternum Acceleration X (g) vs. Time [ms]




**<Max>**

552.59 g at 11.52 ms

**<Min>**

-313.96 g at 5.20 ms

CFC_1000

**NHTSA**

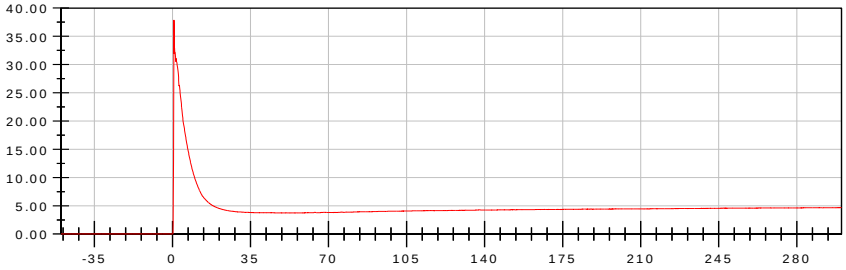
Test Date: 07/23/2020

Position #2 Hybrid III 3 year old Dummy (Part 572 P) (13Y6)

Test Lab: CTF

Test Number: 200723-2 (M20200309TWG2)

Airbag Event Right Side Passenger Seat (V) vs. Time [ms]




**<Max>**

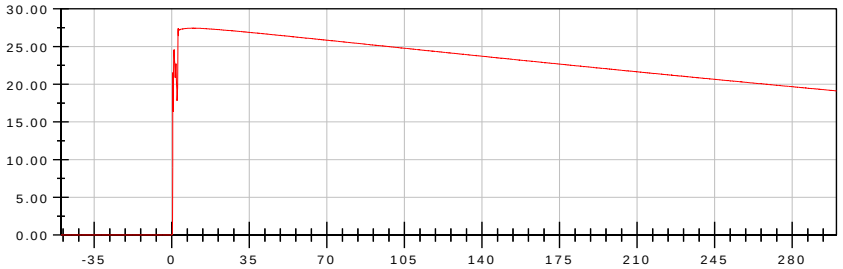
37.87 V at 0.64 ms

**<Min>**

0.00 V at -50.00 ms

Unfiltered

Airbag Event Right Side Passenger Curtain (V) vs. Time [ms]




**<Max>**

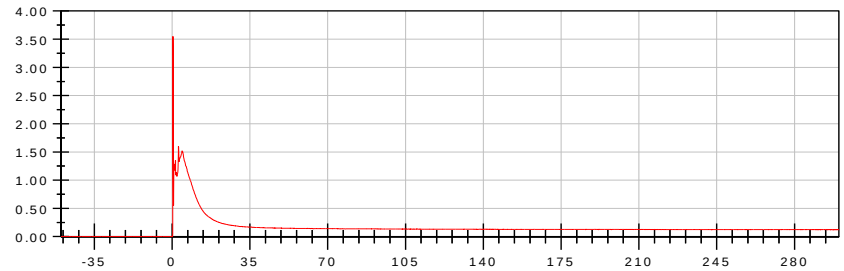
27.47 V at 9.76 ms

**<Min>**

0.00 V at -50.00 ms

Unfiltered

Airbag Event Right Side Passenger Seat (A) vs. Time [ms]




**<Max>**

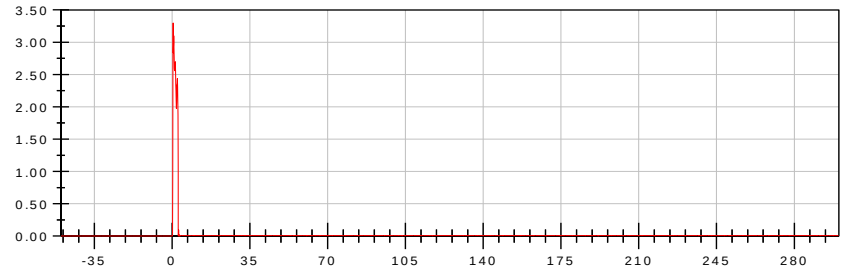
3.55 A at 0.40 ms

**<Min>**

0.00 A at -50.00 ms

Unfiltered

Airbag Event Right Side Passenger Curtain (A) vs. Time [ms]




**<Max>**

3.30 A at 0.48 ms

**<Min>**

0.00 A at -50.00 ms

Unfiltered

## APPENDIX C

## TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION

| | | | Serial Number | Manufacturer and Model # | Calibration Date | Date Due |
|---|---|---|---|---|---|---|
| ATD | | N/A | 040 | FTSS | 16-Jul-2020 | |
| Head Accelerometers | Primary | X | P97685 | Endevco | 15-Jul-2020 | 14-Jan-2021 |
| | | Y | P97528 | Endevco | 15-Jul-2020 | 14-Jan-2021 |
| | | Z | P97862 | Endevco | 14-Jul-2020 | 13-Jan-2021 |
| | Redundant | X | P97696 | Endevco | 15-Jul-2020 | 15-Jan-2021 |
| | | Y | P97533 | Endevco | 15-Jul-2020 | 14-Jan-2021 |
| | | Z | P97531 | Endevco | 15-Jul-2020 | 14-Jan-2021 |
| Upper Neck Load Cell | | Fx, Fy, Fz, Mx, My, Mz | 214 | Denton | 15-Jul-2020 | 15-Jul-2021 |
| Lower Neck Load Cell | | Fx, Fy, Fz, Mx, My, Mz | 210 | Denton | 15-Jul-2020 | 15-Jul-2021 |
| Chest Potentiometer | | Dx | CST040 | Servo | 15-Jul-2020 | 15-Jul-2021 |
| Sternum Accelerometer | | X | P97686 | Endevco | 15-Jul-2020 | 14-Jan-2021 |
| Spine Accelerometer | | X | T11394 | Endevco | 14-Jul-2020 | 13-Jan-2021 |
| Data System | | N/A | 223 | Kayser-Threde | 23-Jul-2020 | |
| Inclinometer | | N/A | DP-7 | Mitutoyo Pro 360 | 7-Nov-2019 | 7-Nov-2020 |

# APPENDIX D

# DUMMY QUALIFICATION DATA

**Pre-Test Calibration Sheets**
**Passenger S/N 040**

# Transportation Research Center Inc.

Front Head Drop
HIII 3YO Serial No. 040 Certification No. 10-1
Test Date: 7/9/2020

| Test Parameter | Specification | Test Results | Pass |
|---|---|---|---|
| Temperature | 18.9 - 25.6 °C | 20.8 °C | Yes |
| Relative Humidity | 10 - 70 % | 60 % | Yes |
| Peak Head Resultant Acceleration | 250 - 280 g | 278.0 g | Yes |
| Peak Head Lateral Acceleration | (-15) - 15 g | -5.2 g | Yes |
| Is Acceleration Curve Unimodal? | < 10 % | 3.35 % | Yes |

**Test meets specifications.**

**Condition: Used**

**Comments:**
**Head Skin S/N: N/A**

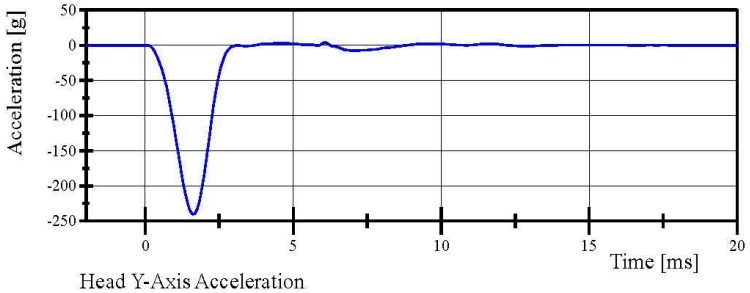
Specification Source: CFR49 Part 572 Subpart P
with Polarity in accordance with J211

07.09.2020 11:19:35 582

# Transportation Research Center Inc.

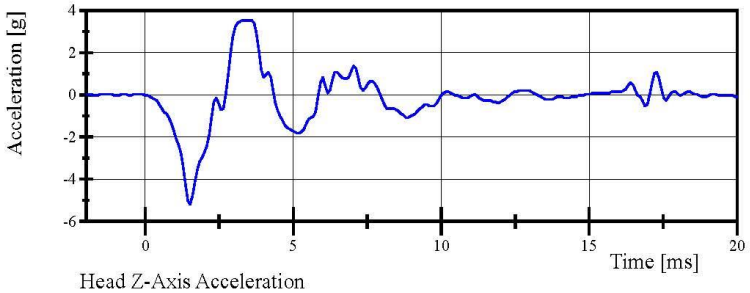
Front Head Drop
HIII 3YO Serial No. 040 Certification No. 10-1
Test Date: 7/9/2020

Head X-Axis Acceleration



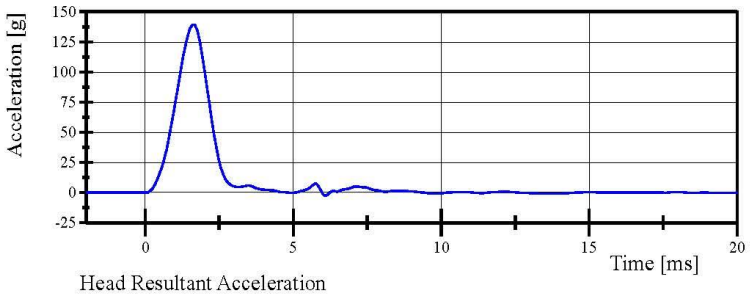

Filter Class: CFC_1000
Max: 3.9 g at 6.1 ms
Min: -240.4 g at 1.6 ms

Head Y-Axis Acceleration



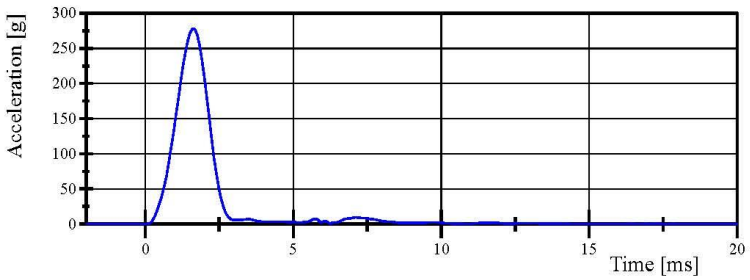

Filter Class: CFC_1000
Max: 3.5 g at 3.3 ms
Min: -5.2 g at 1.5 ms

Head Z-Axis Acceleration




Filter Class: CFC_1000
Max: 139.5 g at 1.6 ms
Min: -2.7 g at 6.1 ms

Head Resultant Acceleration




Filter Class: CFC_1000
Max: 278.0 g at 1.6 ms
Min: 0.0 g at -2.0 ms

Specification Source: CFR49 Part 572 Subpart P
with Polarity in accordance with J211

07.09.2020 11:20:27 582

# Transportation Research Center Inc.

Neck Flexion
HIII 3YO Serial No. 040 Certification No. 10-5
Test Date: 7/15/2020

| Test Parameter | Specification | Test Results | Pass |
|---|---|---|---|
| Temperature | 20.6 - 22.2 °C | 20.8 °C | Yes |
| Relative Humidity | 10 - 70 % | 59 % | Yes |
| Pendulum Impact Velocity | 5.40 - 5.60 m/s | 5.595 m/s | Yes |
| Pendulum Integrated Velocity Change at 10 ms | (-2.0) - (-2.7) m/s | -2.31 m/s | Yes |
| Pendulum Integrated Velocity Change at 15 ms | (-3.0) - (-4.0) m/s | -3.39 m/s | Yes |
| Pendulum Integrated Velocity Change at 20 ms | (-4.0) - (-5.1) m/s | -4.61 m/s | Yes |
| Total Headform D-Plane Rotation | (-70) - (-82) ° | -79.4 ° | Yes |
| Peak Neck Occipital Condyles Moment | 42 - 53 Nm | 49.9 Nm | Yes |
| Neck Occipital Condyles Moment Decay to 10 Nm | 60 - 80 ms | 71.9 ms | Yes |

**Test meets specifications.**

**Condition: Used**

**Comments:**
**Neck S/N: 160308**

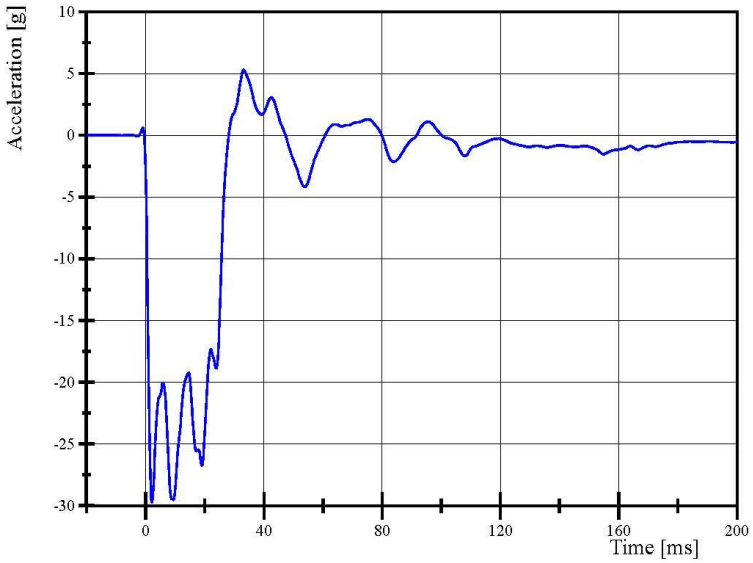
Specification Source: CFR49 Part 572 Subpart P
with Polarity in accordance with J211

07.15.2020 09:27:54 633

# Transportation Research Center Inc.

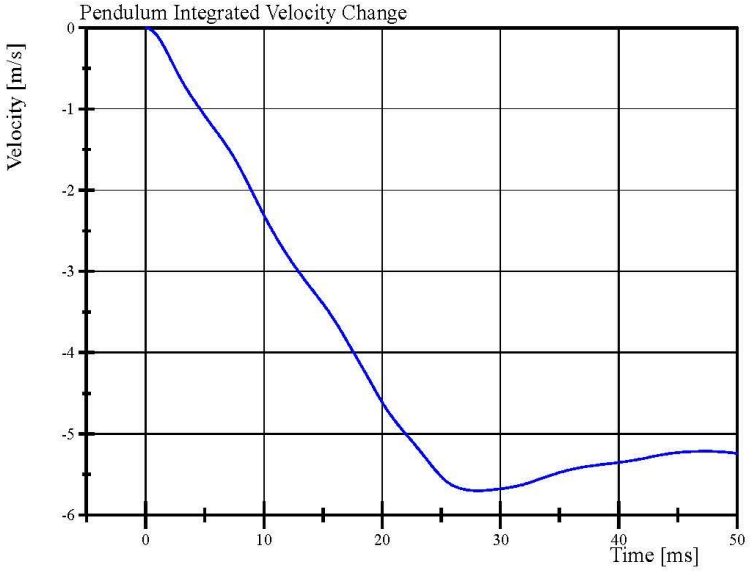
Neck Flexion
HIII 3YO Serial No. 040 Certification No. 10-5
Test Date: 7/15/2020

Pendulum Acceleration




Filter Class: CFC_180
Max: 5.3 g at 33.1 ms
Min: -29.7 g at 2.1 ms

Pendulum Integrated Velocity Change




Filter Class: CFC_180
Max: 0.0 m/s at 0.0 ms
Min: -5.7 m/s at 28.1 ms

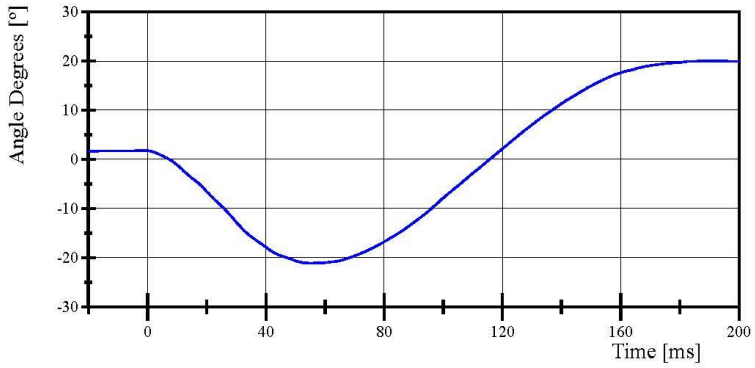
Specification Source: CFR49 Part 572 Subpart P
with Polarity in accordance with J211

07.15.2020 09:28:28 633

# Transportation Research Center Inc.

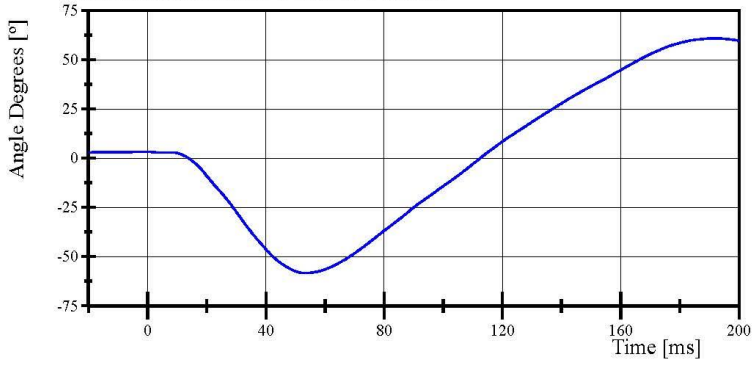
Neck Flexion
HIII 3YO Serial No. 040 Certification No. 10-5
Test Date: 7/15/2020

Pot Rotation at the Base of Neck



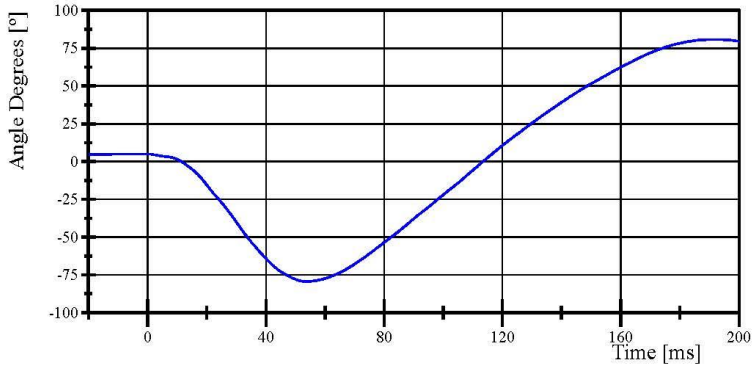

Filter Class: CFC_60
Max: 20.0 ° at 189.9 ms
Min: -21.1 ° at 55.2 ms

Headform Rotation at Occypital Condyles




Filter Class: CFC_60
Max: 60.8 ° at 191.8 ms
Min: -58.3 ° at 53.4 ms

Total Headform D-Plane Rotation




Filter Class: CFC_60
Max: 80.8 ° at 191.8 ms
Min: -79.4 ° at 53.7 ms

Specification Source: CFR49 Part 572 Subpart P
with Polarity in accordance with J211

07.15.2020 09:28:28 633

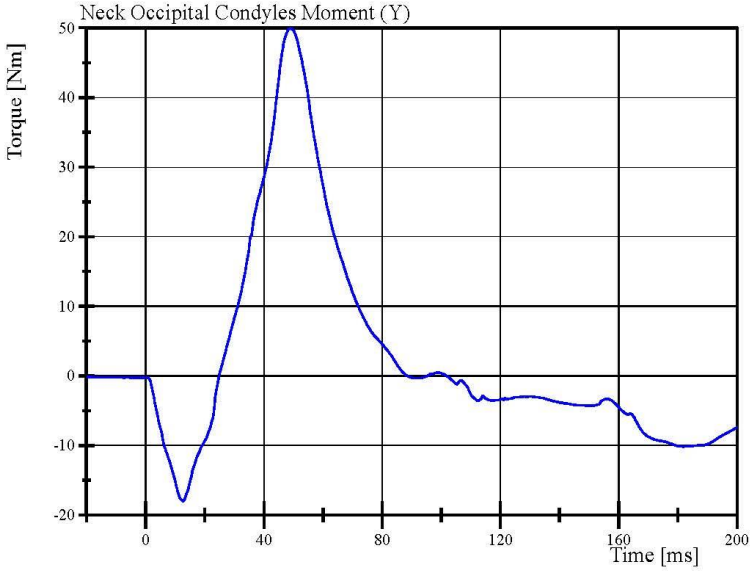
# Transportation Research Center Inc.

Neck Flexion
HIII 3YO Serial No. 040 Certification No. 10-5
Test Date: 7/15/2020

Neck Force (X)


Filter Class: CFC_1000
Max: 117.1 N at 185.8 ms
Min: -583.9 N at 52.0 ms

Neck Occipital Condyles Moment (Y)




Filter Class: CFC_600
Max: 49.9 Nm at 49.0 ms
Min: -18.0 Nm at 12.6 ms

Specification Source: CFR49 Part 572 Subpart P
with Polarity in accordance with J211

07.15.2020 09:28:29 633

# Transportation Research Center Inc.

Neck Extension
HIII 3YO Serial No. 040 Certification No. 10-5
Test Date: 7/15/2020

| Test Parameter | Specification | Test Results | Pass |
|---|---|---|---|
| Temperature | 20.6 - 22.2 °C | 20.8 °C | Yes |
| Relative Humidity | 10 - 70 % | 59 % | Yes |
| Pendulum Impact Velocity | (-3.55) - (-3.75) m/s | -3.741 m/s | Yes |
| Pendulum Integrated Velocity Change at 6 ms | 1.0 - 1.4 m/s | 1.21 m/s | Yes |
| Pendulum Integrated Velocity Change at 10 ms | 1.9 - 2.5 m/s | 2.23 m/s | Yes |
| Pendulum Integrated Velocity Change at 14 ms | 2.8 - 3.5 m/s | 3.21 m/s | Yes |
| Total Headform D-Plane Rotation | 83 - 93 ° | 86.6 ° | Yes |
| Peak Neck Occipital Condyles Moment | (-43.7) - (-53.3) Nm | -44.14 Nm | Yes |
| Neck Occipital Condyles Moment Decay to 10 Nm | 60 - 80 ms | 70.6 ms | Yes |

**Test meets specifications.**

**Condition: Used**

**Comments:**
**Neck S/N: 160308**

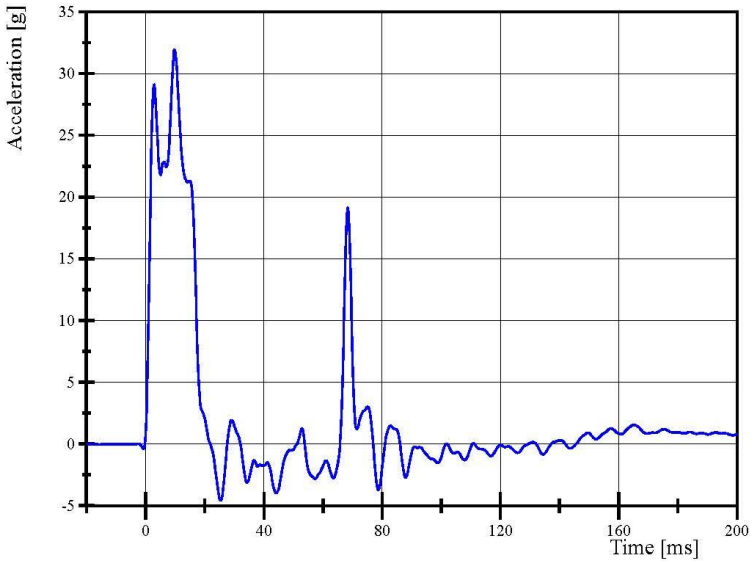
Specification Source: CFR49 Part 572 Subpart P
with Polarity in accordance with J211

07.15.2020 12:44:39 938

# Transportation Research Center Inc.

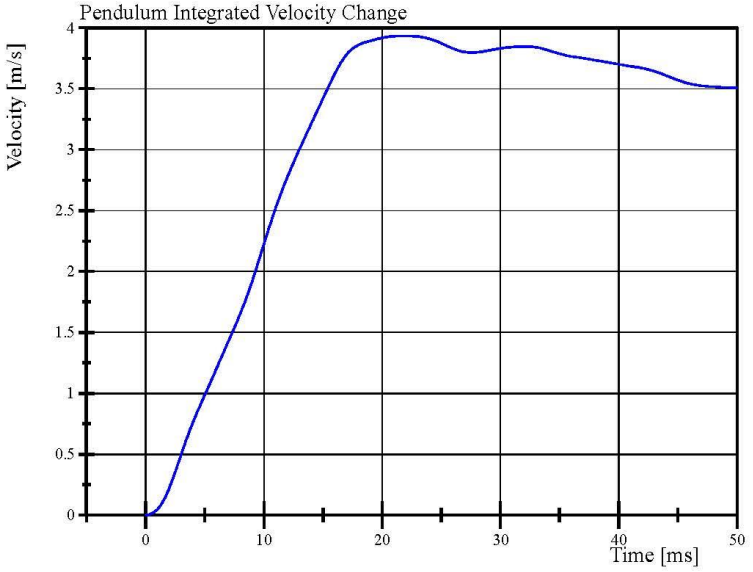
Neck Extension
HIII 3YO Serial No. 040 Certification No. 10-5
Test Date: 7/15/2020

Pendulum Acceleration




Filter Class: CFC_180
Max: 31.9 g at 9.8 ms
Min: -4.6 g at 25.4 ms

Pendulum Integrated Velocity Change




Filter Class: CFC_180
Max: 3.9 m/s at 21.8 ms
Min: 0.0 m/s at 0.0 ms

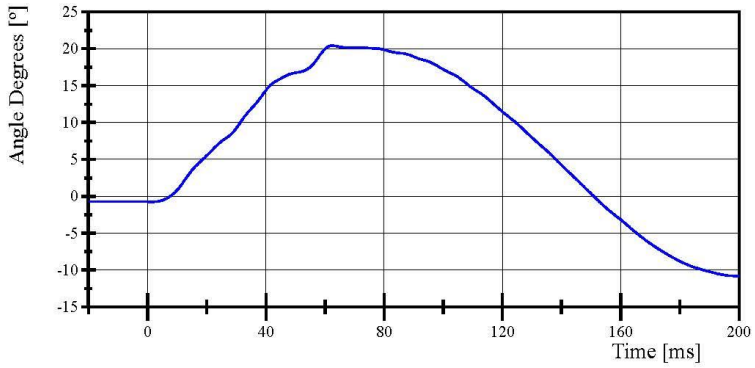
Specification Source: CFR49 Part 572 Subpart P
with Polarity in accordance with J211

07.15.2020 12:45:32 938

# Transportation Research Center Inc.

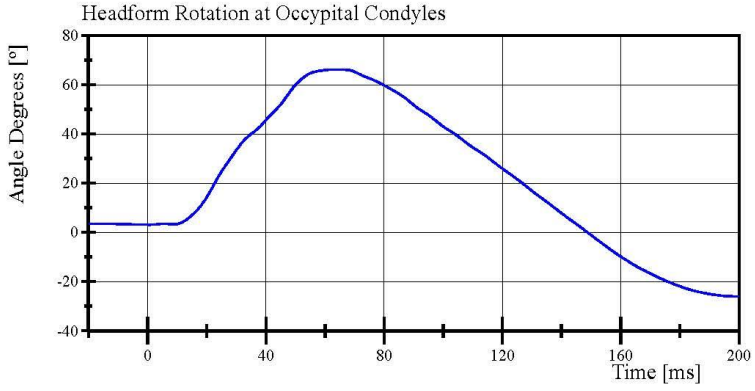
Neck Extension
HIII 3YO Serial No. 040 Certification No. 10-5
Test Date: 7/15/2020

Pot Rotation at the Base of Neck



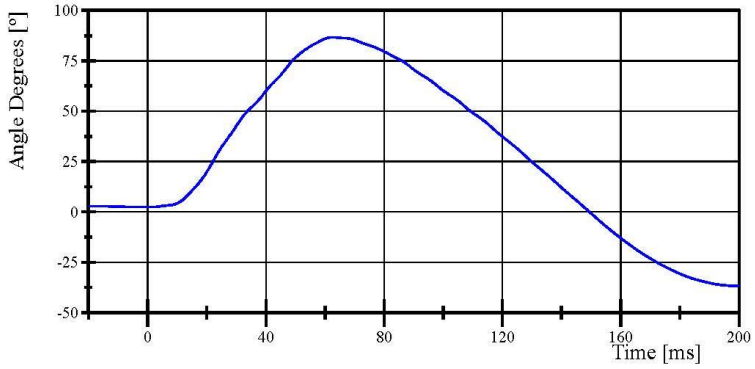

Filter Class: CFC_60
Max: 20.4 ° at 62.5 ms
Min: -10.8 ° at 200.0 ms

Headform Rotation at Occypital Condyles




Filter Class: CFC_60
Max: 66.2 ° at 62.6 ms
Min: -26.0 ° at 200.0 ms

Total Headform D-Plane Rotation




Filter Class: CFC_60
Max: 86.6 ° at 62.5 ms
Min: -36.8 ° at 200.0 ms

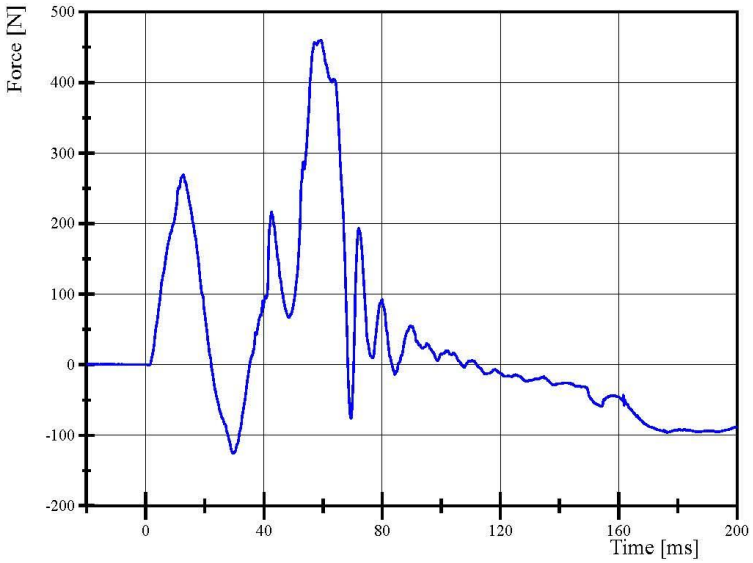
Specification Source: CFR49 Part 572 Subpart P
with Polarity in accordance with J211

07.15.2020 12:45:33 938

# Transportation Research Center Inc.

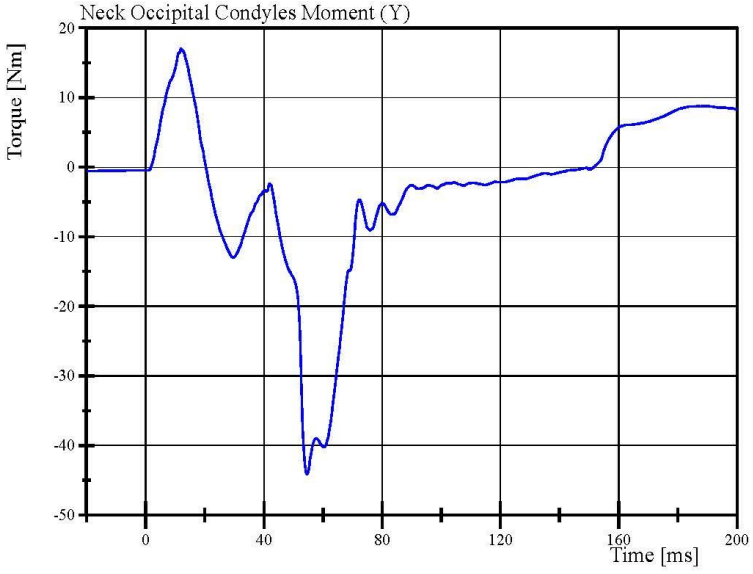
Neck Extension
HIII 3YO Serial No. 040 Certification No. 10-5
Test Date: 7/15/2020

Neck Force (X)




Filter Class: CFC_1000
Max: 459.7 N at 59.4 ms
Min: -125.8 N at 29.6 ms

Neck Occipital Condyles Moment (Y)




Filter Class: CFC_600
Max: 17.0 Nm at 11.9 ms
Min: -44.1 Nm at 54.6 ms

Specification Source: CFR49 Part 572 Subpart P
with Polarity in accordance with J211

07.15.2020 12:45:33 938

# Transportation Research Center Inc.

Front Thorax
HIII 3YO Serial No. 040 Certification No. 10-1
Test Date: 7/16/2020

| Test Parameter | Specification | Test Results | Pass |
|---|---|---|---|
| Temperature | 20.6 - 22.2 °C | 20.8 °C | Yes |
| Relative Humidity | 10 - 70 % | 59 % | Yes |
| Probe Velocity | 5.9 - 6.1 m/s | 5.98 m/s | Yes |
| Probe Force Peak Between 32.0 mm and 38.0 mm Chest Deflection | (-680) - (-810) N | -733.5 N | Yes |
| Probe Force Peak Between 12.5 mm and 32.0 mm Chest Deflection | >= (-910) N | -692.8 N | Yes |
| Maximum Chest Compression | (-32) - (-38) mm | -36.6 mm | Yes |
| Internal Hysteresis | 65 - 85 % | 65.2 % | Yes |

**Test meets specifications.**

**Condition: Used**

**Comments:**
**Jacket S/N: 16312**
**Rib Set S/N: 16030071**

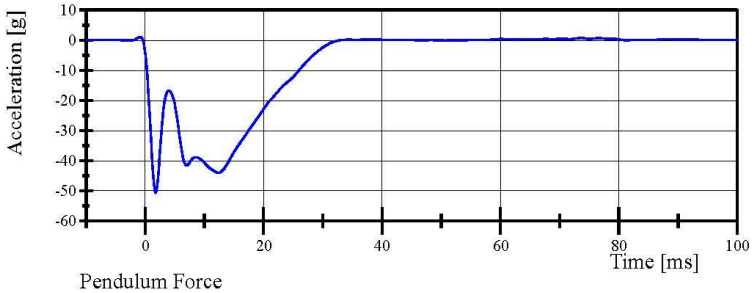
Specification Source: CFR49 Part 572 Subpart P
with Polarity in accordance with J211

07.16.2020 10:05:32 417

# Transportation Research Center Inc.

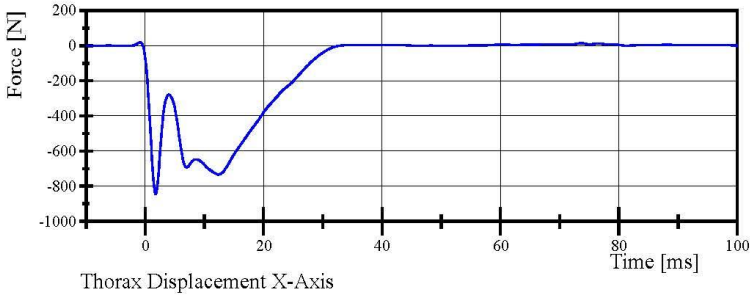
Front Thorax
HIII 3YO Serial No. 040 Certification No. 10-1
Test Date: 7/16/2020

Pendulum Acceleration



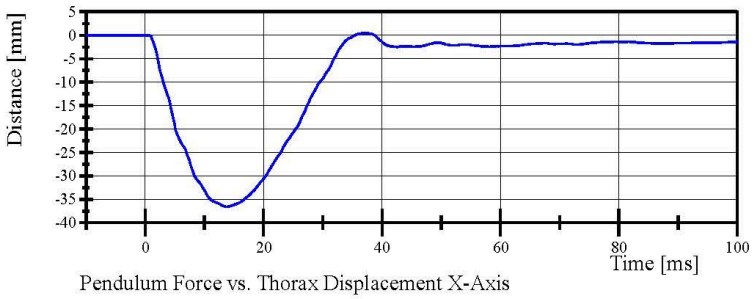

Filter Class: CFC_180
Max: 1.1 g at -0.9 ms
Min: -50.7 g at 1.8 ms

Pendulum Force



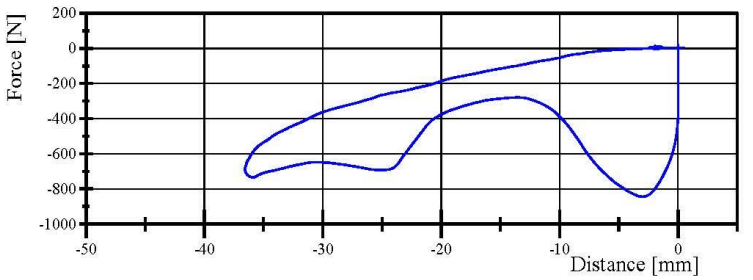

Filter Class: CFC_180
Max: 18.4 N at -0.9 ms
Min: -844.4 N at 1.8 ms

Thorax Displacement X-Axis




Filter Class: CFC_600
Max: 0.5 mm at 37.3 ms
Min: -36.6 mm at 13.8 ms

Pendulum Force vs. Thorax Displacement X-Axis




Filter Class: CFC_180
Max: 18.4 N at -0.0 mm
Min: -844.4 N at -3.0 mm

Specification Source: CFR49 Part 572 Subpart P
with Polarity in accordance with J211

07.16.2020 10:06:28 417

**Post-Test Calibration Sheets**
**Passenger S/N 040**

# Transportation Research Center Inc.

Front Head Drop
HIII 3YO Serial No. 040 Certification No. 11-1
Test Date: 7/27/2020

| Test Parameter | Specification | Test Results | Pass |
|---|---|---|---|
| Temperature | 18.9 - 25.6 °C | 20.8 °C | Yes |
| Relative Humidity | 10 - 70 % | 60 % | Yes |
| Peak Head Resultant Acceleration | 250 - 280 g | 268.7 g | Yes |
| Peak Head Lateral Acceleration | (-15) - 15 g | -5.1 g | Yes |
| Is Acceleration Curve Unimodal? | < 10 % | 3.53 % | Yes |

**Test meets specifications.**

**Condition: Used**

**Comments:**
**Head Skin S/N: N/A**

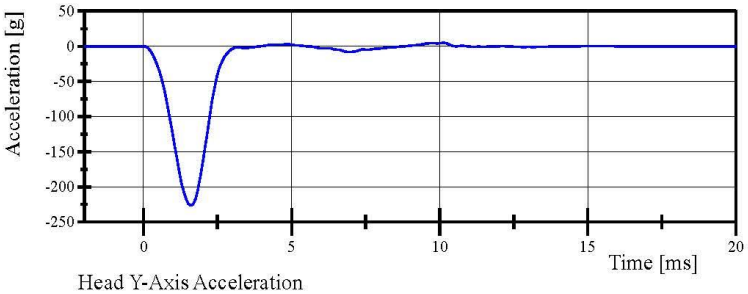
Specification Source: CFR49 Part 572 Subpart P with Polarity in accordance with J211

07.27.2020 13:54:21 582

# Transportation Research Center Inc.

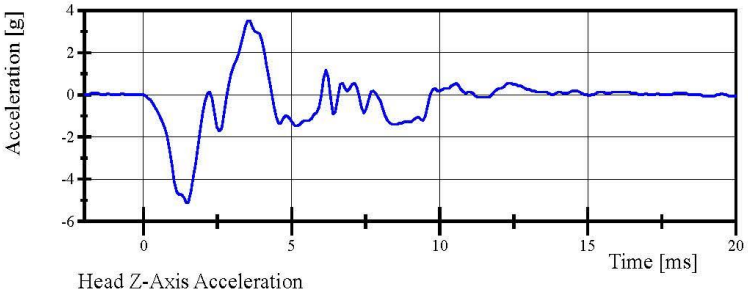
Front Head Drop
HIII 3YO Serial No. 040 Certification No. 11-1
Test Date: 7/27/2020

Head X-Axis Acceleration



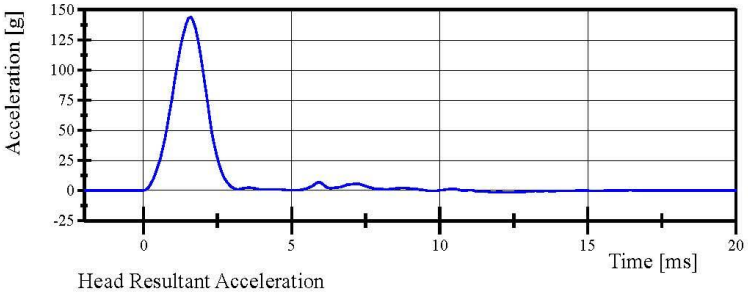

Filter Class: CFC_1000
Max: 4.8 g at 10.2 ms
Min: -226.8 g at 1.6 ms

Head Y-Axis Acceleration



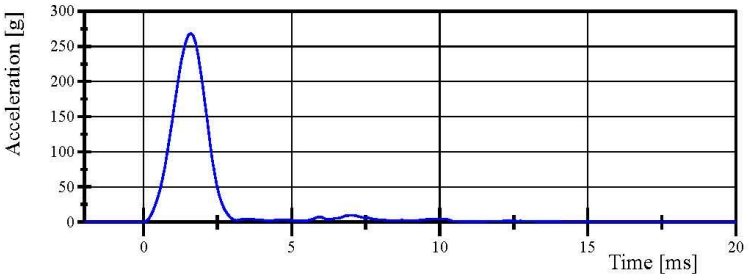

Filter Class: CFC_1000
Max: 3.5 g at 3.5 ms
Min: -5.1 g at 1.4 ms

Head Z-Axis Acceleration




Filter Class: CFC_1000
Max: 144.0 g at 1.6 ms
Min: -1.5 g at 11.8 ms

Head Resultant Acceleration




Filter Class: CFC_1000
Max: 268.7 g at 1.6 ms
Min: 0.0 g at -2.0 ms

Specification Source: CFR49 Part 572 Subpart P
with Polarity in accordance with J211

07.27.2020 13:54:44 582

# Transportation Research Center Inc.

Neck Flexion
HIII 3YO Serial No. 040 Certification No. 11-1
Test Date: 7/27/2020

| Test Parameter | Specification | Test Results | Pass |
|---|---|---|---|
| Temperature | 20.6 - 22.2 °C | 20.8 °C | Yes |
| Relative Humidity | 10 - 70 % | 59 % | Yes |
| Pendulum Impact Velocity | 5.40 - 5.60 m/s | 5.588 m/s | Yes |
| Pendulum Integrated Velocity Change at 10 ms | (-2.0) - (-2.7) m/s | -2.46 m/s | Yes |
| Pendulum Integrated Velocity Change at 15 ms | (-3.0) - (-4.0) m/s | -3.71 m/s | Yes |
| Pendulum Integrated Velocity Change at 20 ms | (-4.0) - (-5.1) m/s | -5.03 m/s | Yes |
| Total Headform D-Plane Rotation | (-70) - (-82) ° | -80.4 ° | Yes |
| Peak Neck Occipital Condyles Moment | 42 - 53 Nm | 47.9 Nm | Yes |
| Neck Occipital Condyles Moment Decay to 10 Nm | 60 - 80 ms | 75.0 ms | Yes |

**Test meets specifications.**

**Condition: Used**

**Comments:**
**Neck S/N: 160308**

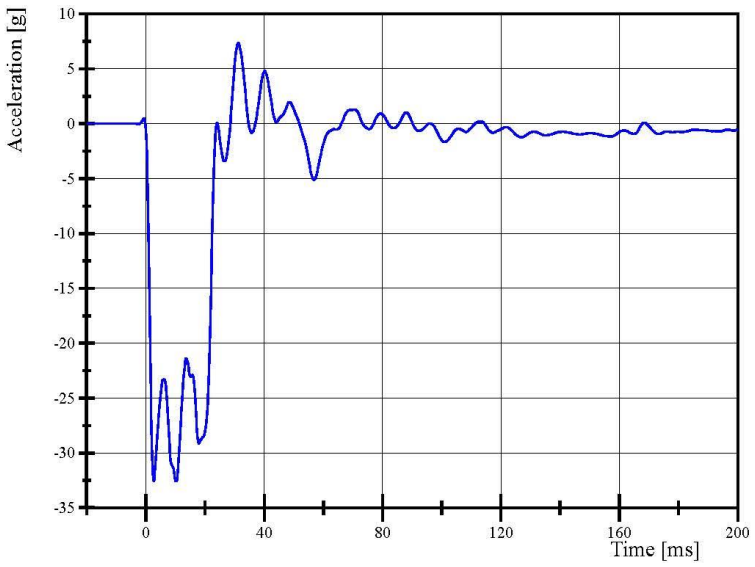
Specification Source: CFR49 Part 572 Subpart P with Polarity in accordance with J211

07.27.2020 13:56:41 628

# Transportation Research Center Inc.

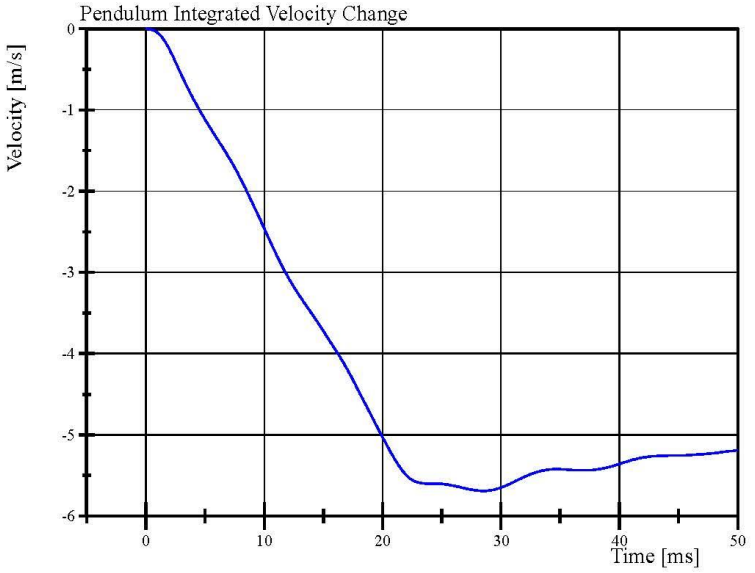
Neck Flexion
HIII 3YO Serial No. 040 Certification No. 11-1
Test Date: 7/27/2020

Pendulum Acceleration




Filter Class: CFC_180
Max: 7.4 g at 31.2 ms
Min: -32.6 g at 10.1 ms

Pendulum Integrated Velocity Change




Filter Class: CFC_180
Max: 0.0 m/s at 0.0 ms
Min: -5.7 m/s at 28.6 ms

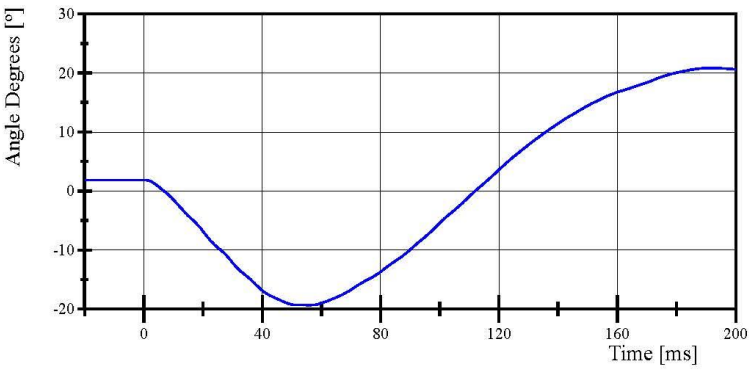
Specification Source: CFR49 Part 572 Subpart P
with Polarity in accordance with J211

07.27.2020 13:57:06 628

# Transportation Research Center Inc.

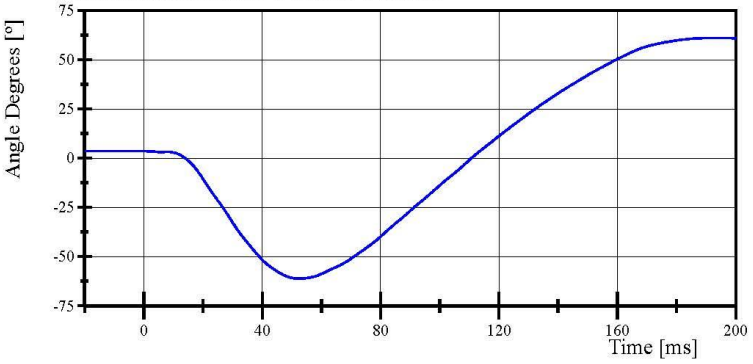
Neck Flexion
HIII 3YO Serial No. 040 Certification No. 11-1
Test Date: 7/27/2020

Pot Rotation at the Base of Neck



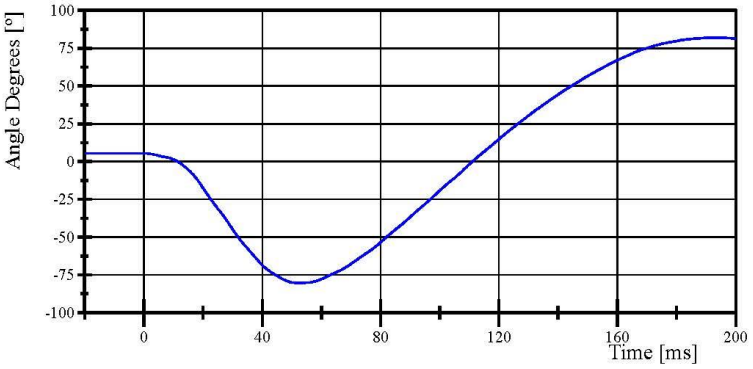

Filter Class: CFC_60
Max: 20.8 ° at 191.0 ms
Min: -19.3 ° at 55.8 ms

Headform Rotation at Occypital Condyles




Filter Class: CFC_60
Max: 61.1 ° at 194.6 ms
Min: -61.0 ° at 52.3 ms

Total Headform D-Plane Rotation




Filter Class: CFC_60
Max: 81.9 ° at 192.8 ms
Min: -80.4 ° at 52.4 ms

Specification Source: CFR49 Part 572 Subpart P
with Polarity in accordance with J211

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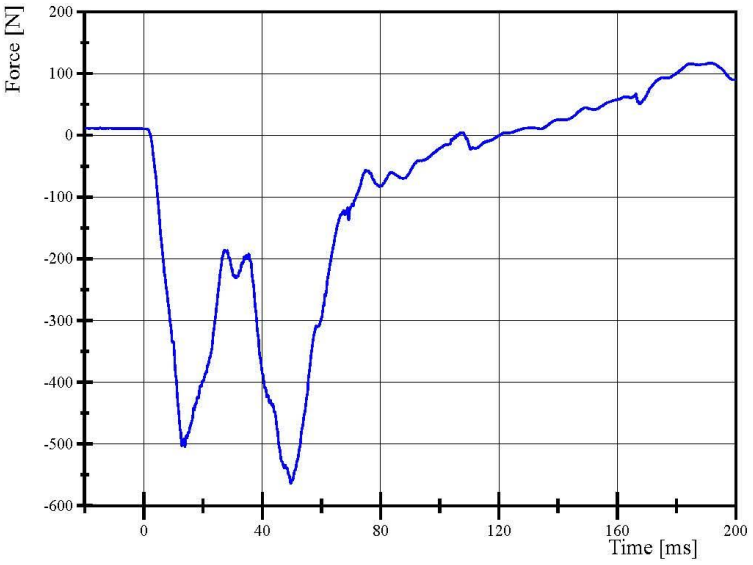
# Transportation Research Center Inc.

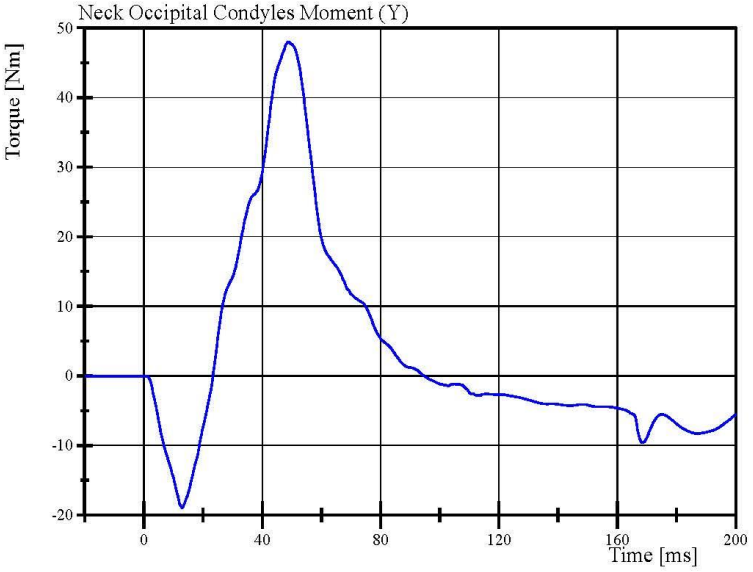
Neck Flexion
HIII 3YO Serial No. 040 Certification No. 11-1
Test Date: 7/27/2020

Neck Force (X)




Filter Class: CFC_1000
Max: 116.9 N at 190.8 ms
Min: -563.2 N at 49.6 ms

Neck Occipital Condyles Moment (Y)




Filter Class: CFC_600
Max: 47.9 Nm at 49.1 ms
Min: -18.9 Nm at 13.0 ms

Specification Source: CFR49 Part 572 Subpart P
with Polarity in accordance with J211

07.27.2020 13:57:07 628

# Transportation Research Center Inc.

Neck Extension
HIII 3YO Serial No. 040 Certification No. 11-1
Test Date: 7/27/2020

| Test Parameter | Specification | Test Results | Pass |
|---|---|---|---|
| Temperature | 20.6 - 22.2 °C | 20.8 °C | Yes |
| Relative Humidity | 10 - 70 % | 59 % | Yes |
| Pendulum Impact Velocity | (-3.55) - (-3.75) m/s | -3.739 m/s | Yes |
| Pendulum Integrated Velocity Change at 6 ms | 1.0 - 1.4 m/s | 1.29 m/s | Yes |
| Pendulum Integrated Velocity Change at 10 ms | 1.9 - 2.5 m/s | 2.38 m/s | Yes |
| Pendulum Integrated Velocity Change at 14 ms | 2.8 - 3.5 m/s | 3.39 m/s | Yes |
| Total Headform D-Plane Rotation | 83 - 93 ° | 88.1 ° | Yes |
| Peak Neck Occipital Condyles Moment | (-43.7) - (-53.3) Nm | -44.83 Nm | Yes |
| Neck Occipital Condyles Moment Decay to 10 Nm | 60 - 80 ms | 70.4 ms | Yes |

**Test meets specifications.**

**Condition: Used**

**Comments:**
**Neck S/N: 160308**

Specification Source: CFR49 Part 572 Subpart P with Polarity in accordance with J211

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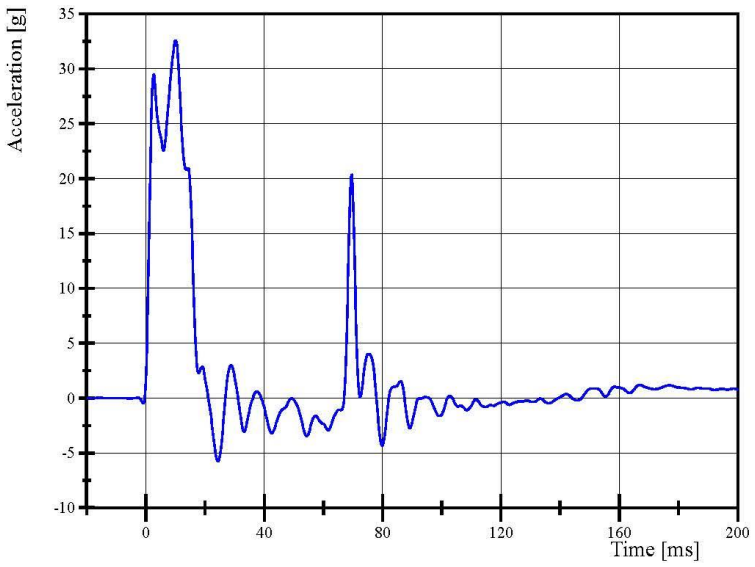
# Transportation Research Center Inc.

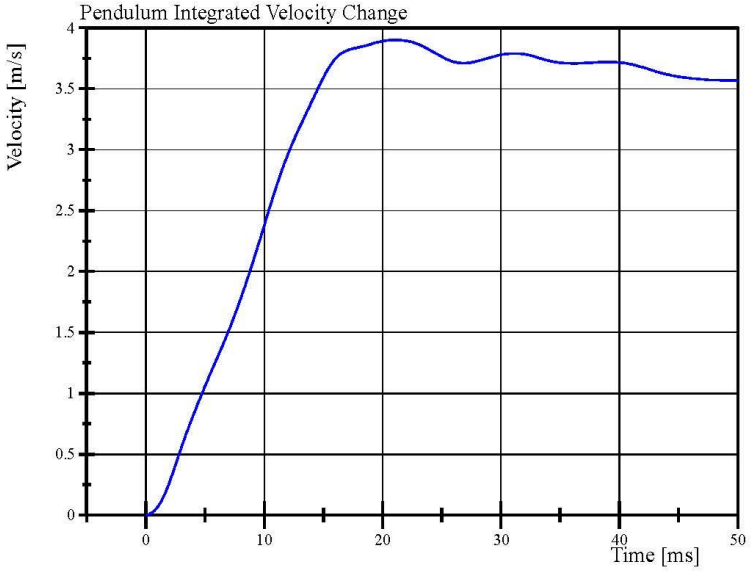
Neck Extension
HIII 3YO Serial No. 040 Certification No. 11-1
Test Date: 7/27/2020

Pendulum Acceleration




Filter Class: CFC_180
Max: 32.6 g at 10.0 ms
Min: -5.7 g at 24.4 ms

Pendulum Integrated Velocity Change




Filter Class: CFC_180
Max: 3.9 m/s at 21.1 ms
Min: 0.0 m/s at 0.0 ms

Specification Source: CFR49 Part 572 Subpart P
with Polarity in accordance with J211

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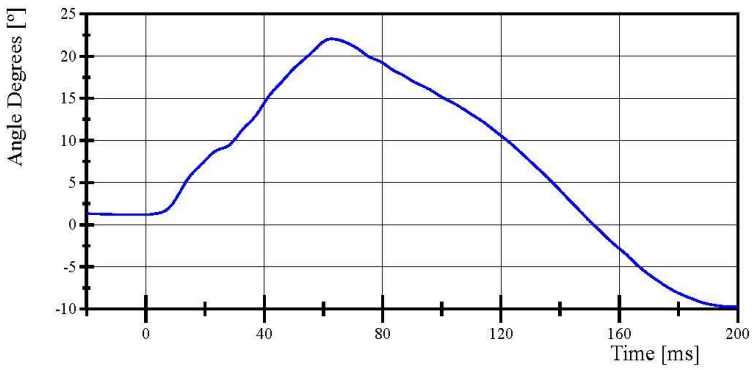
# Transportation Research Center Inc.

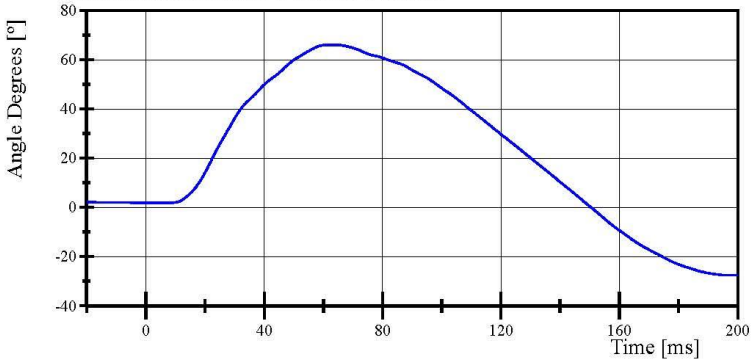
Neck Extension
HIII 3YO Serial No. 040 Certification No. 11-1
Test Date: 7/27/2020

Pot Rotation at the Base of Neck



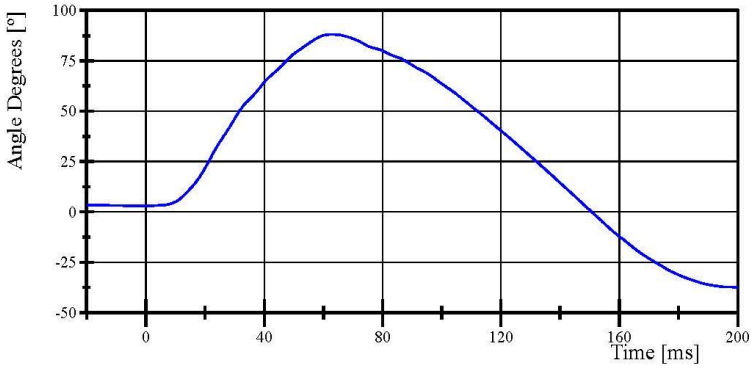

Filter Class: CFC_60
Max: 22.0 ° at 62.7 ms
Min: -9.8 ° at 199.8 ms

Headform Rotation at Occypital Condyles




Filter Class: CFC_60
Max: 66.1 ° at 62.8 ms
Min: -27.7 ° at 198.7 ms

Total Headform D-Plane Rotation




Filter Class: CFC_60
Max: 88.1 ° at 62.8 ms
Min: -37.4 ° at 199.0 ms

Specification Source: CFR49 Part 572 Subpart P
with Polarity in accordance with J211

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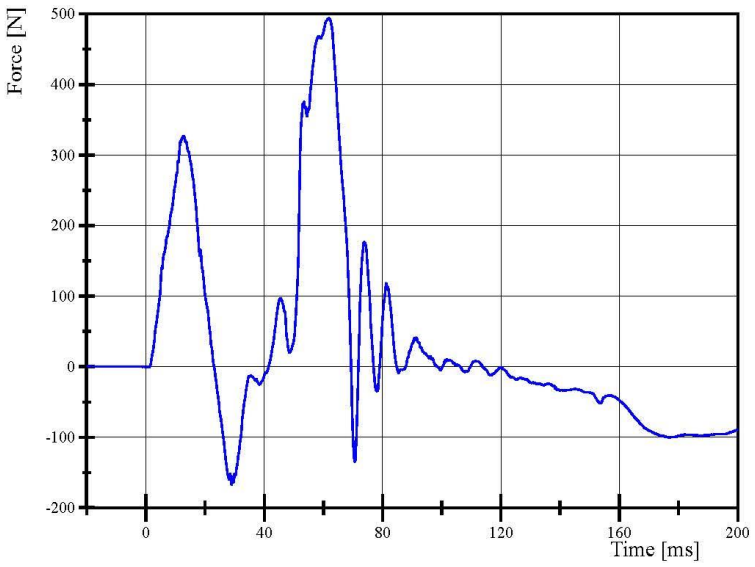
## Transportation Research Center Inc.

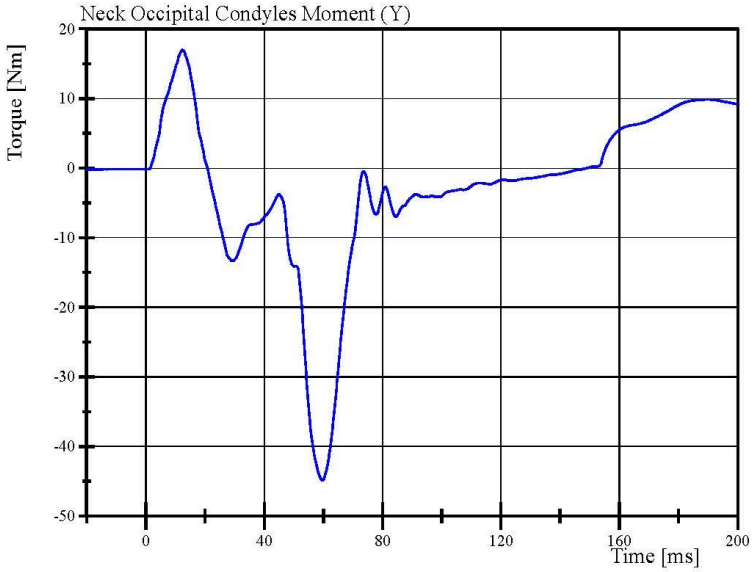
Neck Extension
HIII 3YO Serial No. 040 Certification No. 11-1
Test Date: 7/27/2020

Neck Force (X)




Filter Class: CFC_1000
Max: 493.8 N at 61.9 ms
Min: -167.2 N at 29.0 ms

Neck Occipital Condyles Moment (Y)




Filter Class: CFC_600
Max: 17.0 Nm at 12.3 ms
Min: -44.8 Nm at 59.8 ms

Specification Source: CFR49 Part 572 Subpart P
with Polarity in accordance with J211

07.27.2020 13:59:24 938