

**REPORT NUMBER: NCAP-CAL-22-004**

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

**Hyundai Motor Company  
2022 Hyundai Ioniq 5  
Four Door SUV**

**NHTSA No: M20224200**

**PREPARED BY:  
CALSPAN CORPORATION  
P.O. BOX 400  
BUFFALO, NEW YORK 104625**



**April 7, 2023**

**FINAL REPORT**

**PREPARED FOR:  
U. S. DEPARTMENT OF TRANSPORTATION  
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION  
OFFICE OF CRASHWORTHINESS STANDARDS  
1200 NEW JERSEY AVE SE  
WASHINGTON, D.C. 20590**

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Date: April 7, 2023

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Date: April 7, 2023

#### **FINAL REPORT ACCEPTANCE BY OCWS:**

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

Date: \_\_\_\_\_

\_\_\_\_\_  
COTR, New Car Assessment Program  
NHTSA, Office of Crashworthiness Standards

Date: \_\_\_\_\_



# **TECHNICAL REPORT DOCUMENTATION PAGE**

| <b>1. Report No.</b><br>NCAP-CAL-22-004                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |       | <b>2. Government Accession No.</b>                            |           | <b>3. Recipient's Catalog No.</b>                                                                                                                                                                                              |           |                         |       |                                |  |                                   |  |           |        |           |        |                                           |  |     |         |     |         |                           |    |    |         |    |         |     |  |   |       |   |       |              |   |       |         |       |         |                  |   |       |          |       |          |                  |   |        |           |       |           |                   |   |        |           |       |           |
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| <b>4. Title and Subtitle</b><br>Final Report of New Car Assessment Program<br>Frontal Impact Testing and FMVSS No.305 indicant testing of a<br>2022 Hyundai Ioniq 5 SE SUV<br>NHTSA No.: M20224200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |                                                               |           | <b>5. Report Date</b><br>April 7, 2023                                                                                                                                                                                         |           |                         |       |                                |  |                                   |  |           |        |           |        |                                           |  |     |         |     |         |                           |    |    |         |    |         |     |  |   |       |   |       |              |   |       |         |       |         |                  |   |       |          |       |          |                  |   |        |           |       |           |                   |   |        |           |       |           |
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| <b>9. Performing Organization Name and Address</b><br>Calspan Corporation<br>Transportation Test Operations<br>P.O. Box 400<br>Buffalo, New York 104625                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |       |                                                               |           | <b>10. Work Unit No.</b>                                                                                                                                                                                                       |           |                         |       |                                |  |                                   |  |           |        |           |        |                                           |  |     |         |     |         |                           |    |    |         |    |         |     |  |   |       |   |       |              |   |       |         |       |         |                  |   |       |          |       |          |                  |   |        |           |       |           |                   |   |        |           |       |           |
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| <b>12. Sponsoring Agency Name and Address</b><br>U.S. Department of Transportation<br>National Highway Traffic Safety Administration<br>Office of Crashworthiness Standards<br>1200 New Jersey Ave., SE,<br>Washington, D.C. 20590                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |                                                               |           | <b>13. Type of Report and Period Covered:</b><br>Final Test Report<br>May 24, 2022 - April 7, 2023                                                                                                                             |           |                         |       |                                |  |                                   |  |           |        |           |        |                                           |  |     |         |     |         |                           |    |    |         |    |         |     |  |   |       |   |       |              |   |       |         |       |         |                  |   |       |          |       |          |                  |   |        |           |       |           |                   |   |        |           |       |           |
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| <b>15. Supplementary Notes</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                                                               |           |                                                                                                                                                                                                                                |           |                         |       |                                |  |                                   |  |           |        |           |        |                                           |  |     |         |     |         |                           |    |    |         |    |         |     |  |   |       |   |       |              |   |       |         |       |         |                  |   |       |          |       |          |                  |   |        |           |       |           |                   |   |        |           |       |           |
| <b>16. Abstract</b><br><p>A 56.30 km/h (35 mph), NCAP frontal rigid barrier impact test was conducted on a 2022 Hyundai Ioniq 5 SE SUV in accordance with the specifications of the Office of Crashworthiness Standards Laboratory Procedure for NCAP Full Frontal Rigid Barrier Impact Testing. This test was conducted to obtain data related to FMVSS Nos. 208, 212, 219 (partial), 301, and 305 performance. The test was conducted at Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on May 24, 2022.</p> <p>The impact velocity of the vehicle was 56.39 km/h, and the ambient temperature at the barrier face at the time of impact was 21°C. The target vehicle post-test maximum crush was 633 mm at vehicle centerline. The test vehicle's occupant performance data is as follows:</p> <table border="1"> <thead> <tr> <th rowspan="2">Measurement Description</th> <th rowspan="2">Units</th> <th colspan="2">Driver ATD<br/>(Serial No. 142)</th> <th colspan="2">Passenger ATD<br/>(Serial No. 137)</th> </tr> <tr> <th>Threshold</th> <th>Result</th> <th>Threshold</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC<sub>15</sub>)</td> <td></td> <td>700</td> <td>312.759</td> <td>700</td> <td>201.607</td> </tr> <tr> <td>Maximum Chest Compression</td> <td>mm</td> <td>63</td> <td>-26.479</td> <td>52</td> <td>-18.336</td> </tr> <tr> <td>Nij</td> <td></td> <td>1</td> <td>0.218</td> <td>1</td> <td>0.515</td> </tr> <tr> <td>Neck Tension</td> <td>N</td> <td>4,170</td> <td>904.300</td> <td>2,620</td> <td>460.036</td> </tr> <tr> <td>Neck Compression</td> <td>N</td> <td>4,000</td> <td>-467.018</td> <td>2,520</td> <td>-368.888</td> </tr> <tr> <td>Left Femur Force</td> <td>N</td> <td>10,008</td> <td>-2627.953</td> <td>6,805</td> <td>-2788.433</td> </tr> <tr> <td>Right Femur Force</td> <td>N</td> <td>10,008</td> <td>-3020.205</td> <td>6,805</td> <td>-2427.827</td> </tr> </tbody> </table> |       |                                                               |           |                                                                                                                                                                                                                                |           | Measurement Description | Units | Driver ATD<br>(Serial No. 142) |  | Passenger ATD<br>(Serial No. 137) |  | Threshold | Result | Threshold | Result | Head Injury Criteria (HIC <sub>15</sub> ) |  | 700 | 312.759 | 700 | 201.607 | Maximum Chest Compression | mm | 63 | -26.479 | 52 | -18.336 | Nij |  | 1 | 0.218 | 1 | 0.515 | Neck Tension | N | 4,170 | 904.300 | 2,620 | 460.036 | Neck Compression | N | 4,000 | -467.018 | 2,520 | -368.888 | Left Femur Force | N | 10,008 | -2627.953 | 6,805 | -2788.433 | Right Femur Force | N | 10,008 | -3020.205 | 6,805 | -2427.827 |
| Measurement Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Units | Driver ATD<br>(Serial No. 142)                                |           | Passenger ATD<br>(Serial No. 137)                                                                                                                                                                                              |           |                         |       |                                |  |                                   |  |           |        |           |        |                                           |  |     |         |     |         |                           |    |    |         |    |         |     |  |   |       |   |       |              |   |       |         |       |         |                  |   |       |          |       |          |                  |   |        |           |       |           |                   |   |        |           |       |           |
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| Head Injury Criteria (HIC <sub>15</sub> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |       | 700                                                           | 312.759   | 700                                                                                                                                                                                                                            | 201.607   |                         |       |                                |  |                                   |  |           |        |           |        |                                           |  |     |         |     |         |                           |    |    |         |    |         |     |  |   |       |   |       |              |   |       |         |       |         |                  |   |       |          |       |          |                  |   |        |           |       |           |                   |   |        |           |       |           |
| Maximum Chest Compression                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | mm    | 63                                                            | -26.479   | 52                                                                                                                                                                                                                             | -18.336   |                         |       |                                |  |                                   |  |           |        |           |        |                                           |  |     |         |     |         |                           |    |    |         |    |         |     |  |   |       |   |       |              |   |       |         |       |         |                  |   |       |          |       |          |                  |   |        |           |       |           |                   |   |        |           |       |           |
| Nij                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |       | 1                                                             | 0.218     | 1                                                                                                                                                                                                                              | 0.515     |                         |       |                                |  |                                   |  |           |        |           |        |                                           |  |     |         |     |         |                           |    |    |         |    |         |     |  |   |       |   |       |              |   |       |         |       |         |                  |   |       |          |       |          |                  |   |        |           |       |           |                   |   |        |           |       |           |
| Neck Tension                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | N     | 4,170                                                         | 904.300   | 2,620                                                                                                                                                                                                                          | 460.036   |                         |       |                                |  |                                   |  |           |        |           |        |                                           |  |     |         |     |         |                           |    |    |         |    |         |     |  |   |       |   |       |              |   |       |         |       |         |                  |   |       |          |       |          |                  |   |        |           |       |           |                   |   |        |           |       |           |
| Neck Compression                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | N     | 4,000                                                         | -467.018  | 2,520                                                                                                                                                                                                                          | -368.888  |                         |       |                                |  |                                   |  |           |        |           |        |                                           |  |     |         |     |         |                           |    |    |         |    |         |     |  |   |       |   |       |              |   |       |         |       |         |                  |   |       |          |       |          |                  |   |        |           |       |           |                   |   |        |           |       |           |
| Left Femur Force                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | N     | 10,008                                                        | -2627.953 | 6,805                                                                                                                                                                                                                          | -2788.433 |                         |       |                                |  |                                   |  |           |        |           |        |                                           |  |     |         |     |         |                           |    |    |         |    |         |     |  |   |       |   |       |              |   |       |         |       |         |                  |   |       |          |       |          |                  |   |        |           |       |           |                   |   |        |           |       |           |
| Right Femur Force                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | N     | 10,008                                                        | -3020.205 | 6,805                                                                                                                                                                                                                          | -2427.827 |                         |       |                                |  |                                   |  |           |        |           |        |                                           |  |     |         |     |         |                           |    |    |         |    |         |     |  |   |       |   |       |              |   |       |         |       |         |                  |   |       |          |       |          |                  |   |        |           |       |           |                   |   |        |           |       |           |
| <b>17. Key Words</b><br>56.3 km/h (35 mph) Full Frontal Rigid Barrier Impact Test<br>New Car Assessment Program (NCAP)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |       |                                                               |           | <b>18. Distribution Statement</b><br>Copies of this report are available from:<br>National Highway Traffic Safety Administration<br>Technical Information Services Division<br>1200 New Jersey Ave, SE<br>Washington, DC 20590 |           |                         |       |                                |  |                                   |  |           |        |           |        |                                           |  |     |         |     |         |                           |    |    |         |    |         |     |  |   |       |   |       |              |   |       |         |       |         |                  |   |       |          |       |          |                  |   |        |           |       |           |                   |   |        |           |       |           |
| <b>19. Security Class. (of this report)</b><br><br>UNCLASSIFIED                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |       | <b>20. Security Class. (of this page)</b><br><br>UNCLASSIFIED |           | <b>21. No. of Pages</b><br><br>195                                                                                                                                                                                             |           |                         |       |                                |  |                                   |  |           |        |           |        |                                           |  |     |         |     |         |                           |    |    |         |    |         |     |  |   |       |   |       |              |   |       |         |       |         |                  |   |       |          |       |          |                  |   |        |           |       |           |                   |   |        |           |       |           |
| <b>22. Price</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       |                                                               |           |                                                                                                                                                                                                                                |           |                         |       |                                |  |                                   |  |           |        |           |        |                                           |  |     |         |     |         |                           |    |    |         |    |         |     |  |   |       |   |       |              |   |       |         |       |         |                  |   |       |          |       |          |                  |   |        |           |       |           |                   |   |        |           |       |           |

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## **SECTION 1**

### **PURPOSE AND SUMMARY OF TEST**

#### **PURPOSE**

This 56.3 km/h frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. 693JJ919D000005. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for consumer information purposes.

The 56.3 km/h frontal barrier impact test was conducted in accordance with the Office of Crashworthiness Standards Laboratory Procedure for NCAP Full Frontal Rigid Barrier Impact Testing.

#### **SUMMARY**

A load cell barrier consisting of 128 load cells was impacted by a 2022 Hyundai Ioniq 5 SE SUV at a velocity of 56.39 km/h. The test was performed at Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on May 24, 2022. Pre- and post-test photographs of the vehicle and dummies to document the test can be found in Appendix A. One real-time camera and 16 high-speed cameras were used to document the frontal barrier impact event. Camera locations and other pertinent camera information can be found in Data Sheet 6 of this report.

One Part 572E, 50<sup>th</sup> percentile male anthropomorphic test device (ATD), was placed in the driver seating position and one Part 572O 5<sup>th</sup> percentile female ATD was placed in the right-front passenger seating position according to dummy placement instructions specified in the Laboratory Procedure for NCAP Full Frontal Rigid Barrier Impact Testing. Both ATDs were fully instrumented with head, chest and pelvis tri-axial accelerometers, chest displacement potentiometers, upper neck transducers, femur load cells, and lower leg instrumentation. Seat belt load cells were installed on the driver's lap and shoulder belts and passenger's shoulder belt to measure dummy torso and pelvic section loading. The driver (position 1) ATD (Serial No. 142) and the right-front passenger (position 2) ATD (Serial No. 137) were qualified prior to this test. Certification details, along with instrumentation calibration data, can be found in Appendix C of this report.

The 486 channels of data were recorded on an on-board data acquisition system. Appendix B contains the vehicle, load cell barrier and dummy response data traces.

There was 93.6 percent windshield retention and no intrusion into the protected zone of the windshield during the event. There was a total of 0.0 grams of stoddard solvent leakage after the event or during any phase of the static rollover. The maximum static crush of the vehicle was 633 mm and both driver and passenger side doors remained closed during the impact event and were operable after the impact.

The driver's visible contact points were as follows: The driver's head contacted the frontal airbag and then the head restraint. The upper torso contacted the frontal airbag. Both knees contacted the knee bolster.

The passenger's visible contact points were as follows: The passenger's head contacted the frontal airbag and then the head restraint. The upper torso contacted the frontal airbag. Both knees contacted the glove box. Passenger frontal airbag was observed to have an unexpected hole and the lap belt twisted during the impact event and can be seen in Appendix A.

The occupant data is summarized below.

| ATD Position                 | HIC <sub>15</sub> | Nij   | Neck Tension (N) | Neck Comp. (N) | 3ms Chest Clip (Gs) | Chest Disp. (mm) | Left Femur (N) | Right Femur (N) |
|------------------------------|-------------------|-------|------------------|----------------|---------------------|------------------|----------------|-----------------|
| Driver (50 <sup>th</sup> )   | 312.759           | 0.218 | 904.300          | -467.018       | 45.739              | -26.479          | -2627.953      | -3020.205       |
| Passenger (5 <sup>th</sup> ) | 201.607           | 0.515 | 460.036          | -368.888       | 47.611              | -18.336          | -2788.433      | -2427.827       |

**GENERAL COMMENTS:**

1. P1 (Driver) serial number - 142
2. P2 (Passenger) serial number – 137
3. Lap Seatbelt Load Cell was not used on Passenger.
4. Front Airbag Anomaly
5. Passenger Lap belt post test Anomaly

**Data Anomalies:**

- Engine Top X Acceleration, Questionable data after 44.8 ms
- Engine Bottom X Acceleration, Questionable data after 40.2 ms
- Driver FOOT LEFT Az, Questionable Data after 108.35 ms

## **SECTION 2**

### **OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS**

This section contains information reporting for the following Data Sheets:

Data Sheet No. 1 – General Test and Vehicle Parameter Data

Data Sheet No. 2 – Seat Adjustment, Fuel System, and Steering Wheel Data

Data Sheet No. 3 – Dummy Longitudinal Clearance Dimensions

Data Sheet No. 4 – Dummy Lateral Clearance Dimensions

Data Sheet No. 5 – Seat Belt Positioning Data

Data Sheet No. 6 – High-Speed Camera Locations and Data

Data Sheet No. 7 – Vehicle Accelerometer Locations

Data Sheet No. 8 – Photographic Reference Target Locations

Data Sheet No. 9 – Load Cell Locations on Fixed Barrier

Data Sheet No. 10 – Test Vehicle Summary of Results

Data Sheet No. 11 – Post-Test Observations

Data Sheet No. 12 – Vehicle Profile Measurements

Data Sheet No. 13 – Accident Investigation Division Data

Data Sheet No. 14 – Vehicle Intrusion Measurements

Data Sheet No. 15 – Summary of Indicant FMVSS No. 212 and FMVSS No. 219 (Partial)

Data Sheet No. 16 – FMVSS 301 Barrier Impact and Static Rollover Results

Data Sheet No. 17 – Dummy/Vehicle Temperature Stabilization Chart

Data Sheet No. 305-1 – General Test and Parameter Data for Indicant FMVSS No. 305 Testing

Data Sheet No. 305-2 – Pre-Impact Data for Indicant FMVSS No. 305 Testing

Data Sheet No. 305-3 – Pre-Impact Electrical Isolation Measurements and Calculations for  
Indicant FMVSS No. 305 Testing

Data Sheet No. 305-4 – Post-Impact Data for Indicant FMVSS No. 305 Testing

Data Sheet No. 305-5 –Static Rollover Test Data for Indicant FMVSS No. 305 Testing

**DATA SHEET NO. 1**  
**GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
Test Date: 5/24/2022

**TEST VEHICLE INFORMATION AND OPTIONS**

|                             |                   |                                 |     |
|-----------------------------|-------------------|---------------------------------|-----|
| NHTSA No.                   | M20224200         | Traction Control System (TCS)   | Yes |
| Model Year                  | 2022              | Power Steering                  | Yes |
| Make                        | Hyundai           | Power Window Auto-Reverse       | No  |
| Model                       | Ioniq 5 SE        | Driver Frontal Airbag           | Yes |
| Body Style                  | SUV               | Driver Curtain Airbag           | Yes |
| VIN                         | KM8KMDAF0NU084145 | Driver Head/Torso Airbag        | No  |
| Body Color                  | Black             | Driver Torso Airbag             | No  |
| Odometer Reading (km /mi)   | 28                | Driver Torso/Pelvis Airbag      | Yes |
| Engine Displacement (L)     | N/A               | Driver Pelvis Airbag            | No  |
| Type / No. Cylinders        | Electric Vehicle  | Driver Knee Airbag              | No  |
| Engine Placement            | N/A               | Front Pass. Frontal Airbag      | Yes |
| Transmission Type           | Automatic         | Front Pass. Curtain Airbag      | Yes |
| Transmission Speeds         | Direct Drive      | Front Pass. Head/Torso Airbag   | No  |
| Overdrive                   | No                | Front Pass. Torso Airbag        | No  |
| Final Drive                 | Rear Wheel Drive  | Front Pass. Torso/Pelvis Airbag | Yes |
| Roof Rack                   | No                | Front Pass. Pelvis Airbag       | No  |
| Sunroof / T-Top             | No                | Front Pass. Knee Airbag         | No  |
| Running Boards              | No                | Driver Pretensioner             | Yes |
| Tilt Steering Wheel         | Yes               | Driver Load Limiter             | Yes |
| Power Seats                 | Yes               | Front Pass. Pretensioner        | Yes |
| Anti-Lock Brakes (ABS)      | Yes               | Front Pass. Load Limiter        | Yes |
| Automatic Door Locks (ADLs) | Yes               | Other –                         | -   |

Does owner's manual provide instructions to turn off automatic door locks?

No

**DATA FROM CERTIFICATION LABEL**

|                     |                       |                 |      |
|---------------------|-----------------------|-----------------|------|
| Manufactured By     | Hyundai Motor Company | GVWR (kg)       | 2540 |
| Date of Manufacture | MAR/2022              | GAWR Front (kg) | 1280 |
|                     |                       | GAWR Rear (kg)  | 1370 |

**VEHICLE SEATING AND WEIGHT CAPACITY DATA**

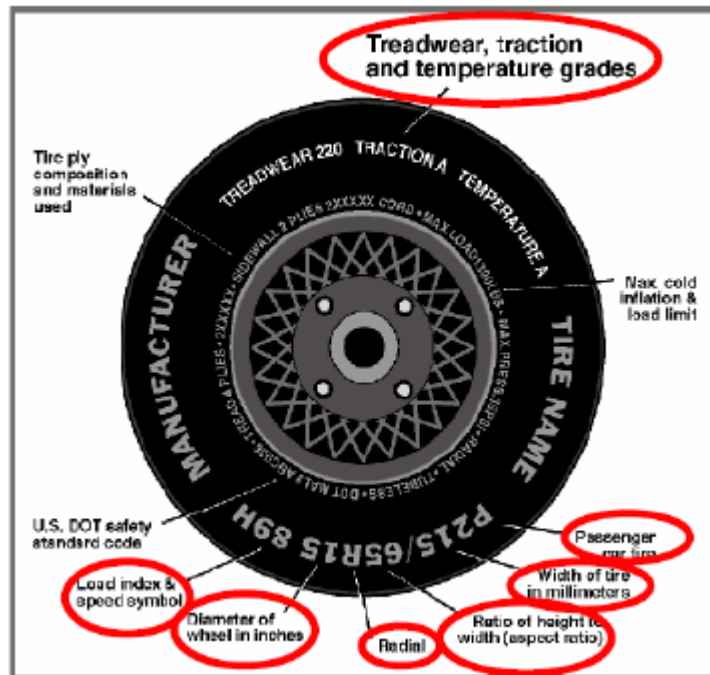
| Measured Parameter      | Front  | Rear  | Third | Total |
|-------------------------|--------|-------|-------|-------|
| Type of Seats           | Bucket | Bench | -     |       |
| Number of Occupants     | 2      | 3     | -     | 5     |
| Capacity Wt. (VCW) (kg) |        |       |       | 390   |
| Cargo Wt. (RCLW) (kg)   |        |       |       | 49.8  |

**DATA SHEET NO. 1 ... (CONTINUED)**  
**GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
 Test Date: 5/24/2022

Collect items circled in red, tire manufacturer, and tire name.



**VEHICLE TIRE INFORMATION**

| Measured Parameter          | Front                                | Rear                                 |
|-----------------------------|--------------------------------------|--------------------------------------|
| Maximum Tire Pressure (kPa) | 350                                  | 350                                  |
| Cold Pressure (kPa)         | 250                                  | 250                                  |
| Recommended Tire Size       | 235/55R19                            | 235/55R19                            |
| Tire Size on Vehicle        | 235/55R19                            | 235/55R19                            |
| Tire Manufacturer           | Michelin                             | Michelin                             |
| Tire Model                  | Primacy A/S                          | Primacy A/S                          |
| Treadwear                   | 540                                  | 540                                  |
| Traction                    | A                                    | A                                    |
| Temperature Grades          | A                                    | A                                    |
| Tire Plies Sidewall         | 2 Polyester                          | 2 Polyester                          |
| Tire Plies Body             | 2 Polyester, 2 Steel,<br>1 Polyamide | 2 Polyester, 2 Steel,<br>1 Polyamide |
| Load Index / Speed Symbol   | 101H                                 | 101H                                 |
| Tire Material               | Rubber                               | Rubber                               |
| DOT Safety Code Left        | B98F073X3821                         | B98F073X3721                         |
| DOT Safety Code Right       | B98F073X3821                         | B98F073X3821                         |

**DATA SHEET NO. 1 ... (CONTINUED)**  
**GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
 Test Date: 5/24/2022

**TEST VEHICLE WEIGHTS**

|        | Units | As Delivered Weights (UVW) |           |       | As Tested Weights (ATW) |           |       |
|--------|-------|----------------------------|-----------|-------|-------------------------|-----------|-------|
|        |       | Front Axle                 | Rear Axle | Total | Front Axle              | Rear Axle | Total |
| Left   | kg    | 524                        | 513       |       | 576                     | 565       |       |
| Right  | kg    | 516                        | 511       |       | 553                     | 554       |       |
| Ratio  | %     | 50.4                       | 49.6      |       | 50.2                    | 49.8      |       |
| Totals | kg    | 1040                       | 1024      | 2064  | 1129                    | 1119      | 2248  |

**TARGET TEST WEIGHT CALCULATION**

| Measured Parameter                      | Units | Value  |         |
|-----------------------------------------|-------|--------|---------|
| Total Delivered Weight (UVW)            | kg    | 2064   | (A)     |
| Weight of 1 P572E ATD & 1 P572O ATD     | kg    | 142    | (B)     |
| Rated Cargo / Luggage Weight (RCLW)     | kg    | 49.8   | (C)     |
| Calculated Vehicle Target Weight (TVTW) | kg    | 2255.8 | (A+B+C) |

**TEST VEHICLE ATTITUDES AND CG**

| Condition    | Units | LF   | RF   | LR  | RR  | CG (aft of front axle) |
|--------------|-------|------|------|-----|-----|------------------------|
| As Delivered | mm    | 884  | 884  | 898 | 902 | 1491                   |
| As Tested    | mm    | 870  | 871  | 889 | 895 | 1499                   |
| Post-Test    | mm    | 848* | 852* | 875 | 904 |                        |

\*Points are approximation due to points moving with hood post hit

**GENERAL TEST VEHICLE DATA**

| Measurement Description                 | Units | Value |
|-----------------------------------------|-------|-------|
| Total Vehicle Wheel Base                | mm    | 3,005 |
| Total Vehicle Length at Left Side       | mm    | 4,564 |
| Total Vehicle Length at Centerline      | mm    | 4,635 |
| Total Vehicle Length at Right Side      | mm    | 4,564 |
| Weight of Ballast in Cargo Area         | kg    | 0     |
| Weight of Vehicle Components Removed    | kg    | 36    |
| Amount of Stoddard Solvent in Fuel Tank | L     | N/A   |

**LIST OF COMPONENTS REMOVED TO MEET TEST WEIGHT:**

Trunk Carpeting, Tail Light, Battery Charger, Air Compressor, Optional First Aid Kit/Cargo Net,  
Rear Right Interior Door Trim, Spoiler, Tail Light, Rear Floor mats



**DATA SHEET NO.1 ... (CONTINUED)**  
**GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
 Test Date: 5/24/2022

**TARGET VEHICLE STRUCTURAL MEASUREMENT**

| No. | Description                           | Pre-Test |
|-----|---------------------------------------|----------|
| 1   | Total Length                          | 4635     |
| 2   | Total Width                           | 1874     |
| 3*  | Bumper Top Height                     | 558      |
| 4*  | Bumper Bottom Height                  | 400      |
| 5*  | Longitudinal Member Top Height        | 560      |
| 6   | Distance Between Longitudinal Members | 886      |
| 7   | Longitudinal Member Width             | 72       |
| 8*  | Engine Top Height                     | 795      |
| 9*  | Engine Bottom Height                  | 183      |
| 10  | Engine and Gearbox Width              | 362      |
| 11  | Front Bumper-Engine Distance          | 619      |
| 12* | Front Shock Absorber Fixing Height    | 969      |
| 13* | Bonnet Leading Edge Height            | 777      |
| 14  | Front Shock Absorber Fixing Width     | 1202     |
| 15  | Front Bumper – Front Axle Distance    | 846      |
| 16  | Front Axle – A Pillar Distance        | 549      |
| 17  | A-Pillar – B-Pillar Distance          | 1158     |
| 18  | B-Pillar – Rear Axle Distance         | 1298     |
| 19  | B-Pillar – C-Pillar Distance          | 1186     |
| 20* | Roof Sill Bottom Height               | 1479     |
| 21* | Roof Sill Top Height                  | 1525     |
| 22* | Floor Sill Bottom Height              | 362      |
| 23* | Floor Sill Top Height                 | 408      |

\*Height Measurements are taken from the ground  
 Note: All measurements are in millimeters

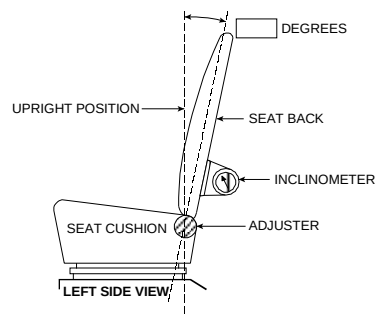
## DATA SHEET NO. 2 SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
Test Date: 5/24/2022

### NOMINAL DESIGN RIDING POSITION

The driver's seat back was set to the manufacturer's designated angle. The passenger's seat back was positioned in a similar manner as the driver's seat back. Seat back angles are measured at the headrest post bezel using a digital inclinometer.



**FRONT SEAT ASSEMBLY**

### SEAT FORE / AFT POSITIONS

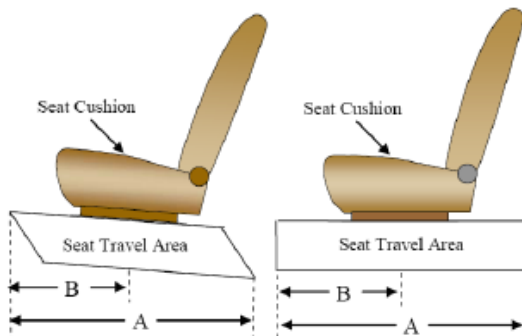
The driver's seat was positioned at the mid-point of fore/aft travel at its lowest position. The passenger's seat was positioned at the most forward position of fore/aft travel. Zero is defined as the forward most position.

| Seating Position | Total Fore / Aft Travel | Placed in Position # |
|------------------|-------------------------|----------------------|
| Driver Seat      | 339                     | 170                  |
| Passenger Seat   | 27 (0-26)               | 0                    |

### SEAT BELT UPPER ANCHORAGE

The driver's seat belt anchorage was positioned according to the manufacturer's designated positioning for a 50<sup>th</sup> percentile adult male ATD. The passenger's seat belt anchorage was positioned according to the manufacturer's designated positioning for a 5<sup>th</sup> percentile adult female ATD. For this test zero is defined as the uppermost position.

| Seating Position | Total # of Positions | Placed in Position # |
|------------------|----------------------|----------------------|
| Driver Seat      | 4 (0-3)              | 0                    |
| Passenger Seat   | 4 (0-3)              | 0                    |



**DATA SHEET NO. 2 ... (CONTINUED)**  
**SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
 Test Program: NCAP Frontal Barrier Impact Test

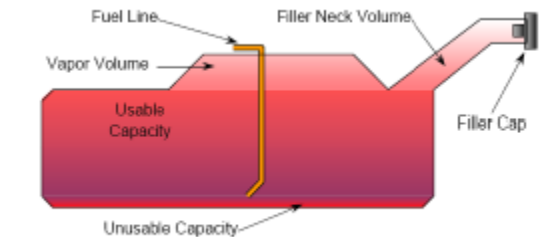
NHTSA No.: M20224200  
 Test Date: 5/24/2022

**FUEL TANK CAPACITY**

| Description                        | Liters |
|------------------------------------|--------|
| Usable Capacity of "Standard Tank" | N/A    |
| Usable Capacity of "Optional Tank" | N/A    |
| 92%-94% of Usable Capacity         | N/A    |
| Actual Amount of Solvent Used      | N/A    |
| 1/3 of Usable Capacity             | N/A    |

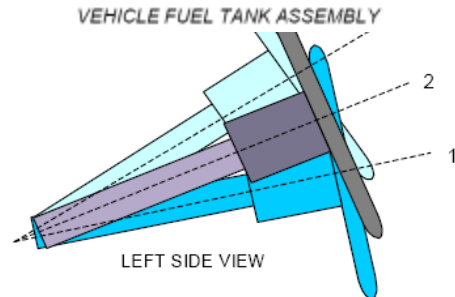
**FUEL PUMP**

The vehicle is equipped with a charge port that is located on the right rear of the vehicle



**STEERING COLUMN ADJUSTMENT**

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when moved through its full range of motion. For angular measurements, a digital inclinometer was used to measure a plate which was placed across the steering wheel rim. A tape measure was used to measure the telescoping steering wheel travel.



STEERING COLUMN ASSEMBLY

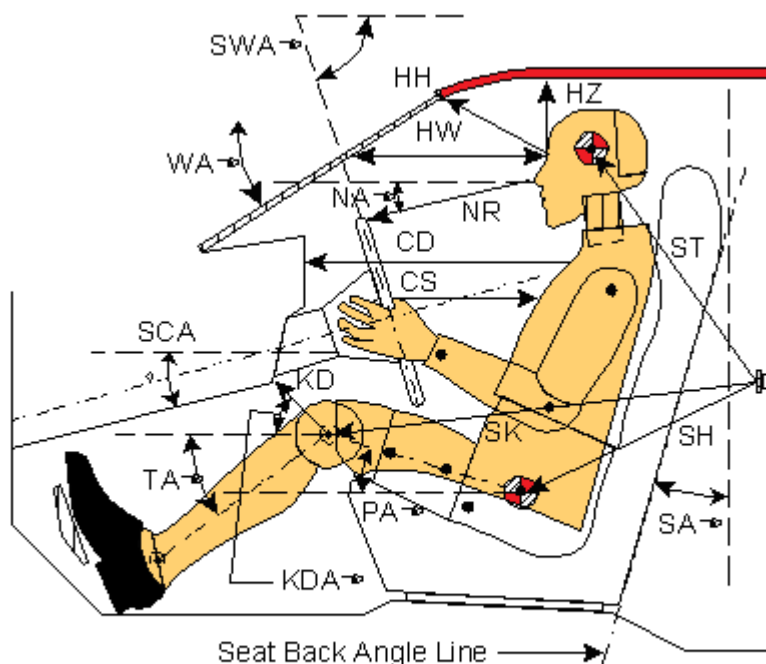
**STEERING COLUMN POSITIONS**

| Description                       | Degrees | Fore / Aft Position (mm) |
|-----------------------------------|---------|--------------------------|
| Lowermost position No. 1          | 21.4    |                          |
| Geometric center position No. 2   | 23.8    |                          |
| Uppermost position No. 3          | 26.2    |                          |
| Telescoping Steering Wheel Travel |         | 55                       |
| Test Position                     | 23.8    | 27.5                     |

**DATA SHEET NO. 3**  
**DUMMY LONGITUDINAL CLEARANCE DIMENSIONS**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
 Test Date: 5/24/2022



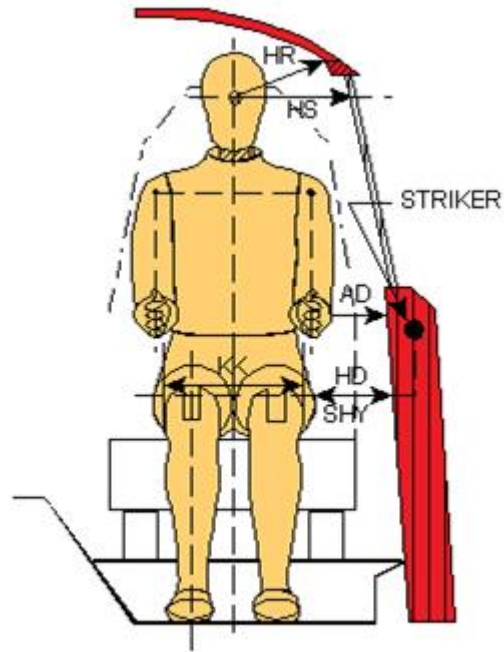
**Left Side View**

| Code        | Measurement Description            | Driver (SN: 142) |           | Passenger (SN: 137) |           |
|-------------|------------------------------------|------------------|-----------|---------------------|-----------|
|             |                                    | Length (mm)      | Angle (°) | Length (mm)         | Angle (°) |
| <b>WA°</b>  | Windshield Angle                   |                  | 29.5      |                     |           |
| <b>SWA°</b> | Steering Wheel Angle               |                  | 24.2      |                     |           |
| <b>SCA°</b> | Steering Column Angle              |                  | 114.2     |                     |           |
| <b>SA°</b>  | Seat Back Angle (on headrest post) |                  | 0.2       |                     | 0.4       |
| <b>HZ</b>   | Head to Roof (Z)                   | 202              | 90.0      | 228                 | 90.0      |
| <b>HH</b>   | Head to Header                     | 378              | 25.3      | 342                 | 45.6      |
| <b>HW</b>   | Head to Windshield                 | 686              | 0         | 659                 | 0         |
| <b>NR</b>   | Nose to Rim / Dash                 | 381              | 7.2       | 500                 | 30.3      |
| <b>CD</b>   | Chest to Dash                      | 566              |           | 423                 |           |
| <b>CS</b>   | Chest to Steering Hub              | 294              | 0.4       |                     |           |
| <b>RA</b>   | Rim to Abdomen                     | 197              | 0.1       |                     |           |
| <b>KDL</b>  | Left Knee to Dash                  | 160              | 39.8      | 145                 | 35.7      |
| <b>KDR</b>  | Right Knee to Dash                 | 188              | 26.0      | 143                 | 31.0      |
| <b>PA°</b>  | Pelvic Angle                       |                  | 23.9      |                     | 20.1      |
| <b>TA°</b>  | Tibia Angle                        |                  | 34.0      |                     | 36.0      |
| <b>SK</b>   | Striker to Knee                    | 635              | 5.2       | 738                 | 9.6       |
| <b>ST</b>   | Striker to Head                    | 501              | 68.5      | 468                 | 53.3      |
| <b>SH</b>   | Striker to H-Point                 | 341              | 38.0      | 449                 | 27.1      |

**DATA SHEET NO. 4**  
**DUMMY LATERAL CLEARANCE DIMENSIONS**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
Test Date: 5/24/2022



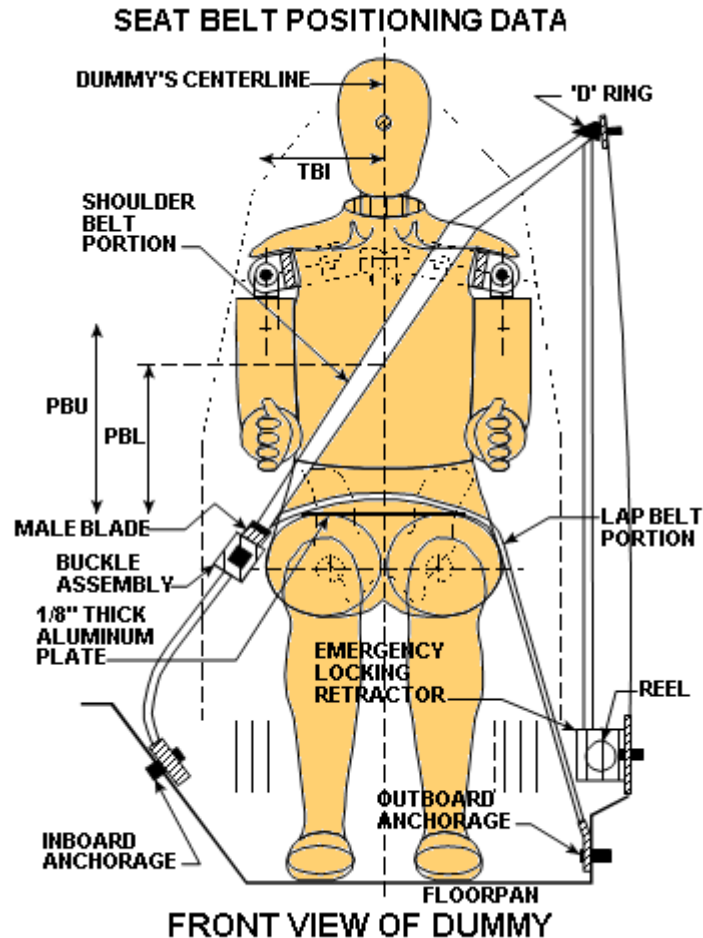
**Front View**

| Code       | Description                      | Driver (mm) | Passenger (mm) |
|------------|----------------------------------|-------------|----------------|
| <b>AD</b>  | Arm to Door                      | 44          | 75             |
| <b>HD</b>  | H-Point to Door                  | 131         | 229            |
| <b>HR</b>  | Head to Side Header              | 232         | 279            |
| <b>HS</b>  | Head to Side Window              | 370         | 409            |
| <b>KK</b>  | Knee to Knee                     | 347         | 210            |
| <b>SHY</b> | Striker to H-Point (Y Direction) | 260         | 285            |
| <b>AA</b>  | Ankle to Ankle                   | 375         | 165            |

## DATA SHEET NO. 5 SEAT BELT POSITIONING DATA

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
 Test Date: 5/24/2022



### SEAT BELT POSITIONING MEASUREMENTS

| Measurement Description                                  | Units | Driver | Passenger |
|----------------------------------------------------------|-------|--------|-----------|
| <b>PBU</b> — Top surface of reference to belt upper edge | mm    | 332    | 300       |
| <b>PBL</b> — Top surface of reference to belt lower edge | mm    | 243    | 200       |

### BELT LENGTH DATA

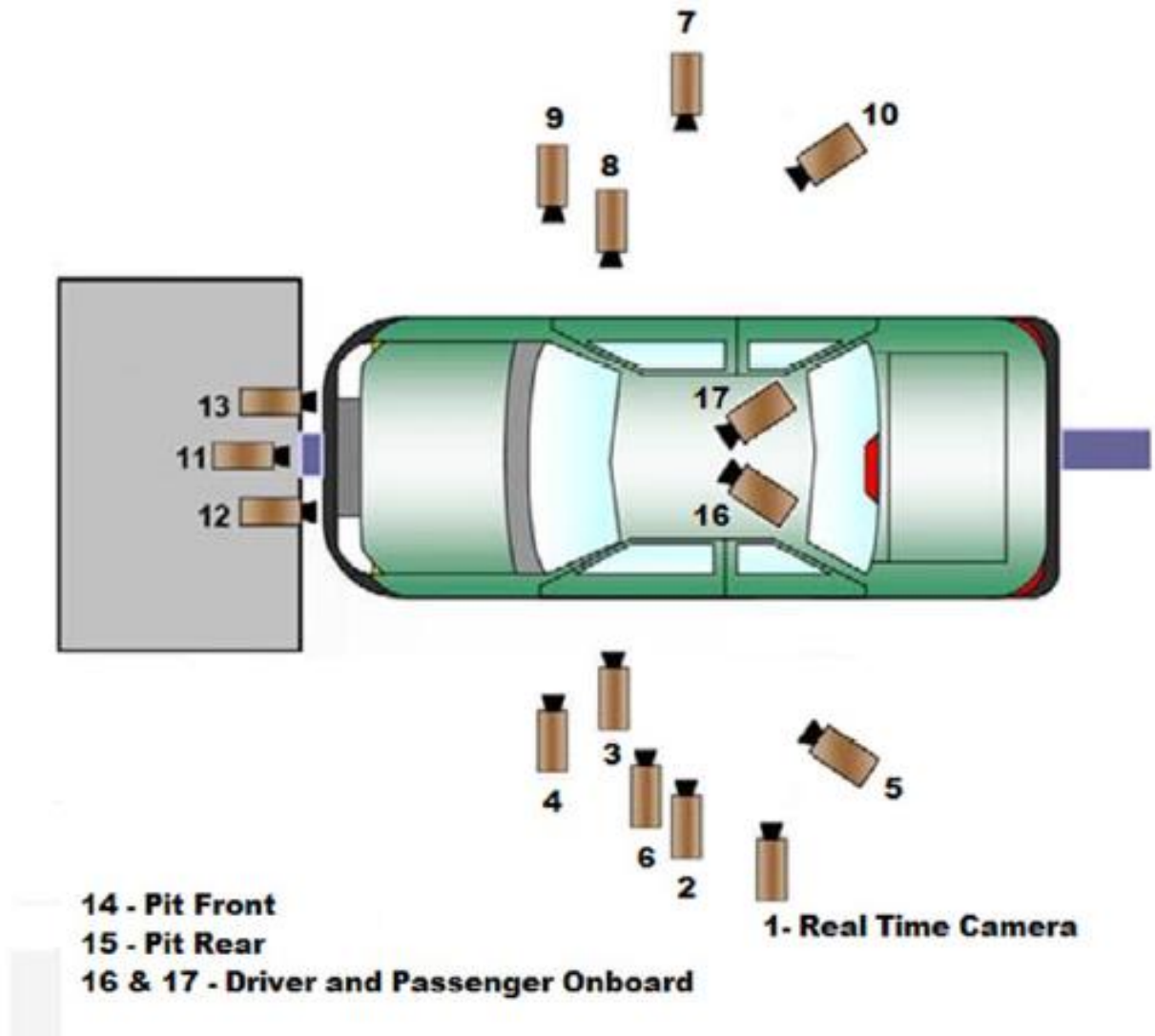
| Measurement Description                          | Units | Driver | Passenger |
|--------------------------------------------------|-------|--------|-----------|
| Shoulder belt length as measured on ATD          | mm    | 920    | 955       |
| Lap Belt Length as measured on ATD               | mm    | 703    | 765       |
| Remainder of belt on reel                        | mm    | 937    | 840       |
| Total belt length for continuous webbing systems | mm    | 2560   | 2560      |

**DATA SHEET NO. 6**  
**HIGH-SPEED CAMERA LOCATIONS AND DATA**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
Test Date: 5/24/2022

**CAMERA POSITIONS FOR FRONTAL IMPACTS**



**DATA SHEET NO. 6 ... (CONTINUED)**  
**HIGH-SPEED CAMERA LOCATIONS AND DATA**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
 Test Date: 5/24/2022

**CAMERA LOCATIONS**

| No. | Camera View                         | Location (mm) |       |       | Lens (mm) | Speed (fps) |
|-----|-------------------------------------|---------------|-------|-------|-----------|-------------|
|     |                                     | X             | Y     | Z     |           |             |
| 1   | Real-Time Left Overall              | -             | -     | -     |           | 60          |
| 2   | Left Overall                        | -2083         | -8442 | -1578 | 24        | 1000        |
| 3   | Driver Close-Up                     | -1083         | -7643 | -1683 | 50        | 1000        |
| 4   | Left Front Half                     | -689          | -6972 | -1435 | 28        | 1000        |
| 5   | Left Angle                          | -4409         | -4811 | -2416 | 50        | 1000        |
| 6   | Steering Column                     | -1321         | -9018 | -2193 | 75        | 1000        |
| 7   | Right Overall                       | -2373         | 8365  | -1743 | 24        | 1000        |
| 8   | Passenger Close-Up                  | -1778         | 8213  | -1763 | 50        | 1000        |
| 9   | Right Front Half                    | -722          | 7192  | -1461 | 28        | 1000        |
| 10  | Right Angle                         | -4266         | 4466  | -2366 | 50        | 1000        |
| 11  | Windshield                          | 1182          | 0     | -3471 | 12.5      | 1000        |
| 12  | Driver Windshield                   | 826           | -460  | -2329 | 25        | 1000        |
| 13  | Passenger Windshield                | 826           | 444   | -2329 | 25        | 1000        |
| 14  | Pit Front                           | -973          | 0     | 2381  | 12.5      | 1000        |
| 15  | Pit Rear                            | -2615         | 0     | 2379  | 12.5      | 1000        |
| 16  | Onboard Driver Airbag (Optional)    |               |       |       |           | 1000        |
| 17  | Onboard Passenger Airbag (Optional) |               |       |       |           | 1000        |

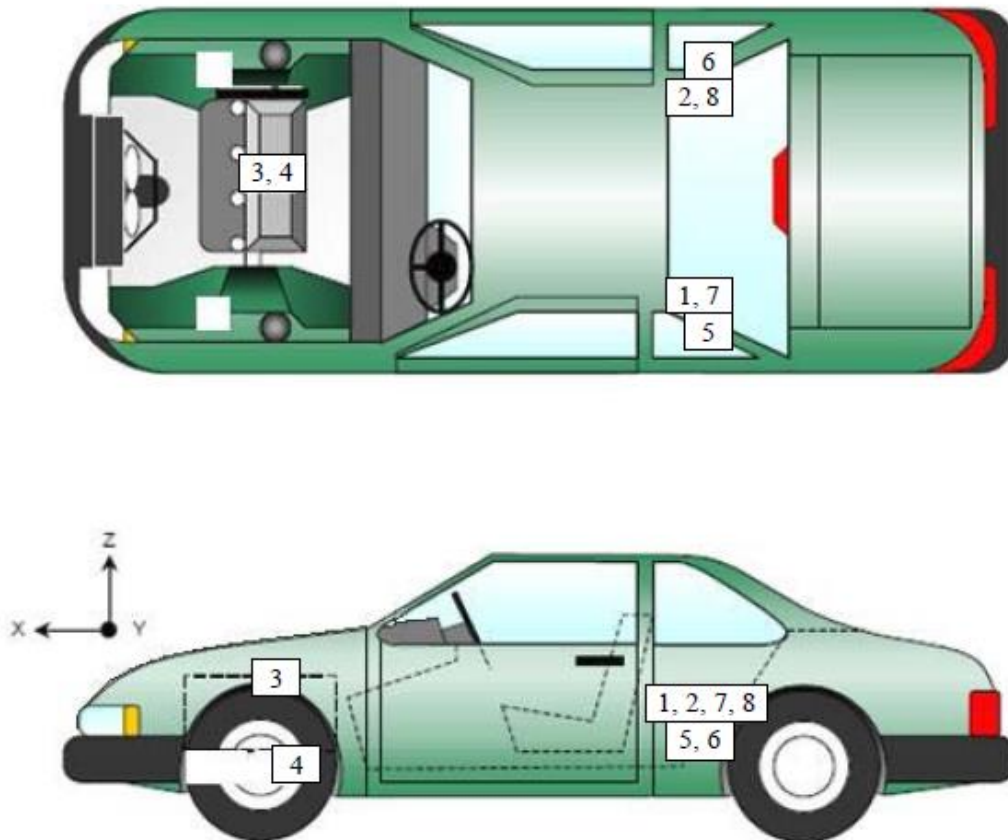
\* COORDINATES:      +X = forward of impact plane  
                              +Y = right of monorail center  
                              +Z = into ground



**DATA SHEET NO. 7**  
**VEHICLE ACCELEROMETER LOCATIONS**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
Test Date: 5/24/2022



**VEHICLE ACCELEROMETER PRE-TEST LOCATIONS**

| No. | Accelerometer Location                           | Measurements (mm) |      |     |
|-----|--------------------------------------------------|-------------------|------|-----|
|     |                                                  | X                 | Y    | Z   |
| 1   | Left Rear Accelerometer – X Direction            | 1781              | -315 | 425 |
| 2   | Right Rear Accelerometer – X Direction           | 1784              | 310  | 435 |
| 3   | Engine Top X                                     | 3816              | 48   | 9   |
| 4   | Engine Bottom X                                  | 4329              | -23  | 628 |
| 5   | Left Rear Accelerometer – Z Direction            | 1781              | -315 | 425 |
| 6   | Right Rear Accelerometer – Z Direction           | 1784              | 310  | 435 |
| 7   | Left Rear Accelerometer – X Direction Redundant  | 1781              | -315 | 425 |
| 8   | Right Rear Accelerometer – X Direction Redundant | 1784              | 310  | 435 |

*Reference Points:*      *X – Rear Surface of Vehicle (+ forward)*  
                                 *Y – Vehicle Centerline (+ to right)*  
                                 *Z – Ground Plane (+ down)*

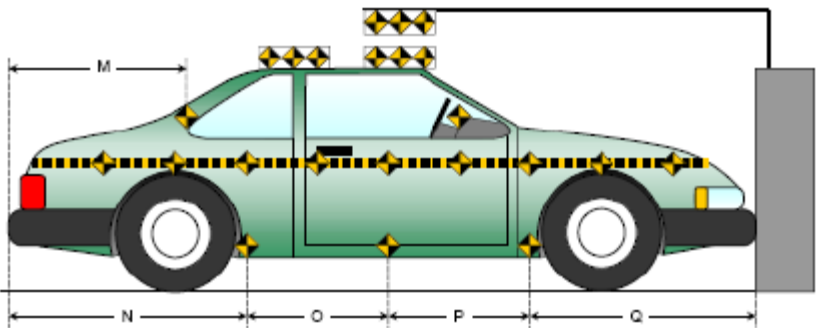
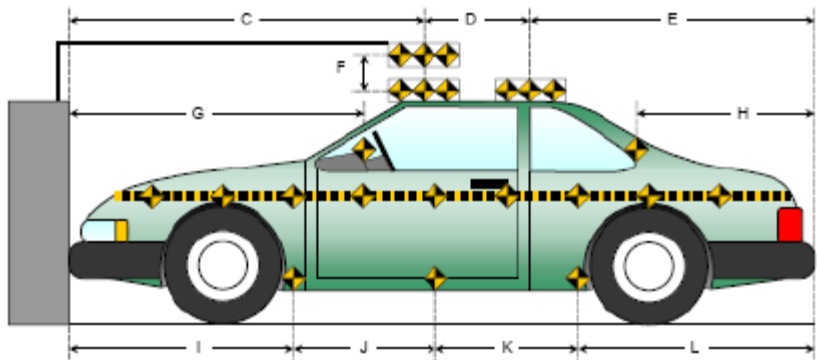
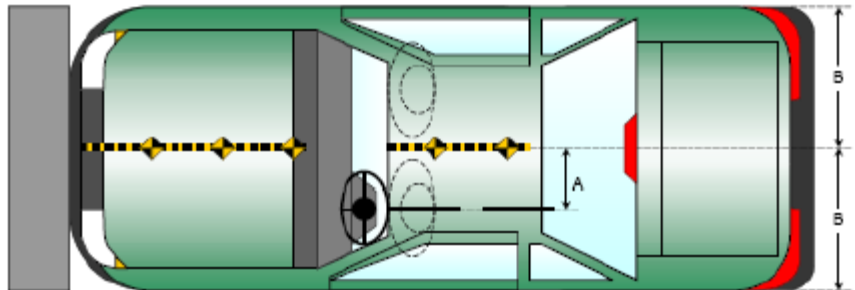
**DATA SHEET NO. 8**  
**PHOTOGRAPHIC REFERENCE TARGET LOCATIONS**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
 Test Date: 5/24/2022

| Item | Value |
|------|-------|
| A    | 380   |
| B    | 937   |
| C    | 2868  |
| D    | 610   |
| E    | 1157  |
| F    | 244   |
| G    | 1711  |
| H    | 1034  |
| I    | 1329  |
| J    | 1012  |
| K    | 1016  |
| L    | 1278  |
| M    | 1026  |
| N    | 1276  |
| O    | 1023  |
| P    | 1005  |
| Q    | 1331  |

All units in millimeters



**DATA SHEET NO. 9**  
**LOAD CELL LOCATIONS ON FIXED BARRIER**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
 Test Date: 5/24/2022

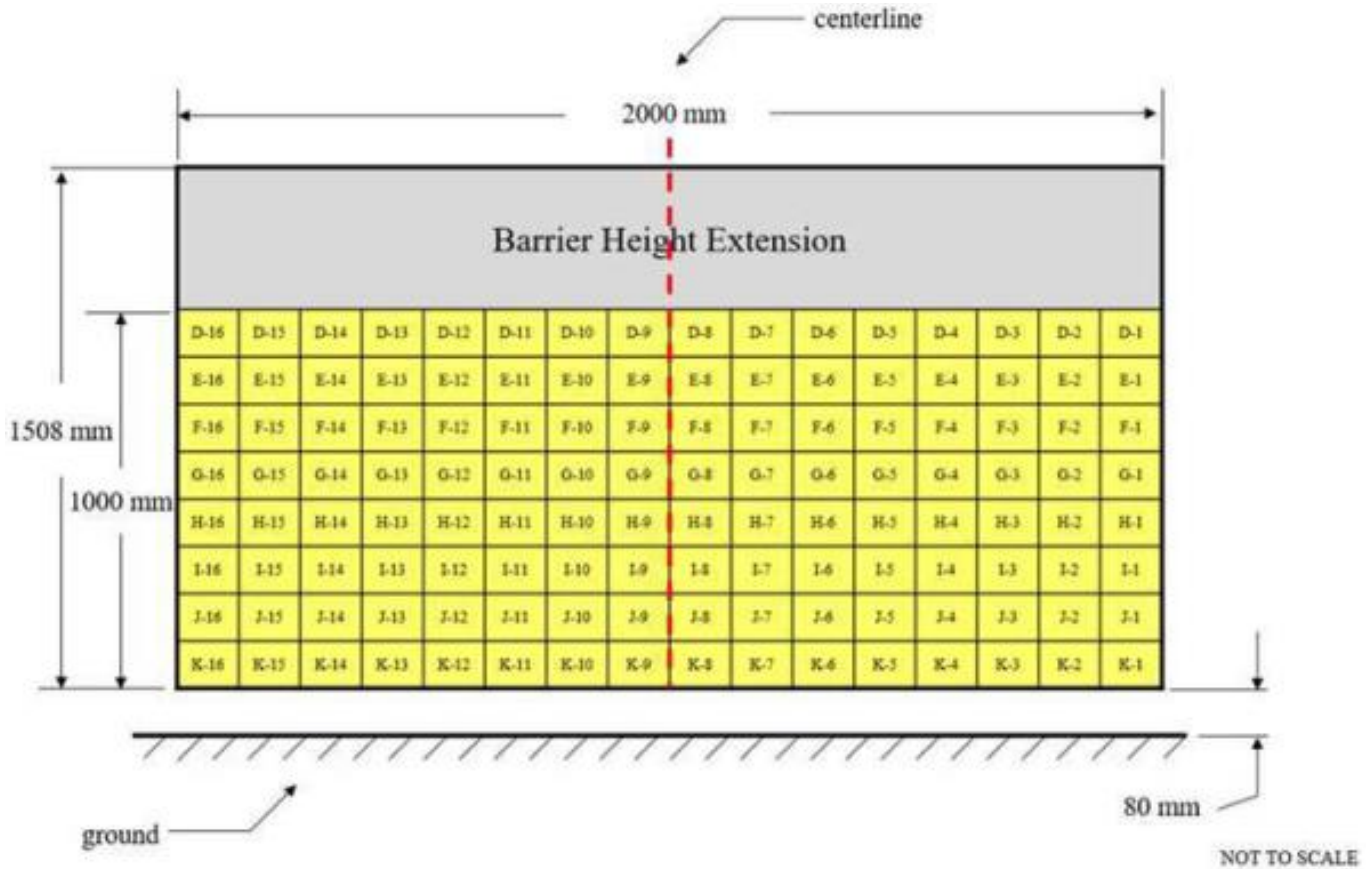


Figure 1 - Load Cell Locations on a 128-Load Cell Barrier with Plywood Height Extension\*  
 Please note above diagram is not actual representation of load cell barrier used.

**DATA SHEET NO. 10**  
**TEST VEHICLE SUMMARY OF RESULTS**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
Test Date: 5/24/2022

**INSTRUMENTATION**

| Instrumentation                  | Number of Channels Collected |
|----------------------------------|------------------------------|
| Driver Dummy Accelerometers      | 47                           |
| Passenger Dummy Accelerometers   | 47                           |
| Vehicle Structure Accelerometers | 8                            |
| Load Cell Barrier                | 384                          |
| <b>Total</b>                     | <b>486</b>                   |

**CAMERA COVERAGE**

| Type of Camera             | Number Used in this Test |
|----------------------------|--------------------------|
| High-Speed Vehicle Onboard | 2                        |
| High-Speed Offboard        | 14                       |
| Real-Time Panning          | 1                        |
| <b>Total</b>               | <b>17</b>                |

**DATA SHEET NO. 11  
POST-TEST OBSERVATIONS**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
Test Date: 5/24/2022

**TEST DUMMY INFORMATION AND CONTACT LOCATIONS**

| Description             | Driver                            | Passenger                          |
|-------------------------|-----------------------------------|------------------------------------|
| Dummy Type / Serial No. | P572E 50 <sup>th</sup> Male / 142 | P5720 5 <sup>th</sup> Female / 137 |
| Head Contact            | Frontal Airbag, Head Restraint    | Frontal Airbag, Head Restraint     |
| Upper Torso Contact     | Frontal Airbag                    | Frontal Airbag                     |
| Lower Torso Contact     | None                              | None                               |
| Left Knee Contact       | Knee Bolster                      | Glove Box                          |
| Right Knee Contact      | Knee Bolster                      | Glove Box                          |

**DOOR OPENING AND SEAT TRACK INFORMATION**

| Description                              | Driver               | Passenger            | Other                |
|------------------------------------------|----------------------|----------------------|----------------------|
| Locked / Unlocked Doors                  | Unlocked             | Unlocked             |                      |
| Front Door Opening                       | Closed & Operational | Closed & Operational |                      |
| Rear Door Opening                        | Closed & Operational | Closed & Operational |                      |
| Trunk/Hatch/Tailgate Opening             |                      |                      | Closed & Operational |
| Seat Track Shift (mm)                    | 0                    | 0                    |                      |
| Seat Back Movement from Initial Position | None                 | None                 |                      |

\*\*NOTE: Indicate "No", "N/A", or "Yes" described

**POST-TEST STRUCTURAL OBSERVATIONS**

| Critical Areas of Performance | Observations and Conclusions                                                                              |
|-------------------------------|-----------------------------------------------------------------------------------------------------------|
| Windshield Damage             | Cracked Throughout                                                                                        |
| Window Damage                 | None                                                                                                      |
| Other                         | Passenger Airbag had holes at the top right side with burns.<br>Passenger lap belt twisted up into dummy. |

**VEHICLE REBOUND FROM BARRIER**

| Measured Parameter | Units | Value |
|--------------------|-------|-------|
| Left Side          | mm    | 2391  |
| Center             | mm    | 2370  |
| Right Side         | mm    | 2360  |
| Average            | mm    | 2374  |

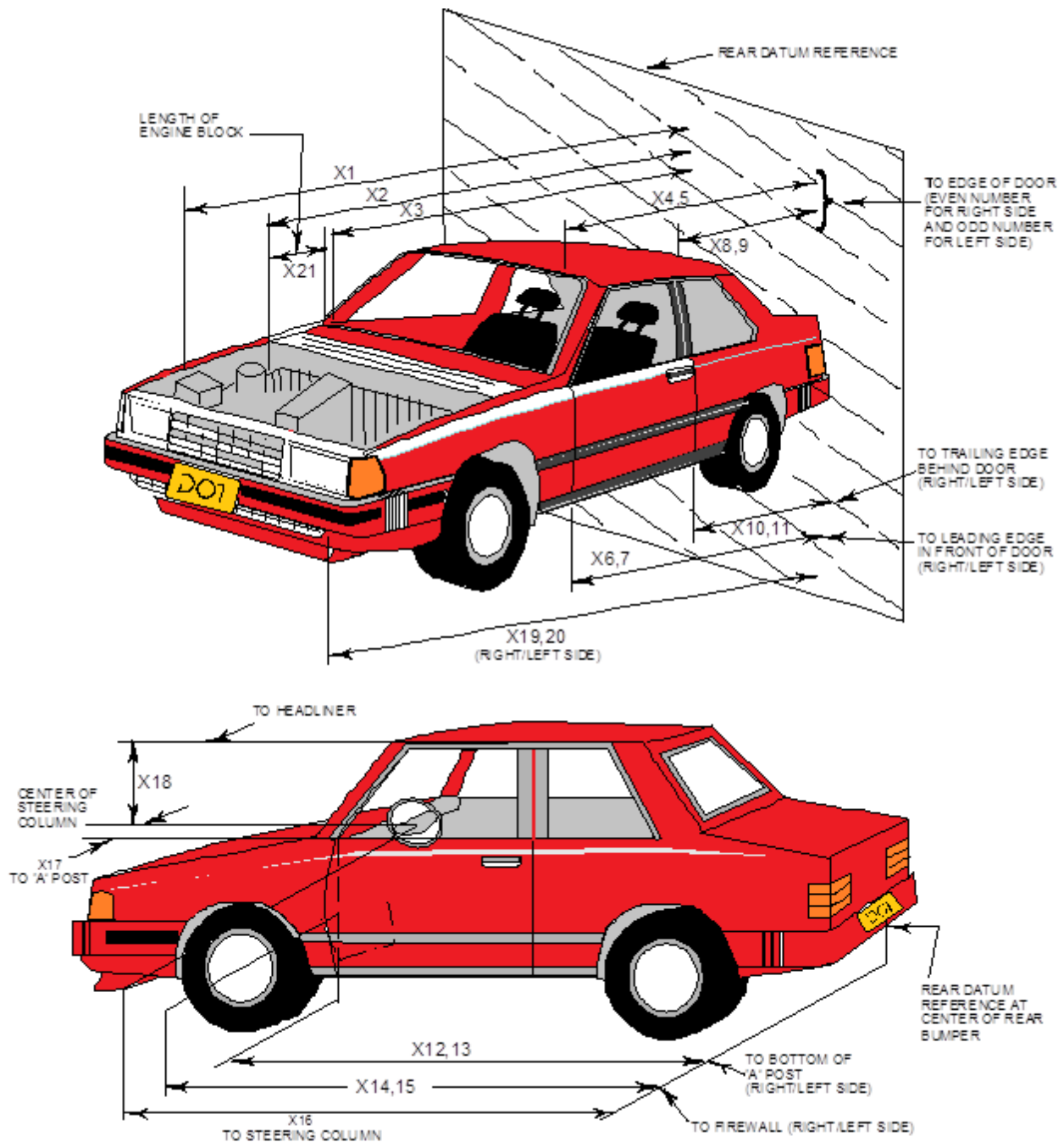
**SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION**

| Restraint Type                      | Driver    |          | Passenger |          |
|-------------------------------------|-----------|----------|-----------|----------|
|                                     | Installed | Deployed | Installed | Deployed |
| Front Airbag                        | Yes       | Yes      | Yes       | Yes      |
| Side Airbag 1 - Curtain             | Yes       | No       | Yes       | No       |
| Side Airbag 2 - Torso/Pelvis Airbag | Yes       | No       | Yes       | No       |
| Knee Airbag                         | No        | N/A      | No        | N/A      |
| Seat Belt Pretensioner              | Yes       | Yes      | Yes       | Yes      |
| Seat Belt Load Limiter              | Yes       | Yes      | Yes       | Yes      |
| Other                               |           |          |           |          |

# **DATA SHEET NO. 12** **VEHICLE PROFILE MEASUREMENTS**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
 Test Date: 5/24/2022



**DATA SHEET NO. 12 ... (CONTINUED)**  
**VEHICLE PROFILE MEASUREMENTS**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
 Test Date: 5/24/2022

| No. | Measurement Description                           | Pre-Test | Post-Test | Difference |
|-----|---------------------------------------------------|----------|-----------|------------|
| 1   | Total Length of Vehicle at Centerline             | 4635     | 4002      | -633       |
| 2   | Rear Surface of Vehicle (RSOV) to Front of Engine | 4016     | 3753      | -263       |
| 3   | RSOV to Firewall                                  | 3708     | 3671      | -37        |
| 4   | RSOV to Upper Leading Edge of Right Door          | 3237     | 3237      | 0          |
| 5   | RSOV to Upper Leading Edge of Left Door           | 3236     | 3237      | 1          |
| 6   | RSOV to Lower Leading Edge of Right Door          | 3238     | 3234      | -4         |
| 7   | RSOV to Lower Leading Edge of Left Door           | 3237     | 3234      | -3         |
| 8   | RSOV to Upper Trailing Edge of Right Door         | 2087     | 2088      | 1          |
| 9   | RSOV to Upper Trailing Edge of Left Door          | 2086     | 2088      | 2          |
| 10  | RSOV to Lower Trailing Edge of Right Door         | 2115     | 2114      | -1         |
| 11  | RSOV to Lower Trailing Edge of Left Door          | 2114     | 2113      | -1         |
| 12  | RSOV to Bottom of "A" Post of Right Side          | 3342     | 3340      | -2         |
| 13  | RSOV to Bottom of "A" Post of Left Side           | 3343     | 3341      | -2         |
| 14  | RSOV to Firewall, Right Side                      | 3573     | 3569      | -4         |
| 15  | RSOV to Firewall, Left Side                       | 3578     | 3568      | -10        |
| 16  | RSOV to Steering Column                           | 2758     | 2759      | 1          |
| 17  | Center of Steering Column to "A" Post             | 315      | 288       | -27        |
| 18  | Center of Steering Column to Headliner            | 418      | 418       | 0          |
| 19  | RSOV to Right Side of Front Bumper                | 4591     | 4064      | -527       |
| 20  | RSOV to Left Side of Front Bumper                 | 4590     | 4026      | -564       |
| 21  | Length of Engine Block                            | 211      | 211       | 0          |
| RD  | RSOV to Right Side of Dash Panel                  | 3055     | 3057      | 2          |
| CD  | RSOV to Center of Dash Panel                      | 2903     | 2883      | -20        |
| LD  | RSOV to Left Side of Dash Panel                   | 3052     | 3051      | -1         |

\*UR= Unrecoverable data point  
 All Dimensions in mm

**DATA SHEET NO. 13**  
**ACCIDENT INVESTIGATION DIVISION DATA**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
Test Date: 5/24/2022

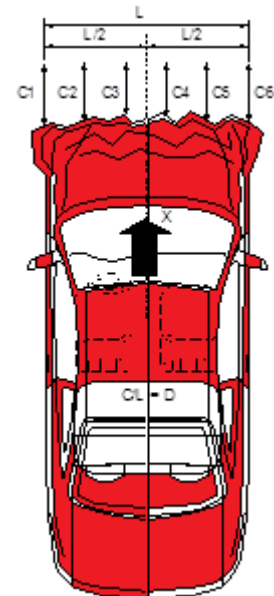
**VEHICLE INFORMATION**

VIN: KM8KMDAF0NU084145  
Vehicle Size Category: MPV

Wheelbase (mm): 3005  
Test Weight (kg): 2248

**ACCELEROMETER DATA**

Accelerometer Locations: Please See Data Sheet No. 7  
Cal. Procedure / Interval: Calspan Procedure / 6 month  
Integration Algorithm: Trapezoidal  
Linearity: > 99%  
Impact Velocity (km/h): 56.39  
Velocity Change (km/h): 69.79  
Time of Separation (ms): 146.6



**CRUSH PROFILE**

Collision Deformation Classification: 12FDEW3  
Midpoint of Damage: C3  
Damage Region Length (mm): 1567  
Impact Mode: Frontal

| No. | Measurement Description    | Units | Pre-Test | Post-Test | Difference |
|-----|----------------------------|-------|----------|-----------|------------|
| C1  | Crush Zone 1 at Left Side  | mm    | 4457     | 4117      | 340        |
| C2  | Crush Zone 2 at Left Side  | mm    | 4585     | 4112      | 473        |
| C3  | Crush Zone 3 at Left Side  | mm    | 4624     | 4056      | 568        |
| C4  | Crush Zone 4 at Right Side | mm    | 4624     | 4067      | 557        |
| C5  | Crush Zone 5 at Right Side | mm    | 4586     | 4093      | 493        |
| C6  | Crush Zone 6 at Right Side | mm    | 4457     | 4064      | 393        |
| L   | C1 to C6                   | mm    | 1532     | 1567      | -35        |



**DATA SHEET NO. 14**  
**VEHICLE INTRUSION MEASUREMENTS**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
Test Program: NCAP Frontal Barrier Impact Test

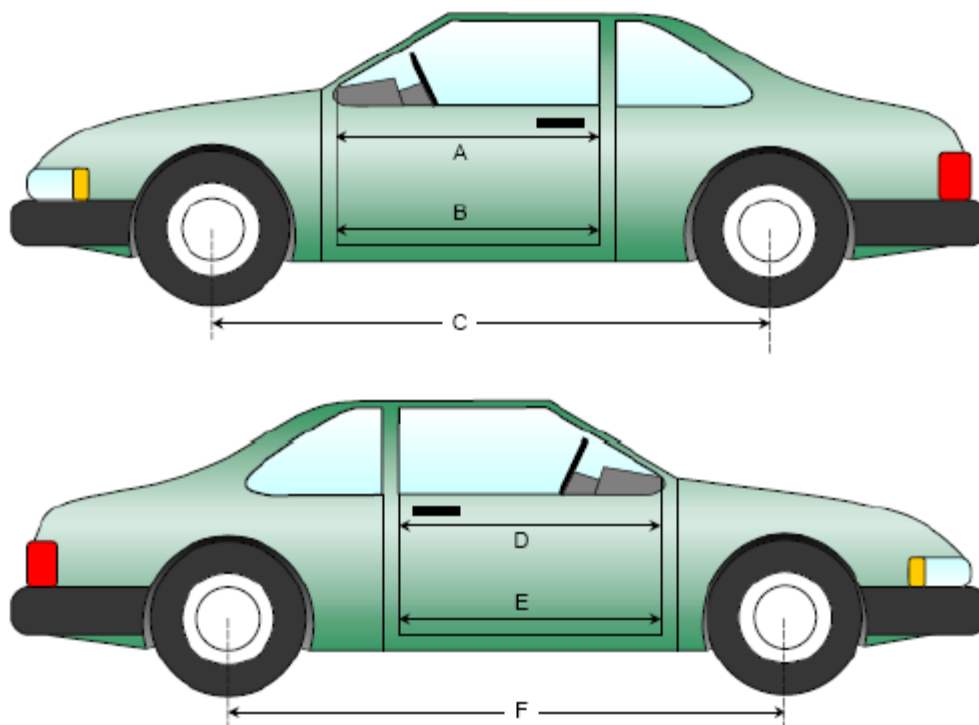
NHTSA No.: M20224200  
Test Date: 5/24/2022

**DOOR OPENING WIDTH**

| Item | Description      | Units | Pre-Test | Post-Test | Difference |
|------|------------------|-------|----------|-----------|------------|
| A    | Left Side Upper  | mm    | 1046     | 1046      | 0          |
| B    | Left Side Lower  | mm    | 893      | 893       | 0          |
| D    | Right Side Upper | mm    | 1048     | 1047      | -1         |
| E    | Right Side Lower | mm    | 902      | 902       | 0          |

**WHEELBASE MEASUREMENTS**

| Item | Description          | Units | Pre-Test | Post-Test | Difference |
|------|----------------------|-------|----------|-----------|------------|
| C    | Left Side Wheelbase  | mm    | 3005     | 2915      | -90        |
| F    | Right Side Wheelbase | mm    | 3005     | 2895      | -110       |



**Left & Right Side Views**

**DATA SHEET NO.14 ... (CONTINUED)**  
**VEHICLE INTRUSION MEASUREMENTS**

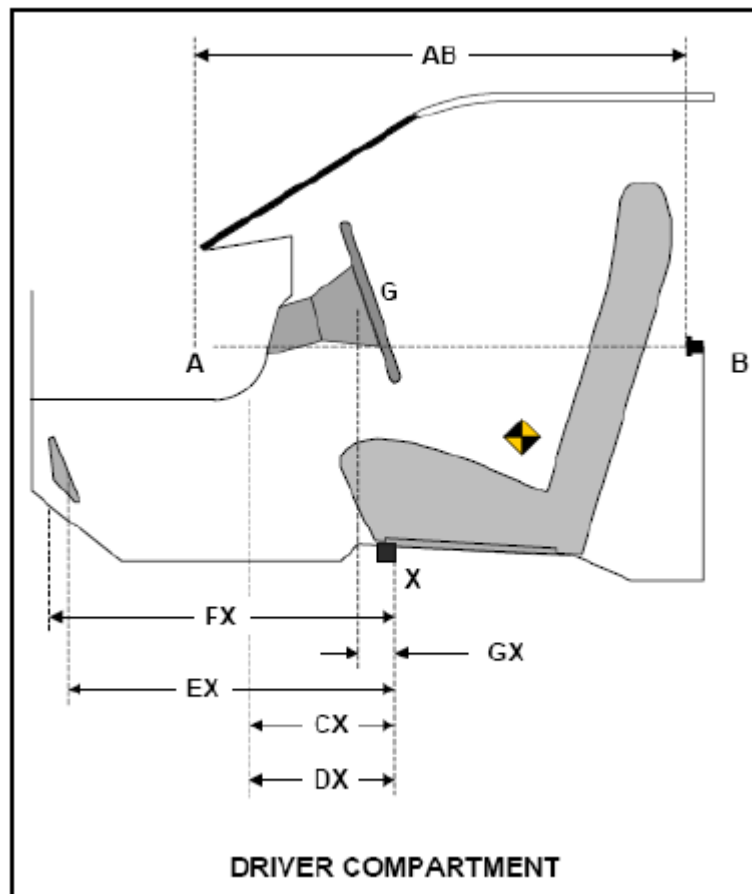
Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
 Test Date: 5/24/2022

**DRIVER COMPARTMENT INTRUSION**

| Item | Description                              | Units | Pre-Test | Post-Test | Difference |
|------|------------------------------------------|-------|----------|-----------|------------|
| AB   | Door Opening (Inside Window Jam)         | mm    | 825      | 825       | 0          |
| CX   | Left Knee Bolster to X                   | mm    | 309      | 294       | -15        |
| DX   | Right Knee Bolster to X                  | mm    | 305      | 270       | -35        |
| EX   | Brake Pedal to X                         | mm    | 554      | 452       | -102       |
| FX   | Foot Rest to X                           | mm    | 579      | 535       | -44        |
| GX   | Center of Steering Column Wheel Hub to X | mm    | 57       | 57        | 0          |

*X = Front of Seat Track (Stationary)*



**DATA SHEET NO. 15**  
**SUMMARY OF FMVSS 212, 219 (PARTIAL), AND 301 DATA**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
 Test Date: 5/24/2022

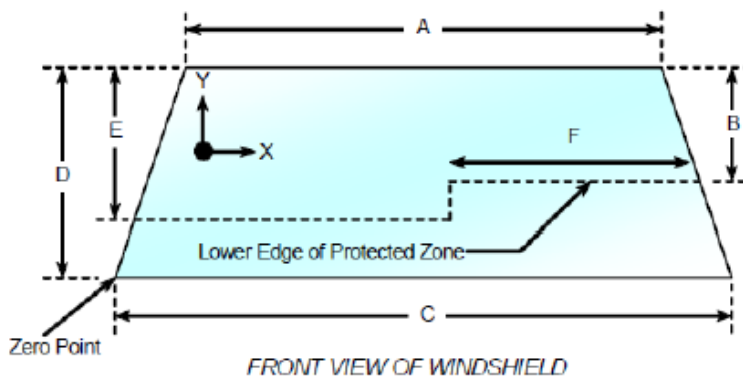
**Windshield Mounting Details:** A 0.8 mm trim surrounds the top and side of windshield while a plastic shroud is on the bottom.

*The standard requires that the post-test retention measurement be a minimum of 75% of the pre-test total periphery measurement for vehicles not equipped with occupant passive restraints and 50% for each side of the windshield for vehicles which are equipped with occupant passive restraints.*

**Temperature of windshield molding during test:** 21° C

**WINDSHIELD PERIPHERY MEASUREMENTS**

| Measurement | Pre-Test (mm) | Post-Test (mm) | % Retention |
|-------------|---------------|----------------|-------------|
| Left Side   | 2326          | 2098           | 90.2        |
| Right Side  | 2325          | 2256           | 97.0        |
| Total       | 4651          | 4354           | 93.6        |



| Item | Units | Value |
|------|-------|-------|
| A    | mm    | 1291  |
| B    | mm    | 506   |
| C    | mm    | 1689  |
| D    | mm    | 837   |
| E    | mm    | 520   |
| F    | mm    | 571   |

**AREAS OF PROTECTED ZONE FAILURES**

A. *Provide coordinates of the area that the protected zone was penetrated more than .25 inches by a vehicle component other than one that is normally in contact with the windshield.*

- No Penetration

| X | Y |
|---|---|
|   |   |
|   |   |
|   |   |
|   |   |

B. *Provide coordinates of the area beneath the protected zone that the inner surface of the windshield was penetrated by a vehicle component.*

- No Penetration

| X | Y |
|---|---|
|   |   |
|   |   |
|   |   |
|   |   |

**DATA SHEET NO. 15 ... (CONTINUED)**  
**SUMMARY OF FMVSS 212, 219 (PARTIAL), AND 301 DATA**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
Test Date: 5/24/2022

**FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA**

Temperature at Time of Impact: 21 ° C

Test Time: 11:30 AM

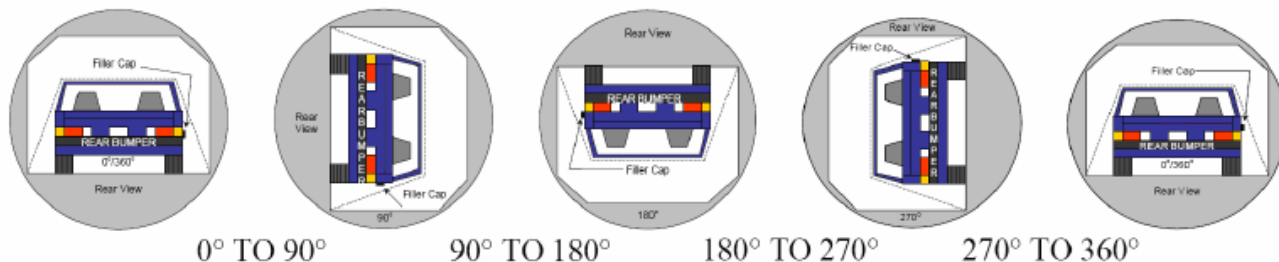
**STODDARD SOLVENT SPILLAGE MEASUREMENTS**

- A. From impact until vehicle motion ceases: 0 oz.  
(Maximum allowable is 1 oz.)
- B. For the 5-minute period after motion ceases: 0 oz.  
(Maximum allowable is 5 oz.)
- C. For the following 25 minutes: 0 oz.  
(Maximum allowable is 1 oz./minute)
- D. Spillage: No Spillage Occurred

**DATA SHEET NO. 16**  
**FMVSS 301 STATIC ROLLOVER RESULTS**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
 Test Date: 5/24/2022



1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.
2. The position hold time at each position is 300 seconds (minimum).
3. Details of Stoddard Solvent Spillage: No Spillage Occurred

**SOLVENT COLLECTION TIME TABLE IN SECONDS**

| Test Phase   | Rotation Time | Hold Time | Total Time |
|--------------|---------------|-----------|------------|
| 0° to 90°    | 70            | 300       | 370        |
| 90° to 180°  | 64            | 300       | 364        |
| 180° to 270° | 61            | 300       | 361        |
| 270° to 360° | 70            | 300       | 370        |

**FMVSS 301 SPILLAGE TABLE**

| Test Phase   | First 5 Minutes | Sixth Minute | Seventh Minute | Eighth Minute |
|--------------|-----------------|--------------|----------------|---------------|
| 0° to 90°    | 0               | 0            | 0              |               |
| 90° to 180°  | 0               | 0            | 0              |               |
| 180° to 270° | 0               | 0            | 0              |               |
| 270° to 360° | 0               | 0            | 0              |               |

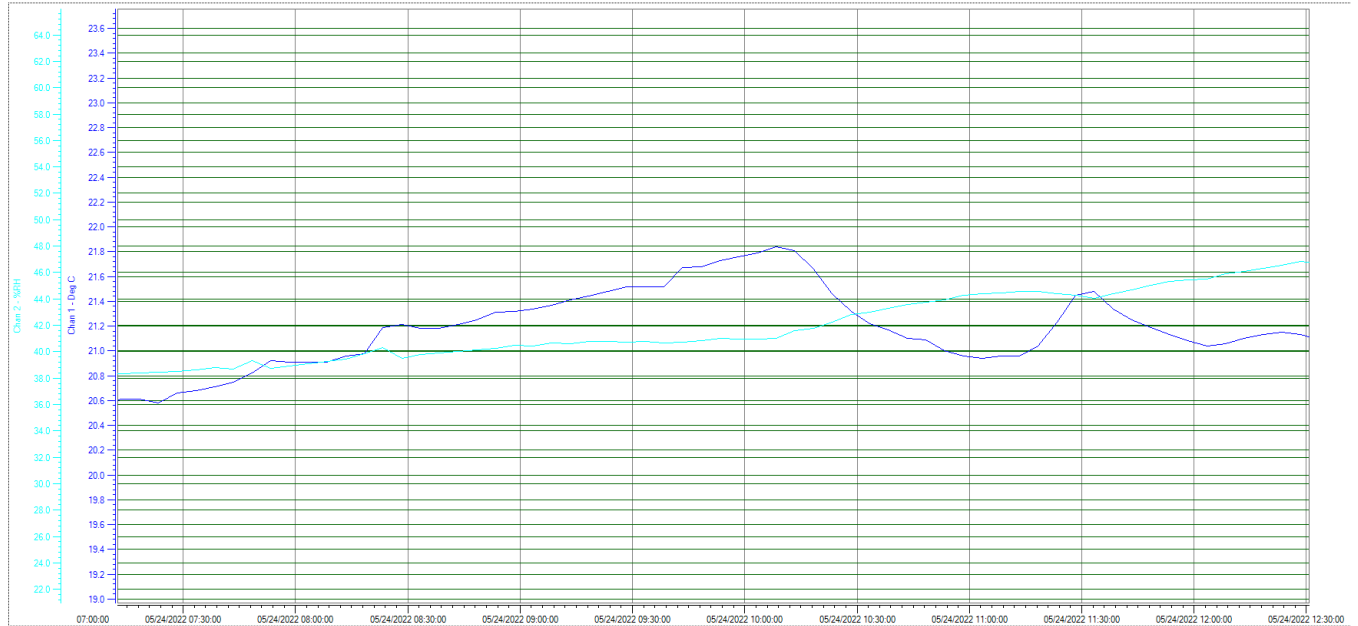
**SOLVENT SPILLAGE LOCATION TABLE**

| Test Phase   | Spillage Location |
|--------------|-------------------|
| 0° to 90°    | None              |
| 90° to 180°  | None              |
| 180° to 270° | None              |
| 270° to 360° | None              |

**DATA SHEET NO. 17**  
**DUMMY / VEHICLE TEMPERATURE STABILIZATION CHART**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
Test Date: 5/24/2022



***Temperature and Humidity Stabilization Chart/Data for Dummies and Test Vehicle***

**DATA SHEET NO. 305-1**  
**GENERAL TEST AND VEHICLE PARAMETER DATA FOR INDICANT FMVSS NO. 305 TESTING**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
 Test Date: 5/24/2022

**ELECTRIC VEHICLE PROPULSION SYSTEM**

| Measured Parameter                                                                | Value                                    |
|-----------------------------------------------------------------------------------|------------------------------------------|
| Type of Electric Vehicle (Electric/Gas-Electric Hybrid/Fuel Cell-Electric Hybrid) | Electric                                 |
| Propulsion Battery Type                                                           | Lithium-ion Polymer                      |
| Nominal Voltage (Volts)                                                           | 697                                      |
| Is this Vehicle equipped with an Automatic Propulsion Battery Disconnect?         | Yes                                      |
| Physical Location of Automatic Propulsion Battery Disconnect, if applicable       | Inside of propulsion battery (Rear side) |
| Auxiliary Battery Type                                                            | Lead-acid battery                        |

**PROPULSION BATTERY SYSTEM DATA (COTR SUPPLIED)**

| Measured Parameter                                                          | Value                                          |
|-----------------------------------------------------------------------------|------------------------------------------------|
| Electrolyte Fluid Type                                                      | Liquid solution, LiPF6 salt, Carbonate solvent |
| Electrolyte Fluid Specific Gravity                                          | 1.19 g/cm3                                     |
| Electrolyte Fluid Kinematic Viscosity (centistokes)                         | 2~3 cP @ 25°C                                  |
| Electrolyte Fluid Color                                                     | Transparent & Pale Yellow                      |
| Propulsion Battery Coolant Type, Color and Specific Gravity (if applicable) | Applied (Water-cooled type), Blue              |
| Location of Battery Modules (Inside or Outside of Passenger Compartment?)   | Outside Passenger Compartment                  |

**PROPULSION BATTERY STATE OF CHARGE**

| Measured Parameter                                                                                                                                           | Units | Value |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|
| <i>For all battery types:</i><br>Voltage Range corresponding to <b>useable energy</b> of the battery:                                                        |       |       |
| Minimum State of Charge                                                                                                                                      | V     | 480   |
| Maximum State of Charge                                                                                                                                      | V     | 826   |
| 95% of Maximum                                                                                                                                               | V     | 784.7 |
| Test Voltage *                                                                                                                                               | V     | 792   |
| <i>For batteries that are rechargeable ONLY by an energy source on the vehicle:</i><br>Voltage range corresponding to <b>useable energy</b> of the battery : |       |       |
| Minimum State of Charge                                                                                                                                      | V     |       |
| Maximum State of Charge                                                                                                                                      | V     |       |
| 95% of Maximum                                                                                                                                               | V     |       |
| Test Voltage *                                                                                                                                               | V     |       |

\* For all battery types-No less than 95% of Maximum Operating Voltage; for batteries that are rechargeable ONLY by an energy source on the vehicle-maximum practicable state of charge within normal operating range.

**DATA SHEET NO. 305-2**  
**PRE-IMPACT DATA FOR INDICANT FMVSS NO. 305 TESTING**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
Test Date: 5/24/2022

**VEHICLE CHASSIS GROUND PT(S) LOCATION(S) & PROPULSION BATTERY SYSTEM**

| Measured Parameter                                   | Value                                                                                                                             |
|------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Details of Vehicle Chassis Ground Points & Locations | Located at the rear of vehicle battery underneath vehicle                                                                         |
| Details of Propulsion Battery Components             | HV battery main cable is located at the rear side of the battery and is where the leads will be attached to read battery voltage. |



**DATA SHEET NO. 305-3**  
**PRE-IMPACT ELECTRICAL ISOLATION MEASUREMENTS AND CALCULATIONS FOR**  
**INDICANT FMVSS NO. 305 TESTING**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
 Test Date: 5/24/2022

**VOLTMETER INFORMATION**

| Measured Parameter       | Units | Value      |
|--------------------------|-------|------------|
| Make & Model             |       | Fluke 1587 |
| Serial No.               |       | 58100115   |
| Internal Impedance Value | MΩ    | 10         |
| Resolution               | V     | 0.001      |
| Last Calibration Date    |       | 4/28/2022  |

**NOTES:**

- The voltmeter used in this test shall measure DC values and have an internal impedance of at least 10 MΩ
- An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles.

**PROPULSION BATTERY VOLTAGE, RESISTANCE &  
ELECTRICAL ISOLATION MEASUREMENTS & CALCULATIONS**

| Measured Parameter                                           | Symbol    | Units | Value     |
|--------------------------------------------------------------|-----------|-------|-----------|
| Normal operating voltage range specified by the manufacturer | $V_b$     | V     | 480 - 826 |
| Propulsion Battery Voltage : (ready to drive position)       | $V_b$     | V     | 792       |
| Propulsion Battery to Vehicle Chassis                        | $V_1$     | V     | 496       |
| Propulsion Battery to Vehicle Chassis                        | $V_2$     | V     | 413       |
| Propulsion Battery to Vehicle Chassis Across Known Resistor  | $R_o$     | Ω     | 403,000   |
| Propulsion Battery to Vehicle Chassis with $R_o$ installed   | $V_1'$    | V     | 72.4      |
| Propulsion Battery to Vehicle Chassis with $R_o$ installed   | $V_2'$    | V     | 72.5      |
| $R_{i1} = R_o * (1 + V_2/V_1) * [(V_1 - V_1')/V_1']$         | $R_{i1}$  | Ω     | 4,321,203 |
| $R_{i2} = R_o * (1 + V_1/V_2) * [(V_2 - V_2')/V_2']$         | $R_{i2}$  | Ω     | 4,165,796 |
| Lesser value of $R_{i1}$ and $R_{i2}$                        | $R_i$     | Ω     | 4,165,796 |
| Electrical Isolation Value (Minimum E.I. Value is 500 Ω/V)   | $R_i/V_b$ | Ω/V   | 5,260     |

Is the Electrical Isolation Value  $\geq 500 \Omega/V$  (Yes/No)? X Yes  No (Fail)

**NOTES:**

- The measurement shall be made with the propulsion battery connected to the vehicle propulsion system, and the vehicle in the "ready-to-drive" (propulsion motor(s) activated) position.
- If the voltage measurement is not at the voltage or within the normal operating voltage range specified by the manufacturer, the battery must be charged.
- The known resistance  $R_o$  (in Ohms) should be approximately 500 times the nominal operating voltage of the vehicle (in volts) per SAE J1766
- If measured voltage is zero and results in a division by zero, record "Zero Volts." This "zero voltage" condition is considered as being compliant

**DATA SHEET NO. 305-4**  
**POST-IMPACT DATA FOR INDICANT FMVSS NO. 305 TESTING**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
 Test Date: 5/24/2022

**VOLTMETER INFORMATION**

| Measured Parameter                           | Units | Value      |
|----------------------------------------------|-------|------------|
| Make & Model                                 |       | Fluke 1587 |
| Serial No.                                   |       | 58100115   |
| Internal Impedance Value                     | MΩ    | 10         |
| Propulsion Battery Voltage (V <sub>b</sub> ) | V     | 0.33       |

**NOTES:**

- The voltmeter used in this test shall measure DC values and have an internal impedance of at least 10 MΩ
- An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles.

**ELECTRICAL ISOLATION MEASUREMENTS & IMPACT CALCULATIONS**

| Parameter                        | Value     | Units |       | Value |         | Value |         |
|----------------------------------|-----------|-------|-------|-------|---------|-------|---------|
| V <sub>1</sub> =                 | 2.85      | V     | Time: | 4     | Minutes | 10    | Seconds |
| V <sub>2</sub> =                 | 2.61      | V     | Time: | 4     | Minutes | 22    | Seconds |
| R <sub>0</sub> =                 | 403,000   | Ω     | Time: |       | Minutes |       | Seconds |
| V <sub>1</sub> ' =               | 1.14      | V     | Time: | 4     | Minutes | 25    | Seconds |
| V <sub>2</sub> ' =               | 0.36      | V     | Time: | 4     | Minutes | 30    | Seconds |
| R <sub>i1</sub> =                | 1,158,095 | Ω     | Time: | 4     | Minutes | 25    | Seconds |
| R <sub>i2</sub> =                | 5,269,109 | Ω     | Time: | 4     | Minutes | 30    | Seconds |
| R <sub>i</sub> =                 | 1,158,095 | Ω     | Time: | 4     | Minutes | 25    | Seconds |
| R <sub>i</sub> /V <sub>b</sub> = | 3,509,378 | Ω/V   | Time: | 4     | Minutes | 25    | Seconds |

Is the Electrical Isolation Value ≥ 500 Ω/V (Yes/No)? X Yes  No (Fail)

**NOTES:**

- $R_{i1} = R_0 * (1 + V_2/V_1) * [(V_1 - V_1')/V_1]$ ,  $R_{i2} = R_0 * (1 + V_1/V_2) * [(V_2 - V_2')/V_2]$ ,  $R_i$  = Lesser value of  $R_{i1}$  and  $R_{i2}$
- If measured voltage is zero and results in a division by zero, record "Zero Volts." This "zero voltage" condition is considered as being compliant
- Minimum Electrical Isolation Value is 500 Ω/V

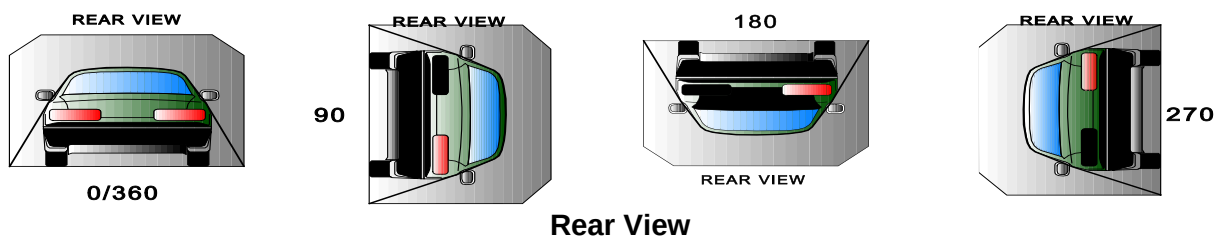
**PROPULSION BATTERY SYSTEM COMPONENTS**

| Measured Parameter                                                                  | Comments | Passed | Failed |
|-------------------------------------------------------------------------------------|----------|--------|--------|
| Propulsion Battery Module movement within the passenger compartment                 | None     | X      |        |
| Intrusion of an outside Propulsion Battery Component into the passenger compartment | None     | X      |        |
| Is propulsion battery electrolyte spillage visible in the passenger compartment?    |          | X      |        |

**DATA SHEET NO. 305-5**  
**STATIC ROLLOVER TEST DATA FOR INDICANT FMVSS NO. 305 TESTING**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
 Test Date: 5/24/2022



**DETERMINATION OF PROPULSION BATTERY ELECTROLYTE COLLECTION TIME PERIOD**

| Rollover Stage | Rotation Time (spec. 1 -3 min) |         | FMVSS 301 Hold Time | Total Time |         | Next Whole Minute Interval |
|----------------|--------------------------------|---------|---------------------|------------|---------|----------------------------|
|                | Minutes                        | Seconds |                     | Minutes    | Seconds |                            |
| 0° to 90°      | 1                              | 10      | 5                   | 6          | 10      | 7                          |
| 90° to 180°    | 1                              | 4       | 5                   | 6          | 4       | 7                          |
| 180° to 270°   | 1                              | 1       | 5                   | 6          | 1       | 7                          |
| 270° to 360°   | 1                              | 10      | 5                   | 6          | 10      | 7                          |

**ACTUAL TEST VEHICLE PROPULSION BATTERY ELECTROLYTE SPILLAGE**

| Rollover Stage        | Propulsion Battery Electrolyte Spillage | Units         | Spillage Location |
|-----------------------|-----------------------------------------|---------------|-------------------|
| 0° to 90°             | 0.0                                     | Liters        | None              |
| 90° to 180°           | 0.0                                     | Liters        | None              |
| 180° to 270°          | 0.0                                     | Liters        | None              |
| 270° to 360°          | 0.0                                     | Liters        | None              |
| <b>Total Spillage</b> | <b>0.0</b>                              | <b>Liters</b> | <b>None</b>       |

\* FMVSS 305 Requirements: Maximum allowable propulsion battery electrolyte spillage is **5.0 Liters**

Is the total spillage of propulsion battery electrolyte greater than 5.0 Liters? ☐ Yes (Fail) ☒ No  
 Is propulsion battery electrolyte spillage visible in the passenger compartment? ☐ Yes (Fail) ☒ No

**VOLTMETER INFORMATION**

| Measured Parameter                           | Units | Value      |
|----------------------------------------------|-------|------------|
| Make & Model                                 |       | Fluke 1587 |
| Serial No.                                   |       | 58100115   |
| Internal Impedance Value                     | MΩ    | 10         |
| Propulsion Battery Voltage (V <sub>b</sub> ) | V     | Zero Volts |

**NOTES:**

- The voltmeter used in this test shall measure DC values and have an internal impedance of at least 10 MΩ
- An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles.

**DATA SHEET NO. 305-5**  
**STATIC ROLLOVER TEST DATA FOR INDICANT FMVSS NO. 305 TESTING (CONT'D)**

Test Vehicle: 2022 Hyundai Ioniq 5 SE SUV  
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20224200  
 Test Date: 5/24/2022

**ELECTRICAL ISOLATION MEASUREMENTS & CALCULATIONS**

| Parameter   | Rollover Stage | Value      | Units      |       | Minutes | Seconds |
|-------------|----------------|------------|------------|-------|---------|---------|
| $V_1 =$     | 90°            | 0.01       | V          | Time: | 1       | 20      |
|             | 180°           | 0.02       | V          |       | 9       | 7       |
|             | 270°           | 0.02       | V          |       | 15      | 33      |
|             | 360°           | 0.02       | V          |       | 22      | 45      |
| $V_2 =$     | 90°            | 0.01       | V          | Time: | 1       | 25      |
|             | 180°           | 0.02       | V          |       | 9       | 13      |
|             | 270°           | 0.02       | V          |       | 15      | 37      |
|             | 360°           | 0.02       | V          |       | 22      | 50      |
| $V_1' =$    | 90°            | Zero Volts | V          | Time: | 1       | 31      |
|             | 180°           | Zero Volts | V          |       | 9       | 17      |
|             | 270°           | Zero Volts | V          |       | 15      | 43      |
|             | 360°           | Zero Volts | V          |       | 22      | 54      |
| $V_2' =$    | 90°            | Zero Volts | V          | Time: | 1       | 34      |
|             | 180°           | Zero Volts | V          |       | 9       | 21      |
|             | 270°           | Zero Volts | V          |       | 15      | 48      |
|             | 360°           | Zero Volts | V          |       | 23      | 0       |
| $R_{i1} =$  | 90°            | Zero Volts | $\Omega$   | Time: | 1       | 31      |
|             | 180°           | Zero Volts | $\Omega$   |       | 9       | 17      |
|             | 270°           | Zero Volts | $\Omega$   |       | 15      | 43      |
|             | 360°           | Zero Volts | $\Omega$   |       | 22      | 54      |
| $R_{i2} =$  | 90°            | Zero Volts | $\Omega$   | Time: | 1       | 34      |
|             | 180°           | Zero Volts | $\Omega$   |       | 9       | 21      |
|             | 270°           | Zero Volts | $\Omega$   |       | 15      | 48      |
|             | 360°           | Zero Volts | $\Omega$   |       | 23      | 0       |
| $R_i =$     | 90°            | Zero Volts | $\Omega$   | Time: | 1       | 31      |
|             | 180°           | Zero Volts | $\Omega$   |       | 9       | 21      |
|             | 270°           | Zero Volts | $\Omega$   |       | 15      | 48      |
|             | 360°           | Zero Volts | $\Omega$   |       | 23      | 0       |
| $R_i/V_b =$ | 90°            | Zero Volts | $\Omega/V$ | Time: | 9       | 17      |
|             | 180°           | Zero Volts | $\Omega/V$ |       | 9       | 21      |
|             | 270°           | Zero Volts | $\Omega/V$ |       | 15      | 48      |
|             | 360°           | Zero Volts | $\Omega/V$ |       | 1       | 34      |

Is the Electrical Isolation Value  $\geq 500 \Omega/V$  (Yes/No)?



Yes



No (Fail)

**APPENDIX A**  
**PHOTOGRAPHS**

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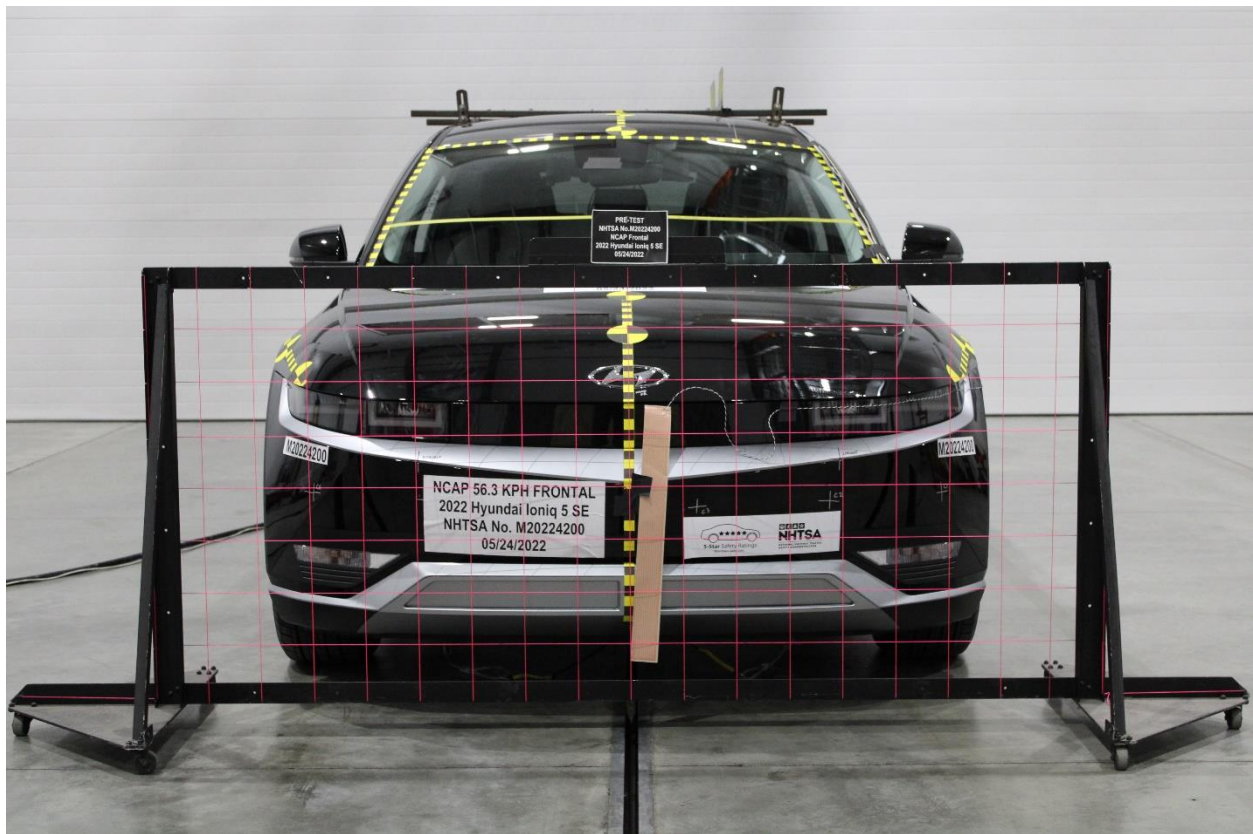
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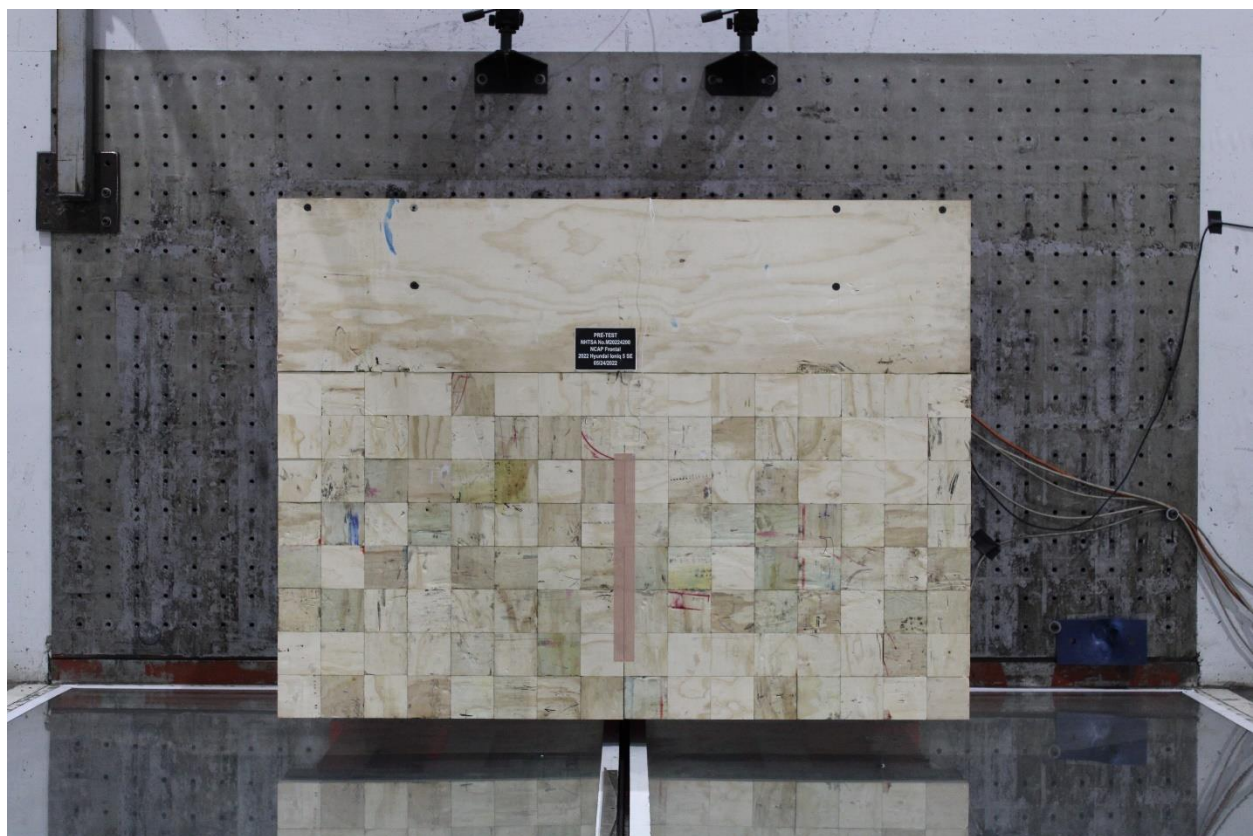


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<sup>1</sup>**NOTE:** *The underbody views should include the following vehicle components: fuel pump, fuel lines, sender unit, fuel tank filler pipe and any other visible system components.*



**Figure A-1: Load Cell Location**



**Figure A-2: Pre-Test Load Cell Wall**





Figure A-3: Post-Test Load Cell Wall



Figure A-4: Manufacturer's Label



M20224200

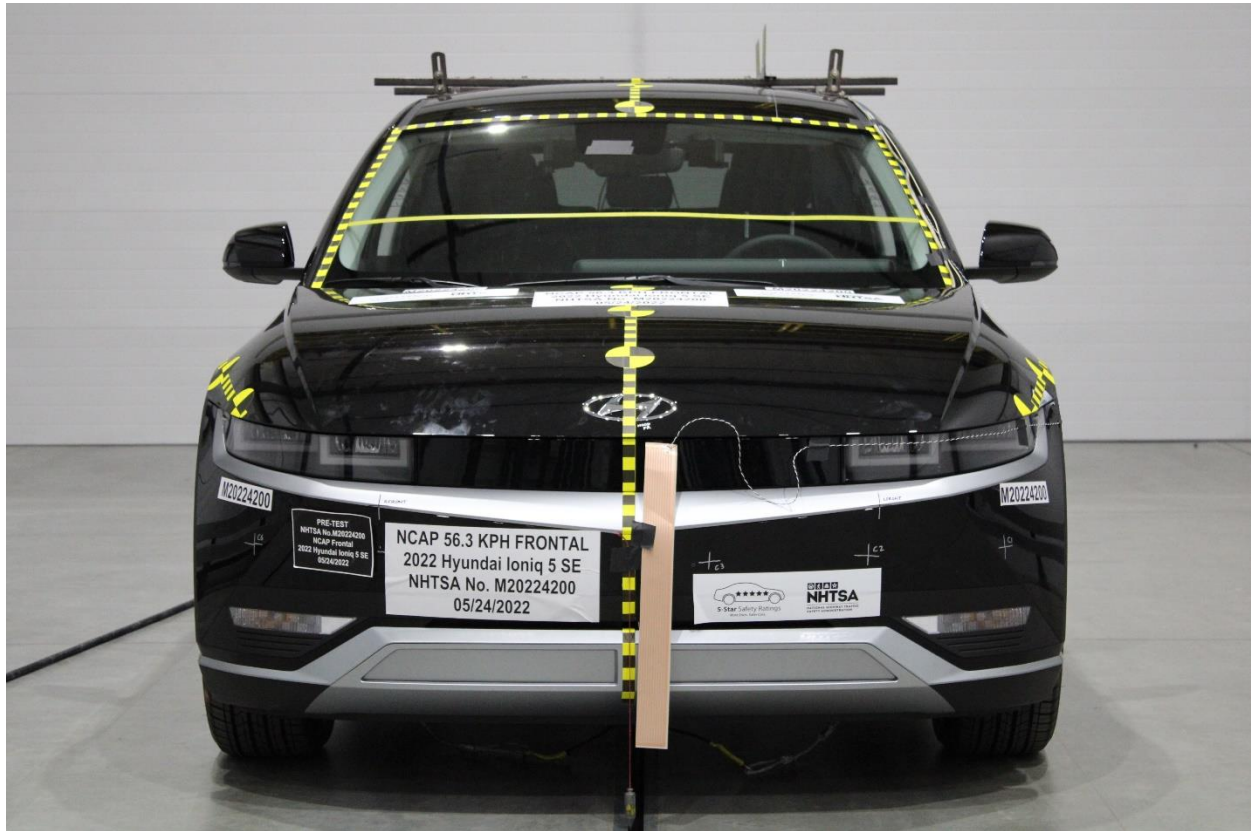


Figure A-5: Tire Placard



Figure A-6: 2022 Hyundai Ioniq 5 Frontal As Delivered





**Figure A-7: Left Rear 3-4 View, As Received**



**Figure A-8: Pre-Test Front View of Test Vehicle**





**Figure A-9: Post-Test Front View of Test Vehicle**



**Figure A-10: Pre-Test Left View of Test Vehicle**



**Figure A-11: Post-Test Left View of Test Vehicle**



**Figure A-12: Pre-Test Right View of Test Vehicle**





**Figure A-13: Post-Test Right View of Test Vehicle**



**Figure A-14: Pre-Test Right Front 3-4 View**





**Figure A-15: Post-Test Right Front 3-4 View**



**Figure A-16: Pre-Test Left Rear 3-4 View**





Figure A-17: Post-Test Left Rear 3-4 View



Figure A-18: Pre-Test Windshield View





Figure A-19: Post-Test Windshield View

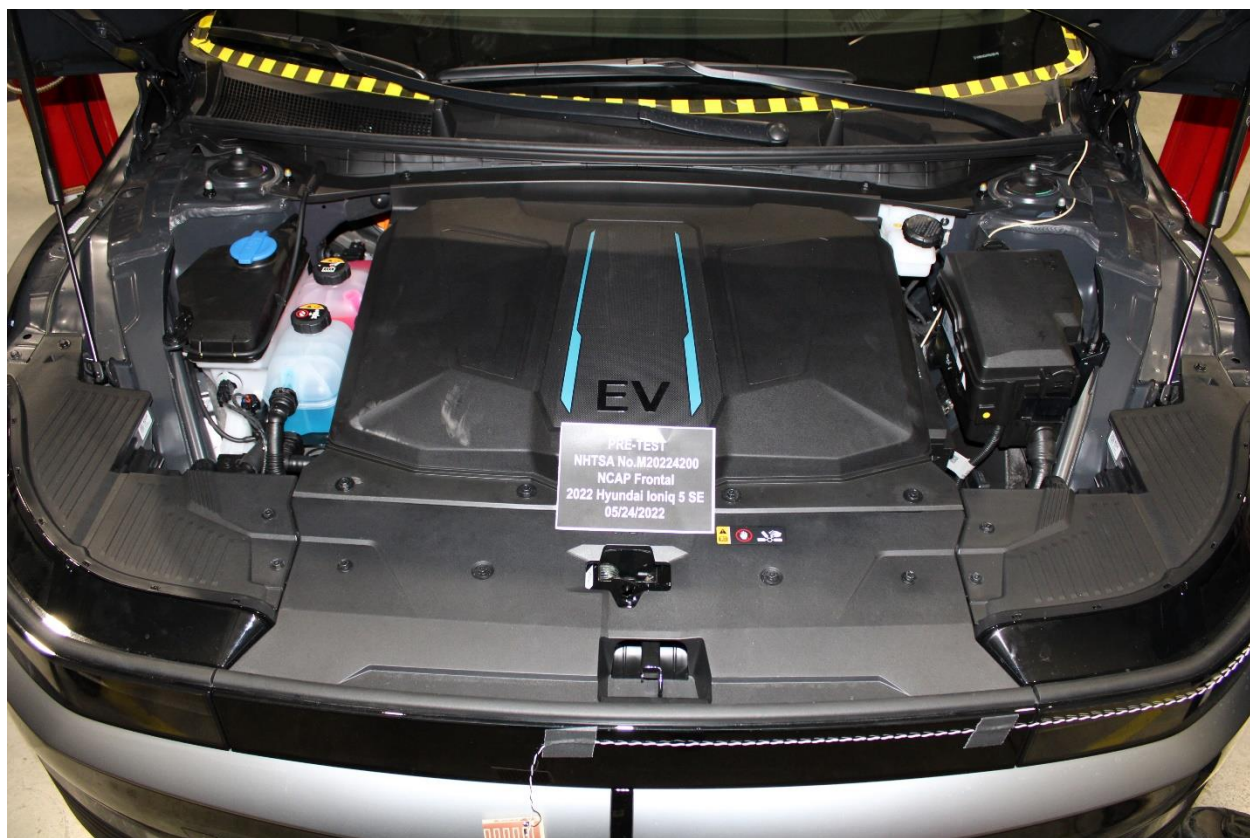


Figure A-20: Pre-Test Engine Compartment View



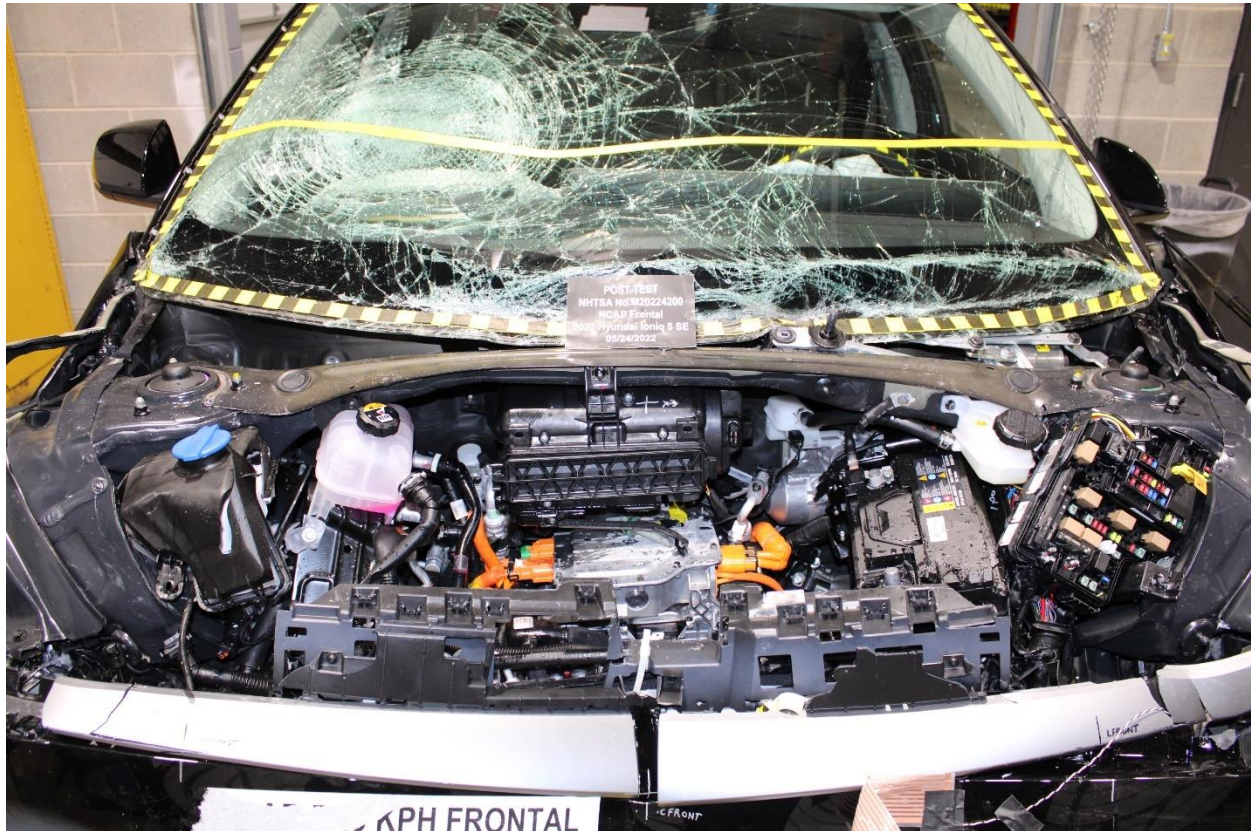


Figure A-21: Post-Test Engine Compartment View



Figure A-22: Pre-Test Fuel Filler Cap View





Figure A-23: Post-Test Fuel Filler Cap View

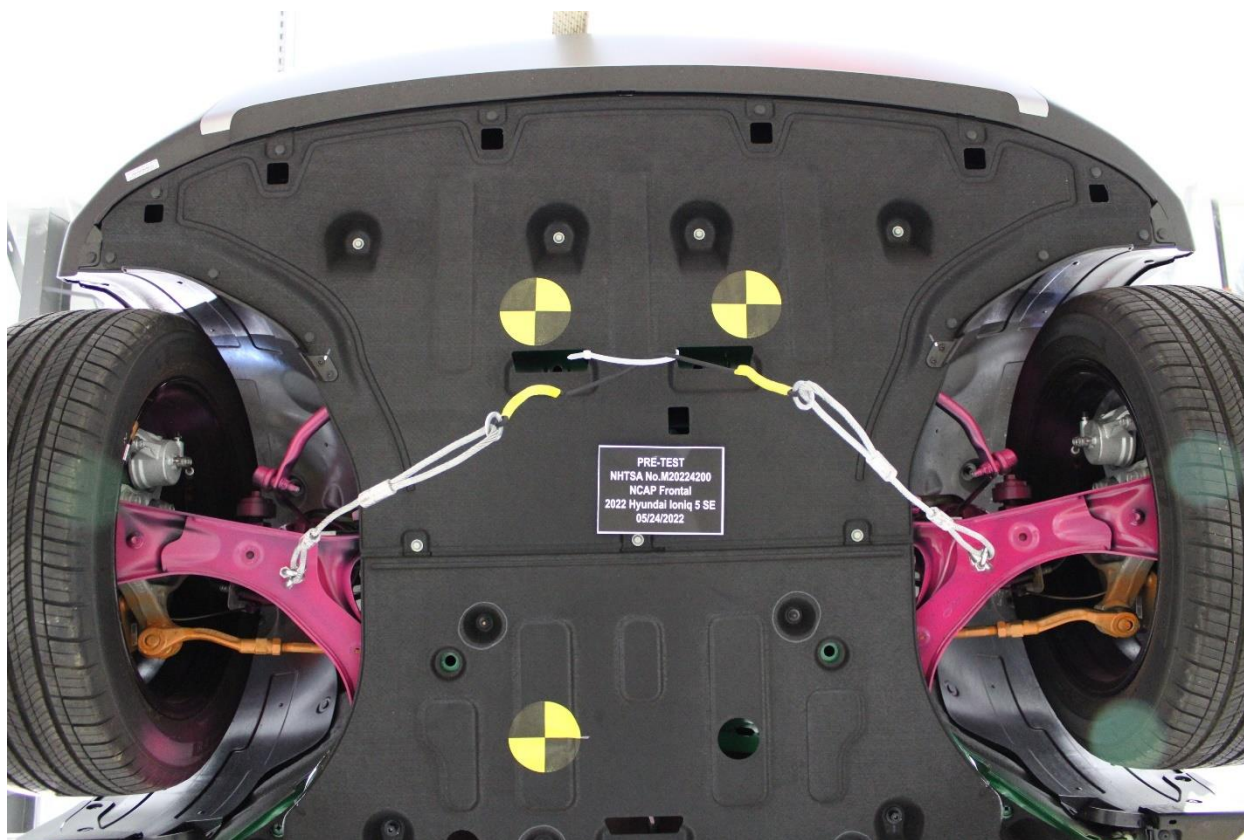
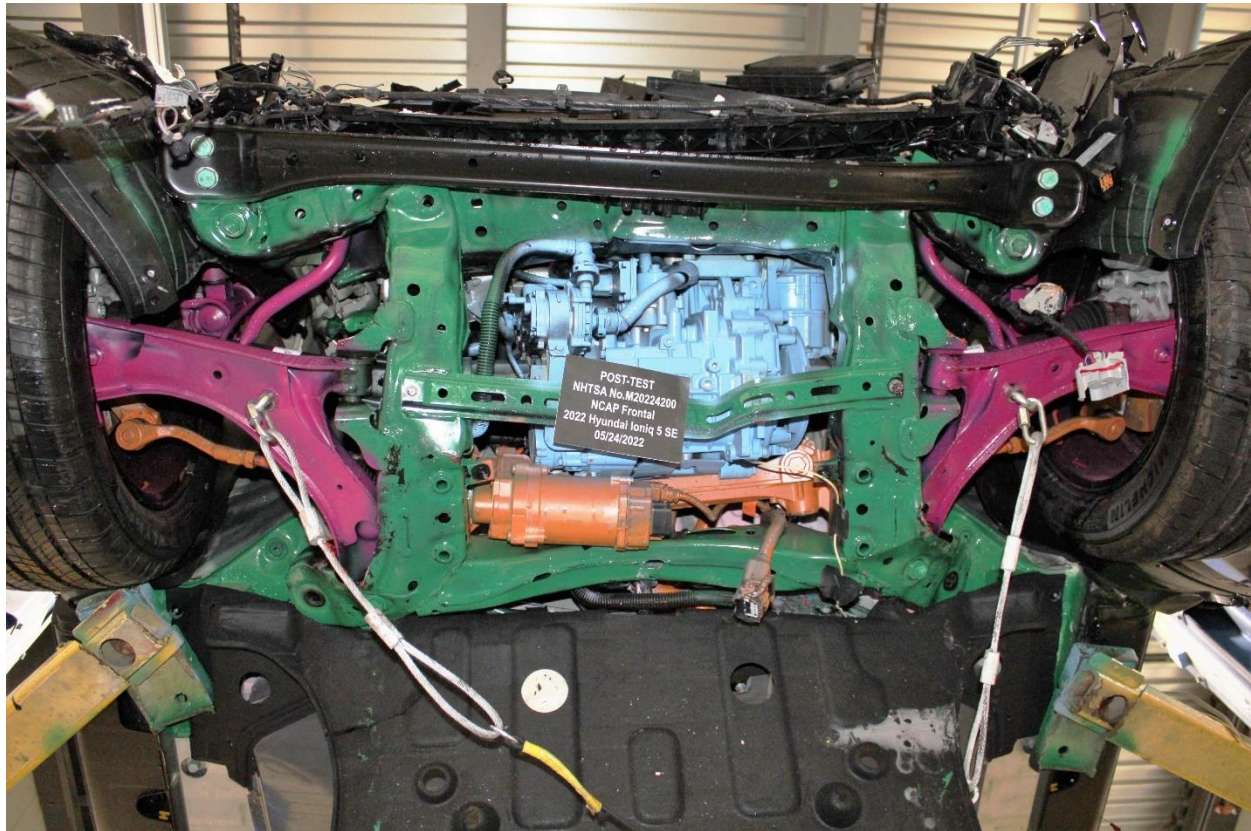
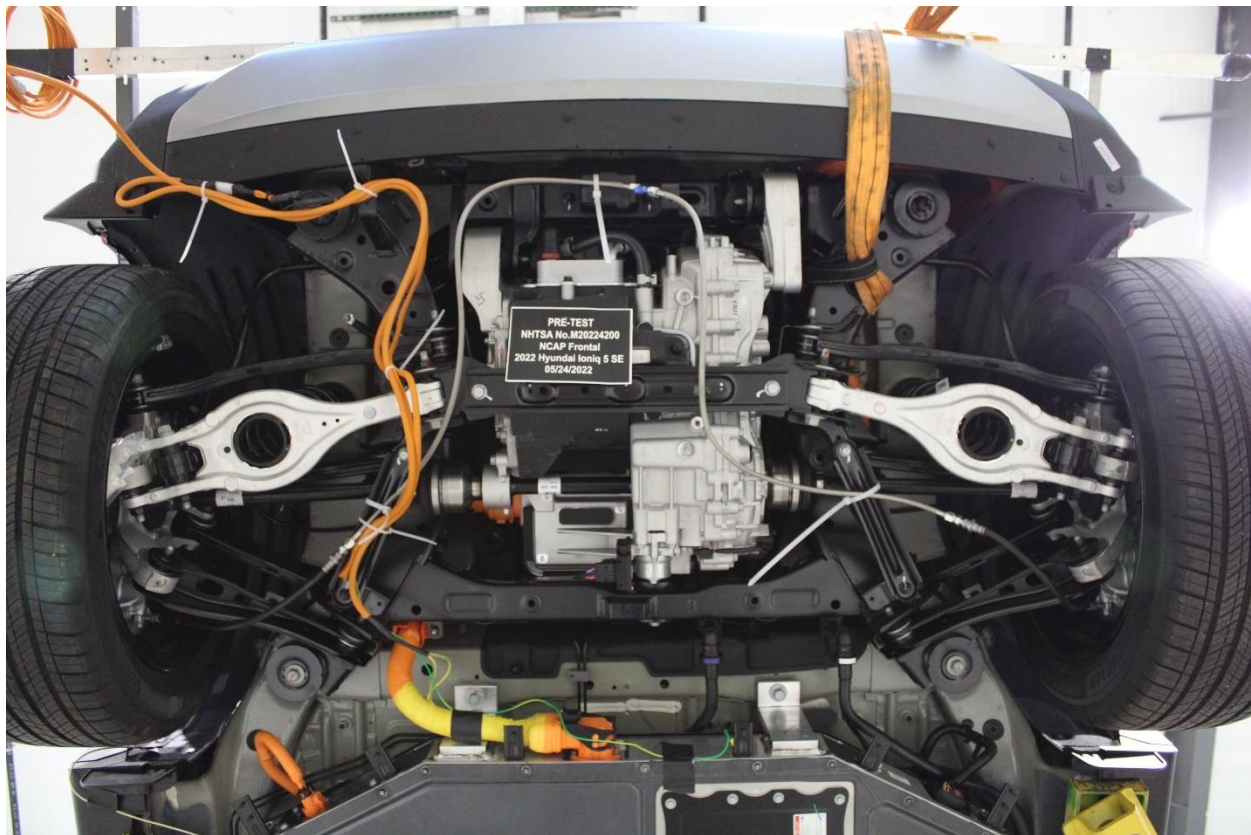


Figure A-24: Pre-Test Front Underbody View



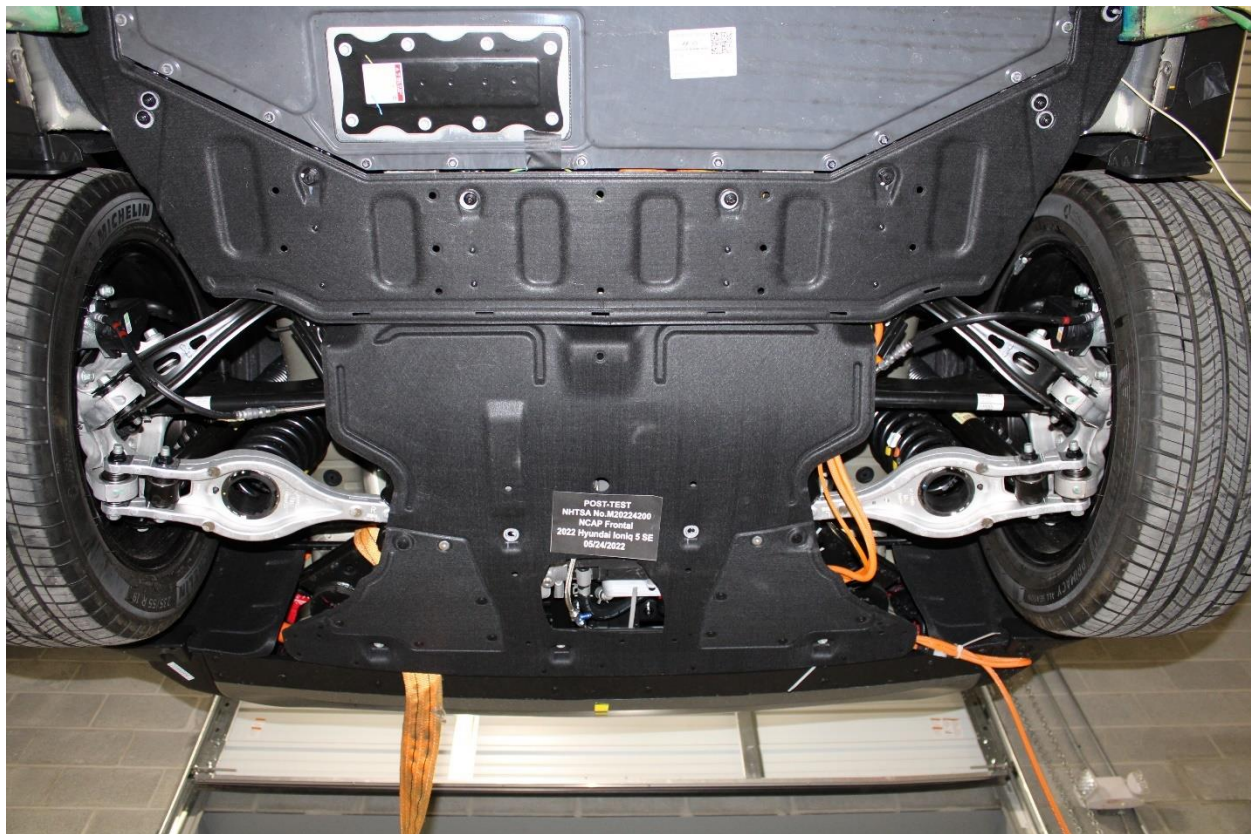


**Figure A-25: Post-Test Front Underbody View**

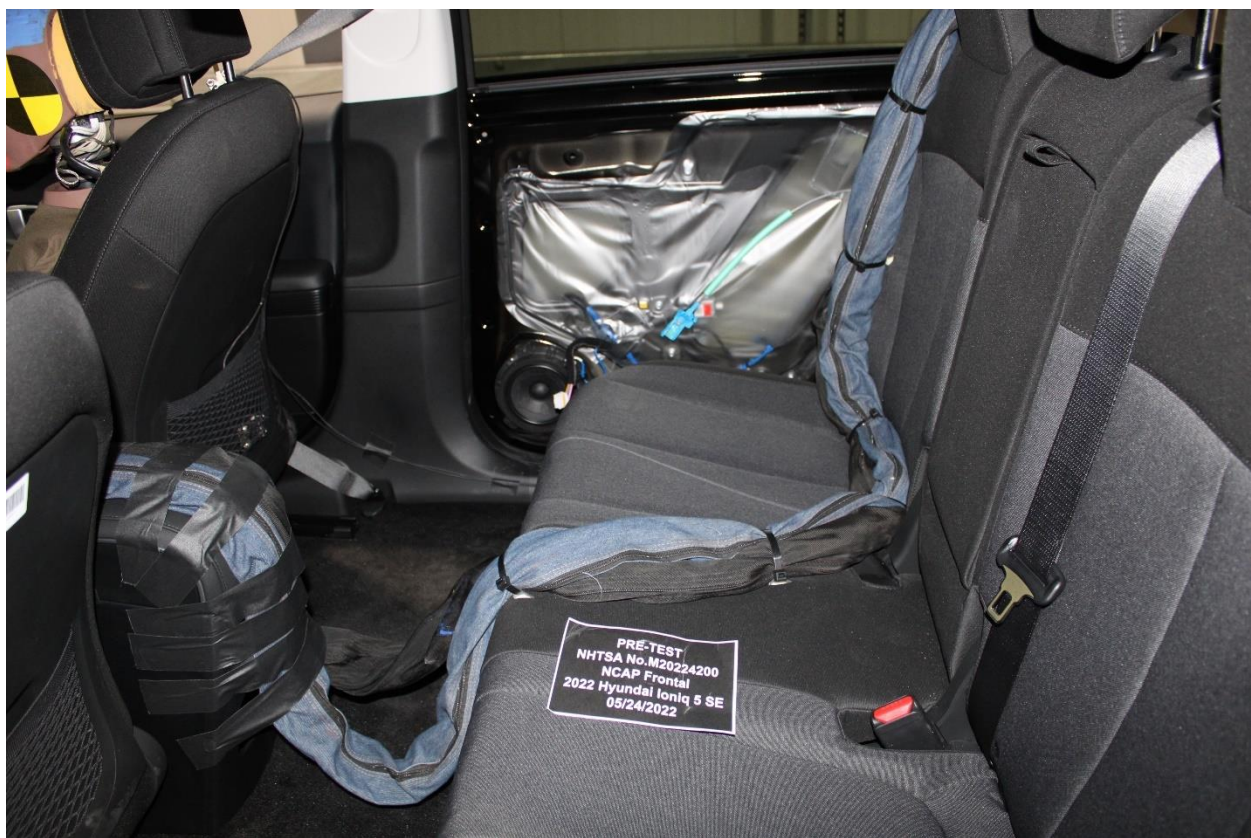


**Figure A-26: Pre-Test Rear Underbody View**



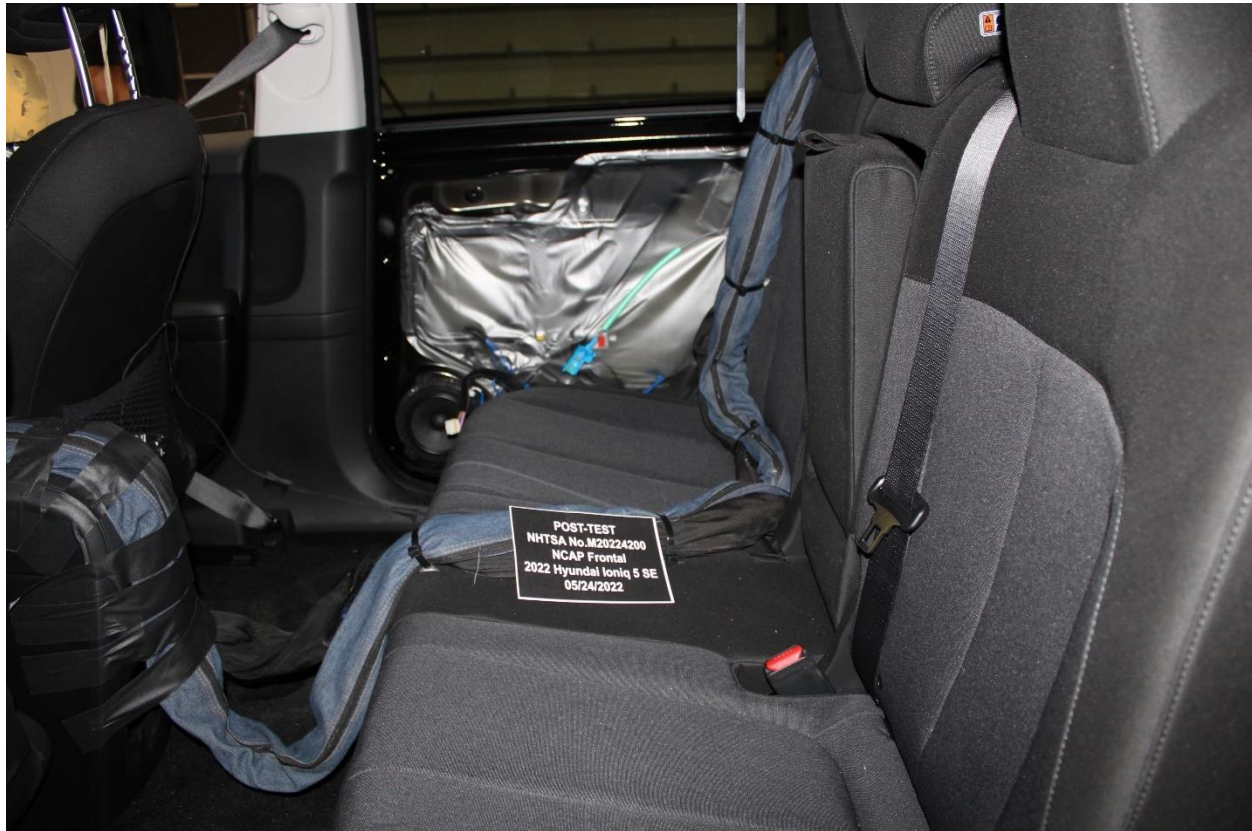


**Figure A-27: Post-Test Rear Underbody View**

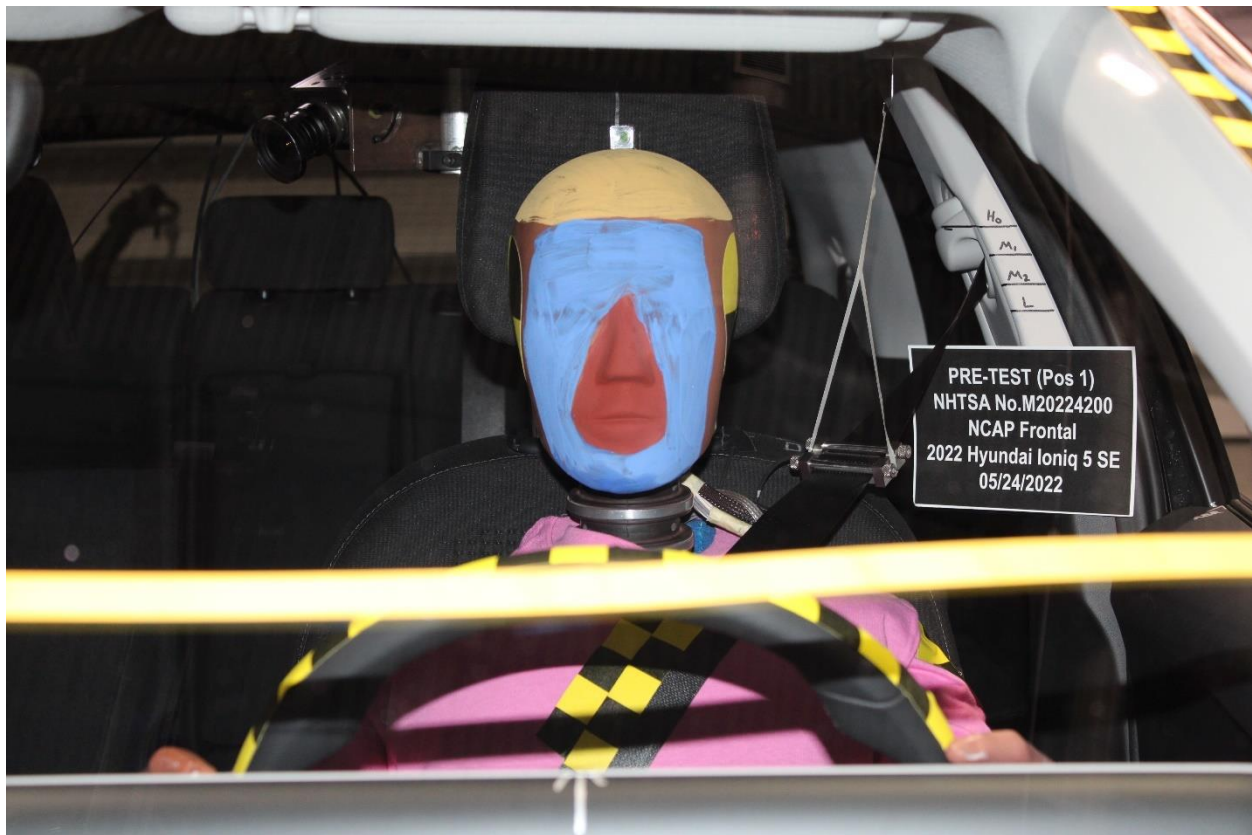


**Figure A-28: Pre-Test Dummy Cable Routing**





**Figure A-29: Post-Test Dummy Cable Routing**



**Figure A-30: Pre-Test Driver Dummy Front View**





**Figure A-31: Post-Test Driver Dummy Front View**



**Figure A-32: Pre-Test Driver Dummy Window View**





**Figure A-33: Post-Test Driver Dummy Window View**



**Figure A-34: Pre-Test Driver Dummy and Vehicle Interior View**





Figure A-35: Post-Test Driver Dummy and Vehicle Interior View



Figure A-36: Pre-Test Driver's Seat Fore-Aft Markings





Figure A-37: Post-Test Driver's Seat Fore-Aft Markings



Figure A-38: Pre-Test View of Belt Anchorage for Driver Dummy





Figure A-39: Post-Test View of Belt Anchorage for Driver Dummy



Figure A-40: Pre-Test View of Belt Buckle and Latch Plate for Driver Dummy





**Figure A-41: Post-Test View of Belt Buckle and Latch Plate for Driver Dummy**



**Figure A-42: Pre-Test Driver Dummy Feet**





Figure A-43: Post-Test Driver Dummy Feet



Figure A-44: Pre-Test Driver's Side Knee Bolster



**Figure A-45: Post-Test Driver's Side Knee Bolster**



**Figure A-46: Pre-Test Driver's Side Floorpan**





**Figure A-47: Post-Test Driver's Side Floorpan**



**Figure A-48: Post-Test Driver Dummy Face**





**Figure A-49: Post-Test Driver Dummy Contact With Airbag**



**Figure A-50: Post-Test Driver Dummy Contact With Headrest**





**Figure A-51: Pre-Test View of the Steering Wheel**



**Figure A-52: Post-Test View of the Steering Wheel**





**Figure A-53: Pre-Test Passenger Dummy Front View**



**Figure A-54: Post-Test Passenger Dummy Front View**





Figure A-55: Pre-Test Passenger Dummy Window View



Figure A-56: Post-Test Passenger Dummy Window View



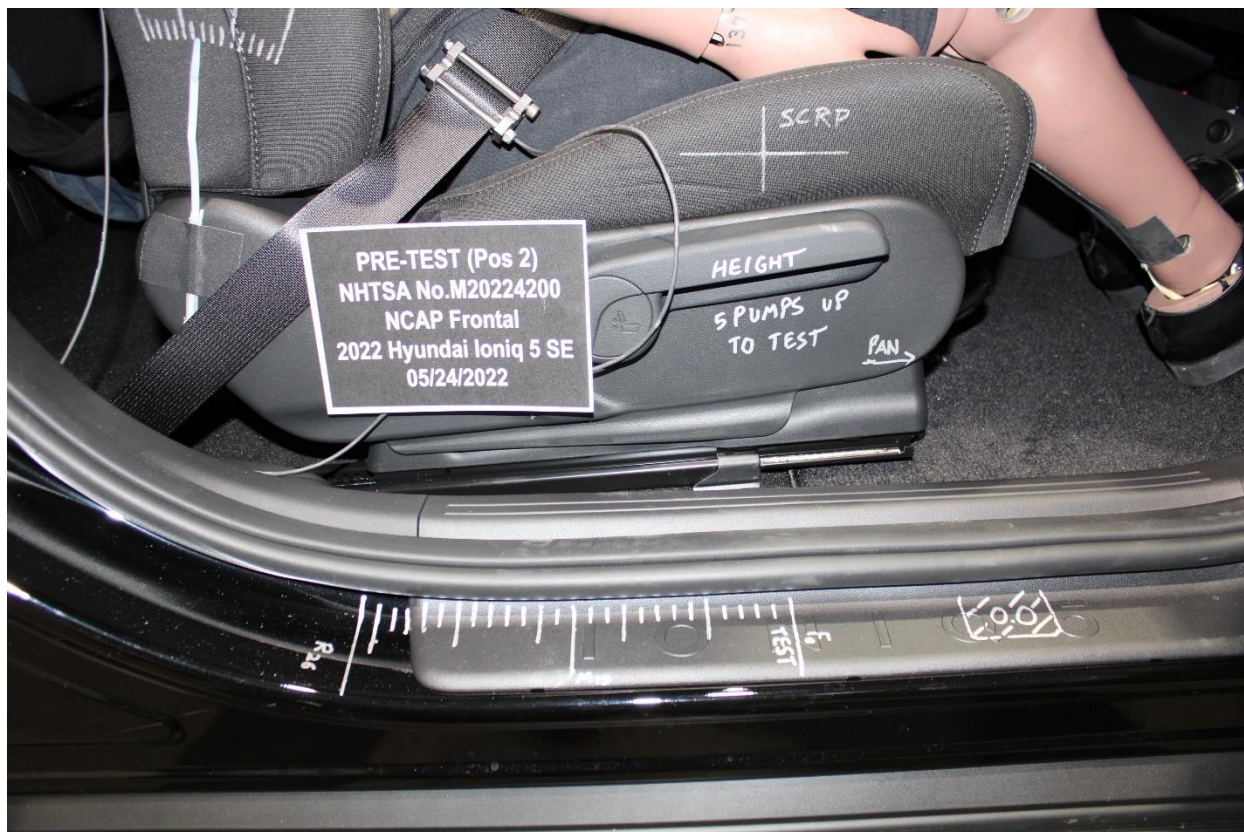


**Figure A-57: Pre-Test Passenger Dummy and Vehicle Interior View**



**Figure A-58: Post-Test Passenger Dummy and Vehicle Interior View**





**Figure A-59: Pre-Test Passenger's Seat Fore-Aft Markings**



**Figure A-60: Post-Test Passenger's Seat Fore-Aft Markings**





Figure A-61: Pre-Test View of Belt Anchorage for Passenger Dummy

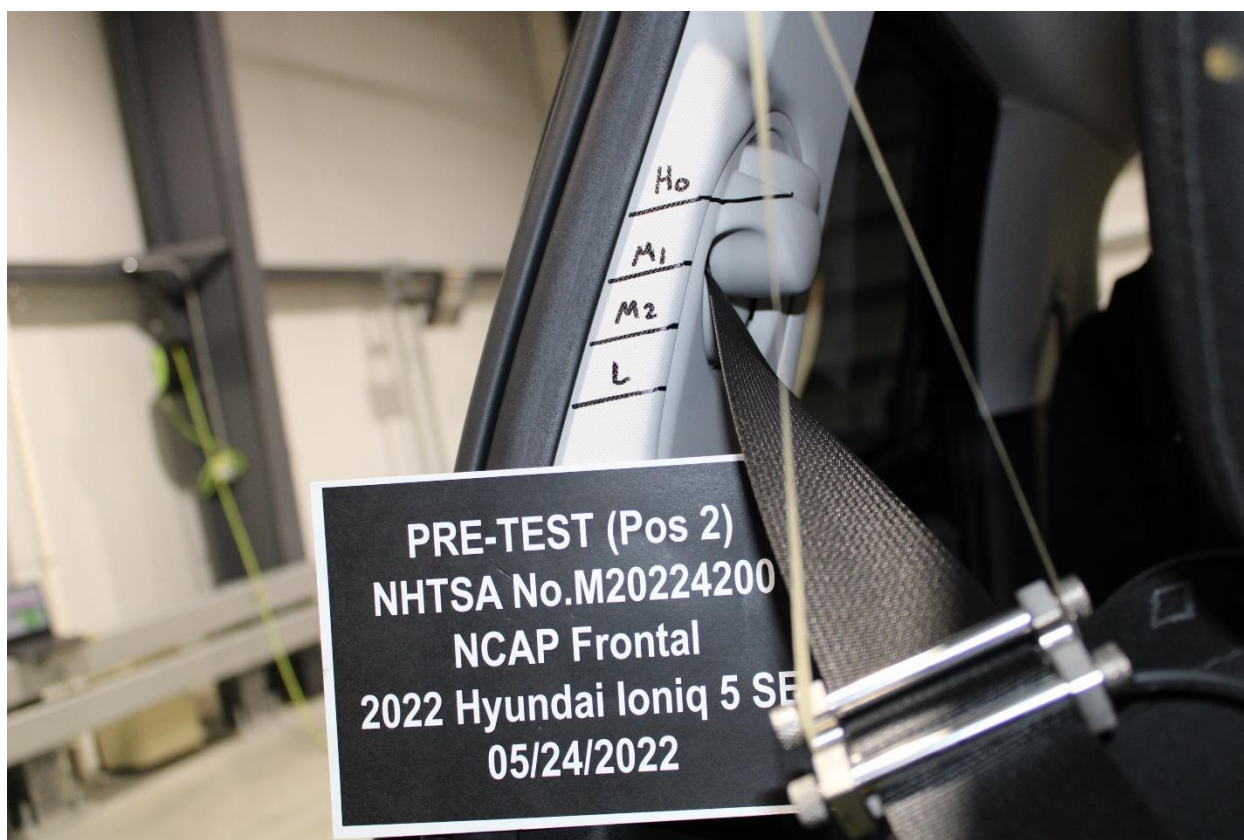


Figure A-62: Post-Test View of Belt Anchorage for Passenger Dummy



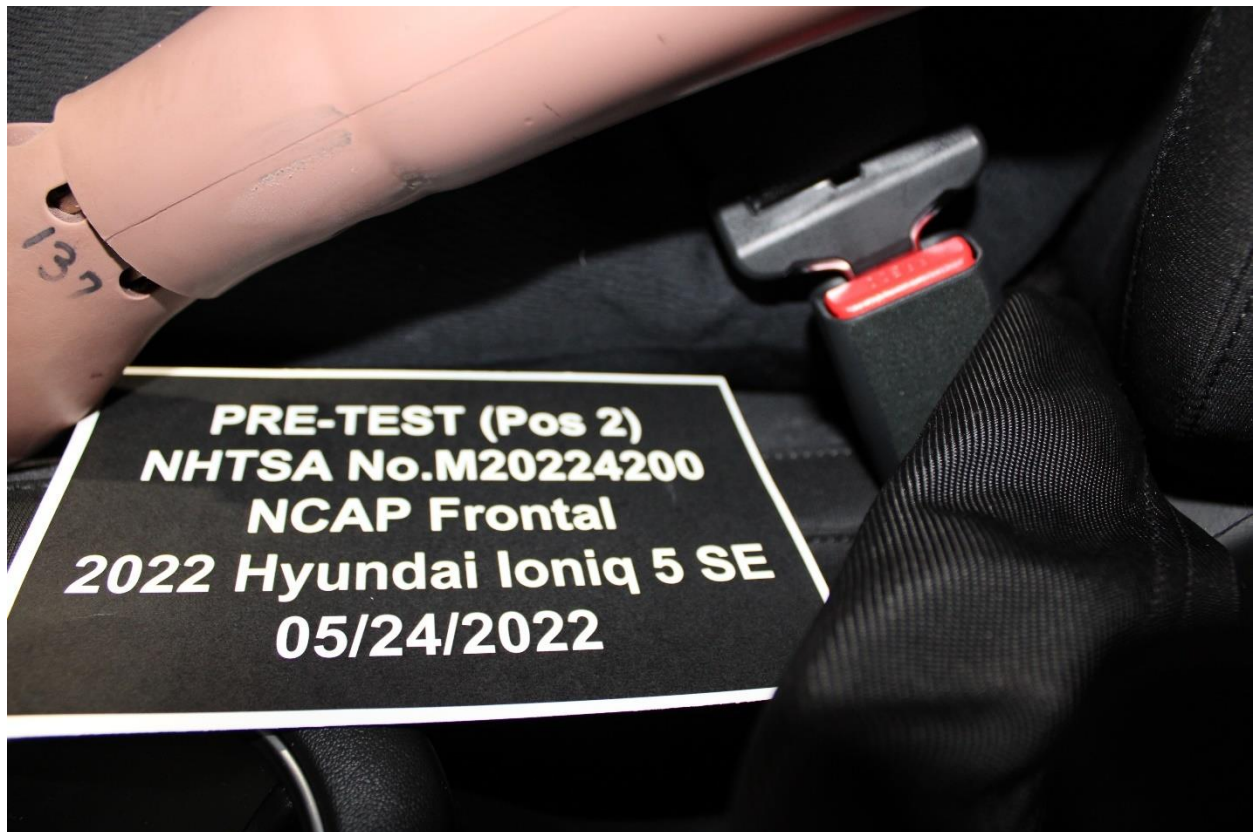


Figure A-63: Pre-Test View of Belt Buckle and Latch Plate for Passenger Dummy



Figure A-64: Post-Test View of Belt Buckle and Latch Plate for Passenger Dummy





**Figure A-65: Pre-Test Passenger Dummy Feet**



**Figure A-66: Post-Test Passenger Dummy Feet**





**Figure A-67: Pre-Test Passenger's Side Knee Bolster**



**Figure A-68: Post-Test Passenger's Side Knee Bolster**





**Figure A-69: Pre-Test Passenger's Side Floorpan**



**Figure A-70: Post-Test Passenger's Side Floorpan**





**Figure A-71: Post-Test Passenger Dummy Face**



**Figure A-72: Post-Test Passenger Dummy Contact With Airbag**





**Figure A-73: Post-Test Passenger Dummy Contact With Headrest**



**Figure A-74: Photograph of Ballast Installed in Vehicle**



# Photo Not Applicable

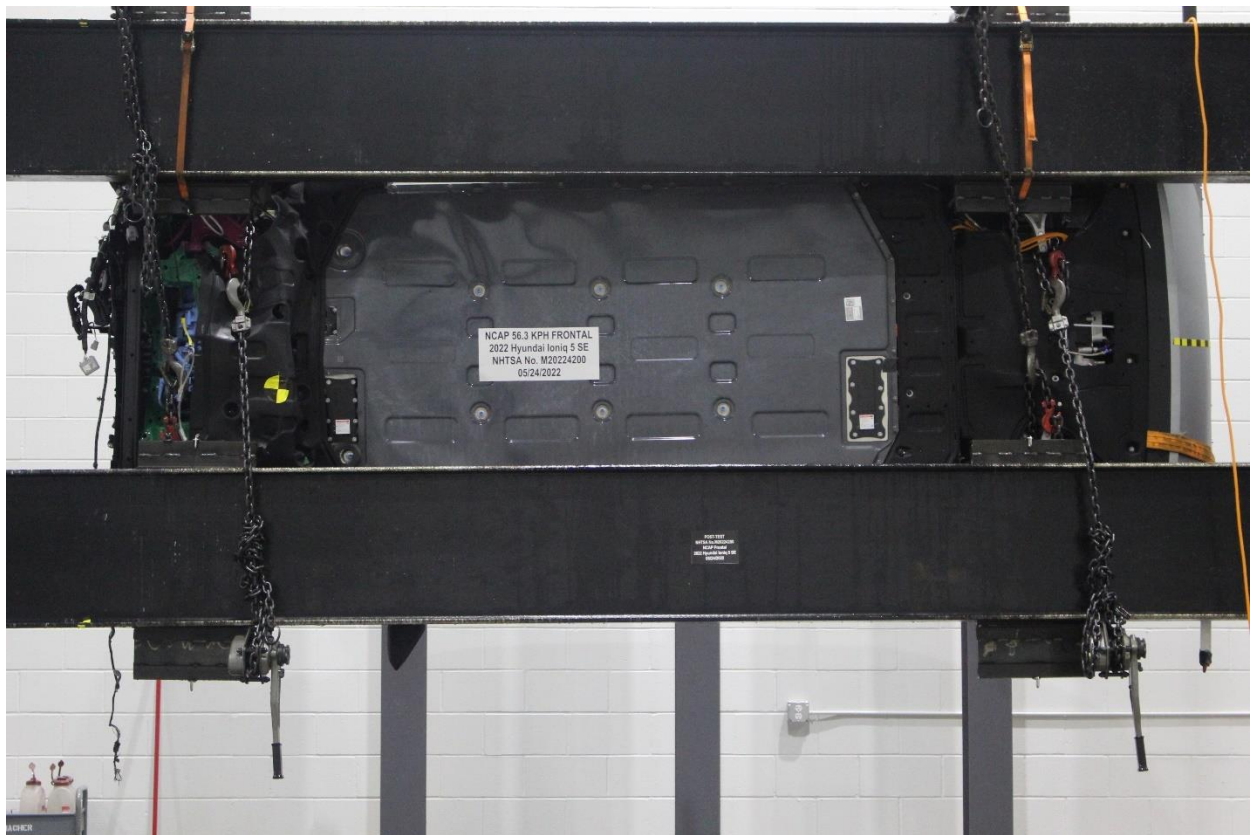
Figure A-75: Post-Test Stoddard Solvent Spillage Location View, If Required



Figure A-76: Post-Test Speed Trap Read-Out



**Figure A-77: Vehicle at 0° on Static Rollover Device**

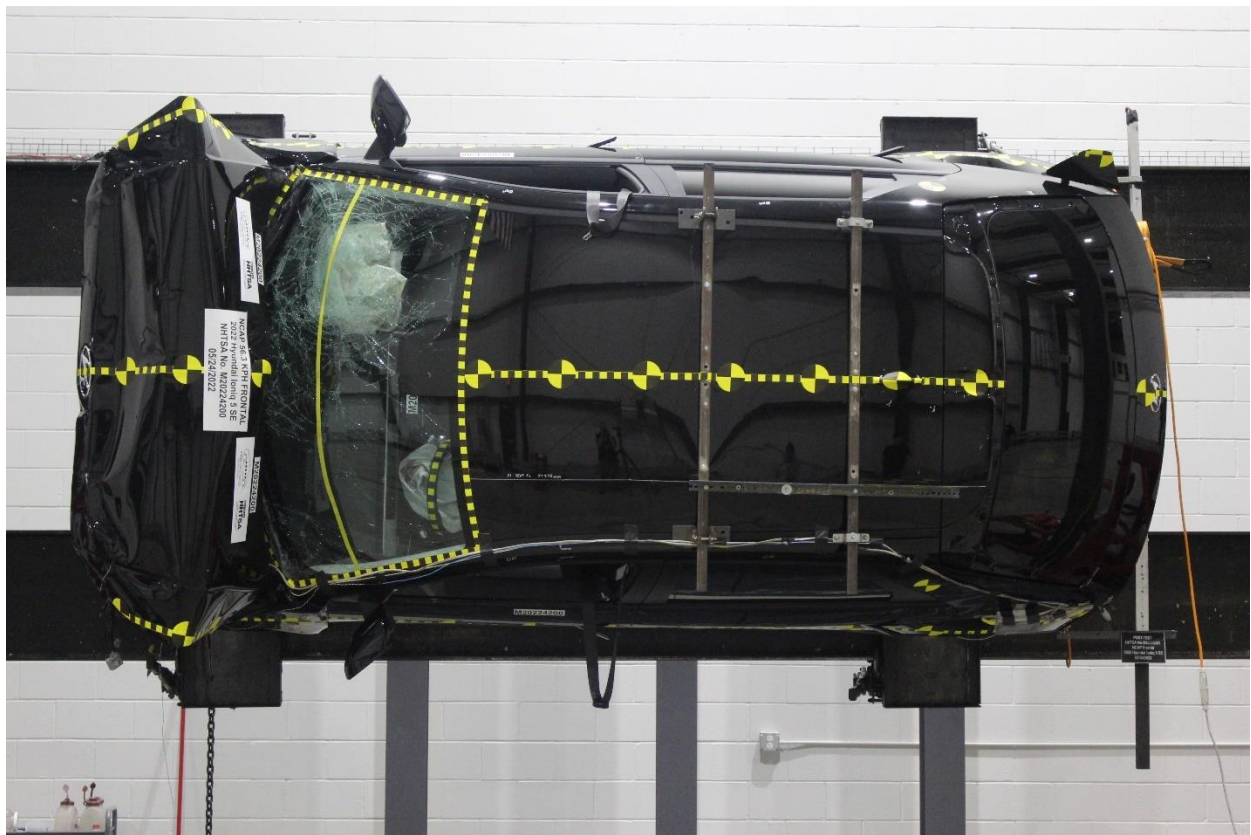


**Figure A-78: Vehicle at 90° on Static Rollover Device**





**Figure A-79: Vehicle at 180° on Static Rollover Device**



**Figure A-80: Vehicle at 270° on Static Rollover Device**





**Figure A-81: Vehicle at 360° on Static Rollover Device**



**Figure A-82: 2022 Hyundai Ioniq 5 Frontal Impact Event**

**HYUNDAI**

**2022 IONIQ 5 SE AWD**

**SOLD TO:** NY077  
TOWNE HYUNDAI  
3525 SOUTHWESTERN BLVD  
ORCHARD PARK NY 14127

**SHIPPED TO:** NY077

**GOVERNMENT 5-STAR SAFETY RATINGS**

This vehicle has not been rated by the government for overall vehicle score, frontal crash, side crash or rollover risk.

Source: National Highway Traffic Safety Administration (NHTSA).  
www.safercar.gov or 1-888-327-4236

**VIN:** KMRKMDAF0NU094145

**MODEL:** SOA12A2Z

**ENGINE:** EM17N2R5811D

**PORT OF ENTRY:** PH

**EXTERIOR COLOR:** PHANTOM BLACK

**INTERIOR SEAT COLOR:** BLACK/BLACK

**TRANSPORT:** TRUCK

**ACCESSORY WEIGHT:** 20 lbs / 9 kgs

**EMISSIONS:** This vehicle meets emissions requirements in all 50 states and is a CARB certified Zero Emission Vehicle (ZEV)

**STANDARD FEATURES:**

**AMERICA'S BEST WARRANTY**  
5-year/100,000-mile New Vehicle Warranty\*  
10-year/100,000-mile Powertrain Warranty\*  
5-year/100,000-mile Electric Vehicle System Warranty\*  
3-year/50,000-mile Anti-perforation Warranty\*  
3-year/50,000-mile Complimentary Maintenance\*  
5-year/Unlimited-mile Roadside Assistance  
\*Limited warranties, see dealer for details

**ADVANCED SAFETY TECHNOLOGY**  
Forward Collision-Avoidance Assist  
Blind-Spot Collision-Avoidance Assist, High Beam Assist  
Lane Keeping Assist, Lane Following Assist  
Rear Cross-Traffic Collision-Avoidance Assist  
Rear View Monitor, Rear Parking Sensors  
Driver Attention Warning  
Rear Occupant Alert, Side Exit Assist  
Tire Pressure Monitoring System w/ Individual Tire Indicator

**POWERTRAIN TECHNOLOGY**  
77.4kWh Lithium-Ion Polymer Battery System (800V)  
DC Ultra-Fast Charging Capability w/ 50A: 30min Port  
10 kW On-Board Charger, Battery Pre-Heating System & Heat Pump  
Single-Speed Reduction Gear, Column-Mounted Shifter  
Regenerative Brake Level Control Paddles

**EXTERIOR**  
18" Alloy Aero Wheels, Active Grille Shutters  
LED Auto headlights, Daytime Running Lights, and Taillights  
Heated Side Mirrors with LED Turn Signal Indicators  
Auto-retracting flush door handles, Privacy Rear Glass  
Rear Spoiler with LED Center High-Mount Stop Light

**COMFORT & CONVENIENCE**  
Cloth-Trimmed Seats, Heated front seats  
8-way Power Driver Seat w/ Lumbar Support  
18-Spoke Telescoping Leather Steering Wheel  
Proximity Key w/ Push Button Start  
Dual Front Auto Temperature Control  
12.3-inch Digital Instrument Cluster w/ EV Tech Display  
Center Console w/ Storage, 2nd Row Armrest w/ Cupholders  
60/40 Split 2nd Row Folding seats with slide & recline  
Front & Rear USB Outlets, 12V Power Outlets  
12.3-inch Navigation with Android Auto (TM) and Apple CarPlay (TM)  
Smart Cruise Control w/ Stop & Go  
Bluetooth® Hands-free System, Dynamic Voice Recognition  
AM/FM/HD Radio® Audio System

**COMFORT & CONVENIENCE (cont.)**  
JBL® 600 Radio w/80 Day Platinum Trial subscription, Not Available in AK & HI  
BlueLink Connected Services 3-years Standard (enrollment req)  
BlueLink Climate Control (3-year Complimentary Service)  
BlueLink Customer Package (3-year Complimentary Service)  
Tire Mobility Kit  
Full Battery Charge

**ADDED FEATURES:**  
Carpeted Floor Mats \$195.00  
Cargo Net \$65.00  
Cargo Tray \$115.00  
First Aid Kit \$30.00  
Mud Guards \$120.00

Manufacturer's Suggested Retail Price: \$47,190.00

Intend Freight & Handling: \$1,245.00  
**Total Price:** \$48,910.00

**IONIQ 5 - The first of its kind.**

**EPA DOT Fuel Economy and Environment** **Electric Vehicle**

**Fuel Economy**  
98 MPGe  
combined city/hwy  
Driving Range: 256 miles  
Charge Time: 8.5 hours (240V)

**You Save \$3,250**  
in fuel costs over 5 years compared to the average new vehicle.

**Annual fuel cost \$650**

**Fuel Economy & Greenhouse Gas Rating** (tailpipe only)  
1 (Best) 10 (Worst)

**Smog Rating** (tailpipe only)  
1 (Best) 10 (Worst)

**Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 27 MPGe and costs \$4,500 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at \$0.18 per kWh for EVs or \$0.12 per gallon for gasoline. Vehicle emissions are a significant cause of climate change and smog.**

**fuel economy.gov**  
Calculate personalized estimates and compare vehicles

**Parts Content Information**  
FOR VEHICLE IN THIS CARLINE:  
U.S./CANADIAN PARTS CONTENT:  
MAJOR SOURCES OF FOREIGN PARTS CONTENT: KOREA: 95 %

Note: Parts content does not include final assembly, distribution, or other non-parts costs.

**FOR THIS VEHICLE:**  
FINAL ASSEMBLY POINT: ULSAN, KOREA  
COUNTRY OF ORIGIN:  
ENGINE: KOREA  
TRANSMISSION: KOREA

92 A Y032020N

Figure A-83: Monroney Label Photograph

Photo Not Applicable

Figure 305-1: Auxiliary Power Module Warning Label





Figure 305-2: Power Inverter Warning Label



Figure 305-3 First Responder Warning Label





Figure 305-4: First Responder Warning Label Location



M20224200

Figure 305-5: Other Vehicle Label Related to Electric Propulsion System





**Figure 305-6: Manual High Voltage Service Disconnect in Place**



**Figure 305-7: Manual High Voltage Service Disconnect Removed (Show Plug)**





Figure 305-8: Manual High Voltage Service Disconnect Removed Location



Figure 305-9: Pre-Impact View of Propulsion Battery





**Figure 305-10: Post-Impact Front View of Propulsion Battery**



**Figure 305-11: Post-Impact Rear View of Propulsion Battery (if any part of it is visible)**





**Figure 305-12: Pre-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules**



**Figure 305-13: Post-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules**

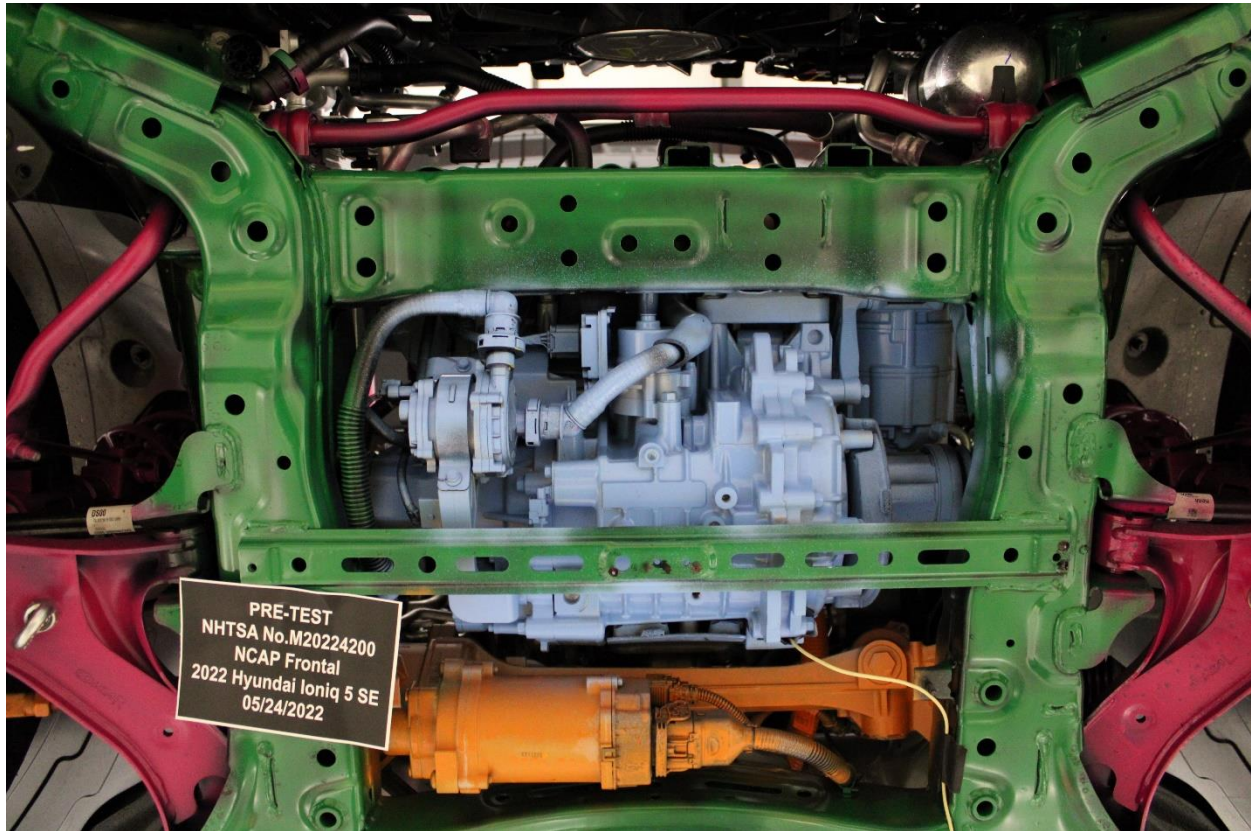
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**Figure 305-14: Pre-Impact View of Propulsion Battery Module(s)**

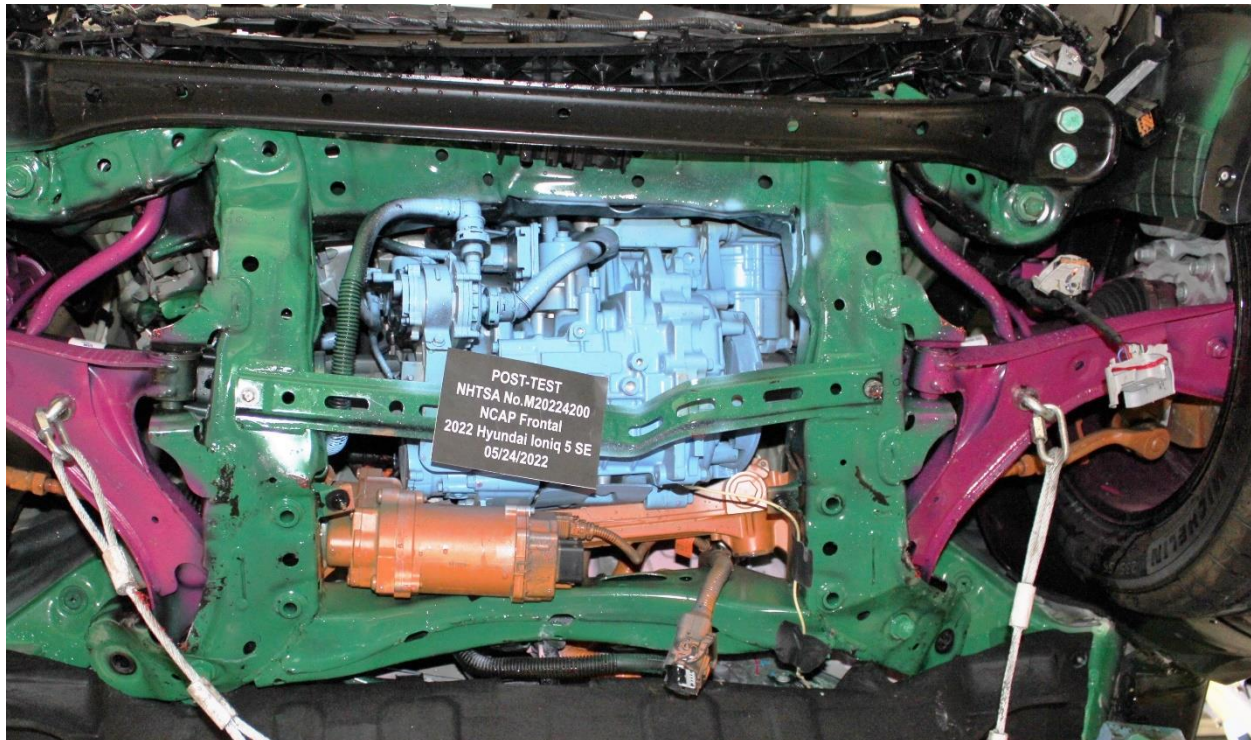
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**Figure 305-15: Post-Impact View of Propulsion Battery Module(s)**



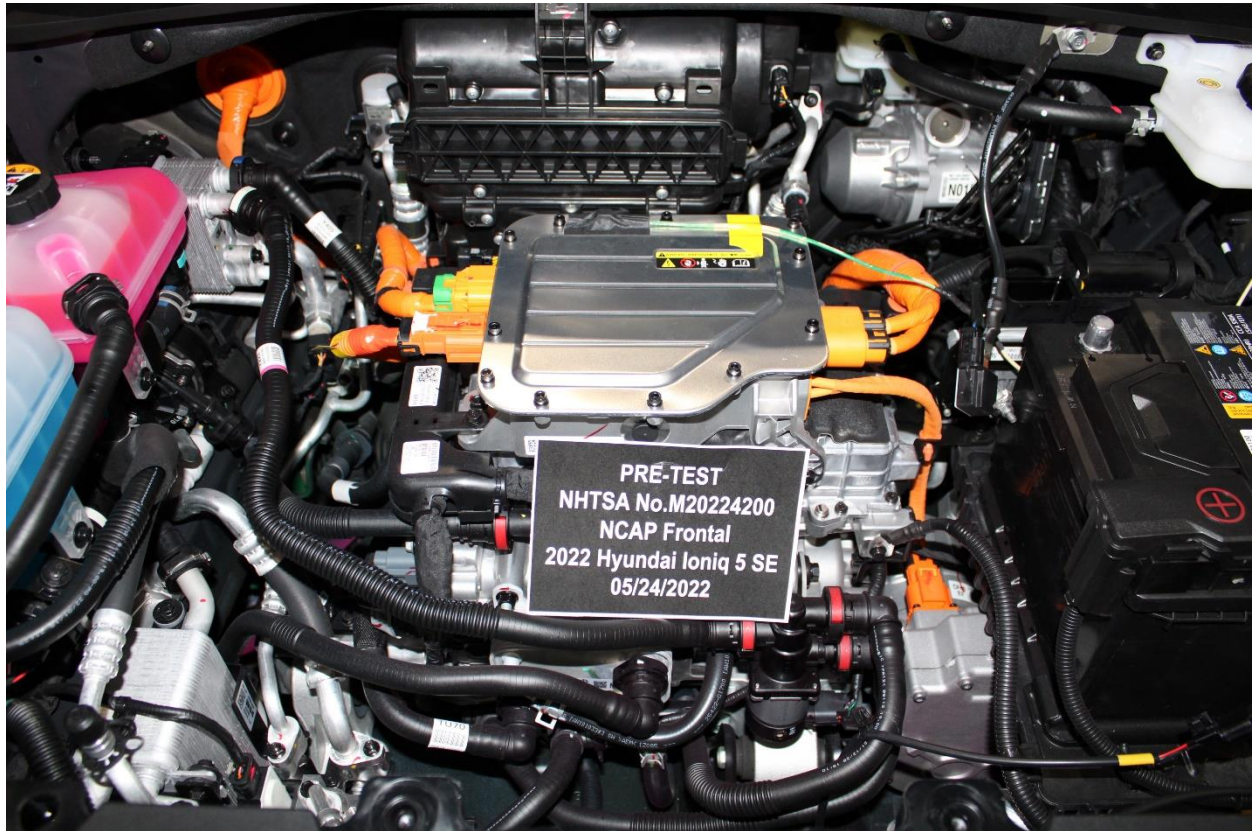


**Figure 305-16: Pre-Impact View of Electric Propulsion Drive**



**Figure 305-17: Post-Impact View of Electric Propulsion Drive**

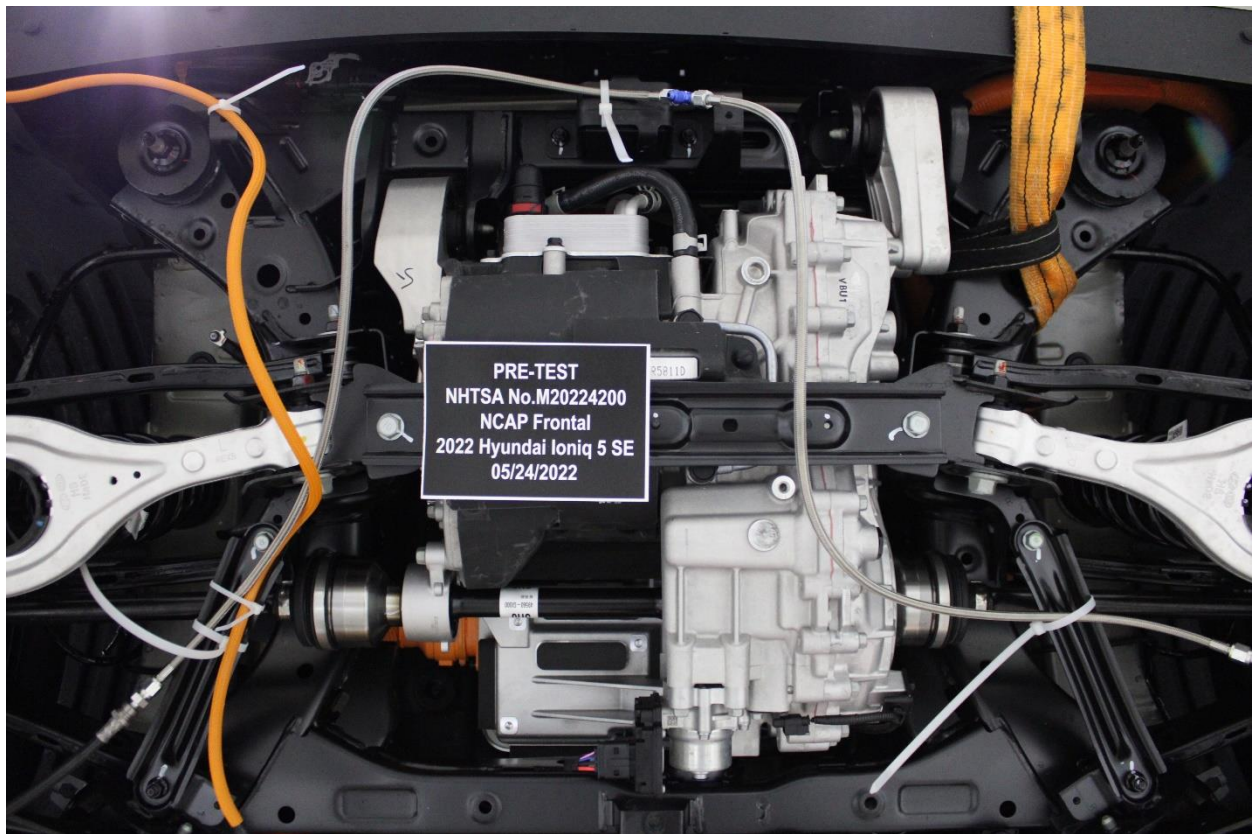




**Figure 305-18: Pre-Impact View of High Voltage Interconnects**

**Photo Not Applicable**

**Figure 305-19: Pre-Impact View of Propulsion Battery Venting System**



**Figure 305-20: Pre-Impact View of Other Visible Electric Propulsion Components**



**Figure 305-21: Pre-Impact View of Ground Lead Attached**





**Figure 305-22: Pre-Impact View of High Voltage Leads Attached**



**Figure 305-23: Pre-Impact Close Up View of High Voltage Leads Attached**





**Figure 305-24: Pre-Impact View of Installed Test Interface Port**



**Figure 305-25: Post-Impact View of Installed Test Interface Port**

**Photo Not Applicable**

**Figure 305-26: Pre-Impact View of Other Test Devices**

**Photo Not Applicable**

**Figure 305-27: Post-Impact View of Other Test Devices**

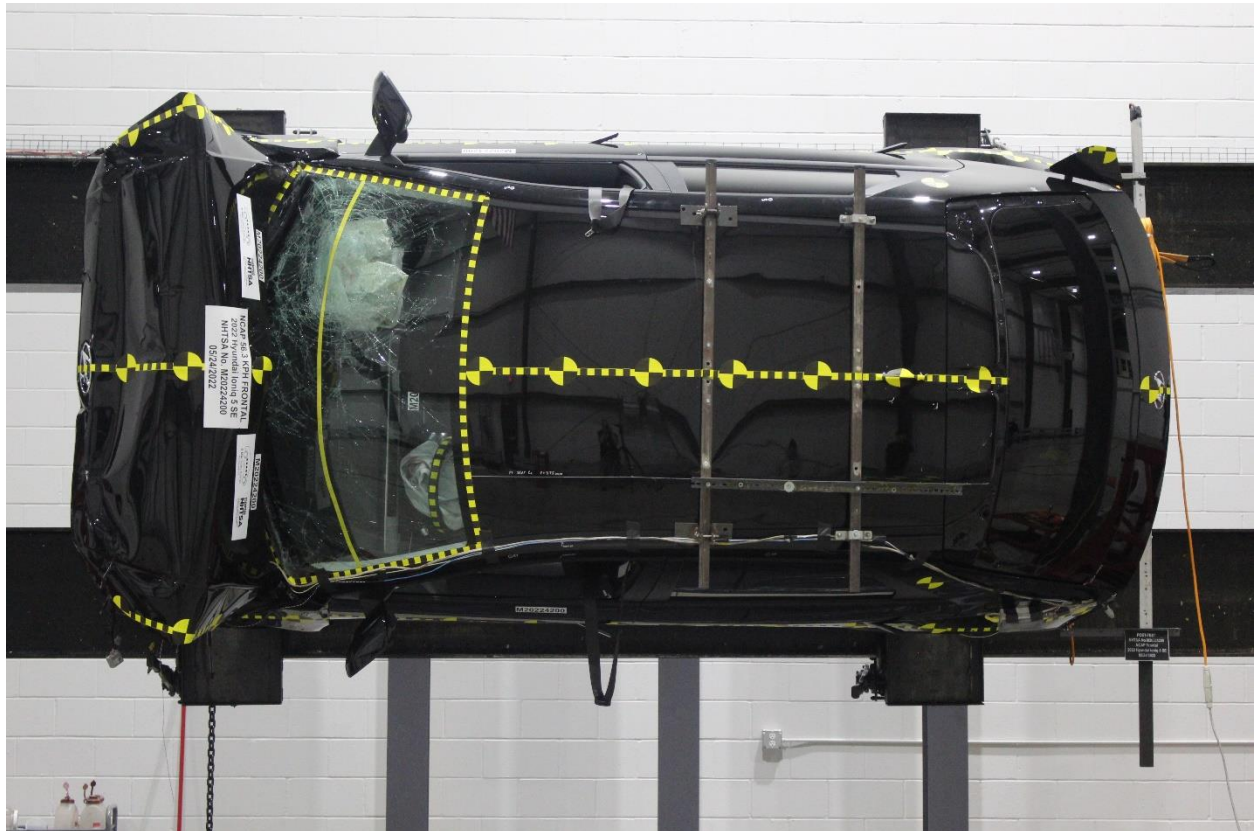




**Figure 305-28: FMVSS No. 305 Static Rollover 90 Degrees**



**Figure 305-29: FMVSS No. 305 Static Rollover 180 Degrees**



**Figure 305-30: FMVSS No. 305 Static Rollover 270 Degrees**



**Figure 305-31: FMVSS No. 305 Static Rollover 360 Degrees**





**Figure 305-32: Pre-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery**



**Figure 305-33: Post-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery**

# Photo Not Applicable

**Figure 305-34: Post-Impact Propulsion Battery System Mounting and-or Intrusion Failure(s)**

# Photo Not Applicable

**Figure 305-35: Post-Impact View of Battery Component Intrusion (if applicable)**



# Photo Not Applicable

Figure 305-36: Post-Impact View of Battery Module Movement or Retention Loss (if applicable)

# Photo Not Applicable

Figure 305-37: Post-Impact View of Propulsion Battery Electrolyte Spillage Location (if applicable)

# Photo Not Applicable

**Figure 305-38: Post-Impact View of Propulsion Battery Electrolyte Spillage Location (after rollover)**



**Post-Impact Passenger Frontal Airbag Tear**





**Post-Impact Passenger Lap Belt**

**APPENDIX B**  
**VEHICLE & DUMMY RESPONSE DATA TRACES**

## Table of Data Plots

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| Plot 2  | Driver Head Y Acceleration vs. Time Primary             | B-5  |
| Plot 3  | Driver Head Z Acceleration vs. Time Primary             | B-5  |
| Plot 4  | Driver Head Resultant Acceleration vs. Time Primary     | B-5  |
| Plot 5  | Driver Chest X Deflection vs. Time                      | B-6  |
| Plot 6  | Driver Chest X Acceleration vs. Time Primary            | B-6  |
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| Plot 27 | Passenger Upper Neck Moment Y vs. Time Primary          | B-11 |
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| Plot 29 | Passenger Left Femur Force vs. Time                     | B-12 |
| Plot 30 | Passenger Right Femur Force vs. Time                    | B-12 |

The following additional dummy and vehicle response data can be found in the R&D section of the NHTSA website at [www.NHTSA.gov](http://www.NHTSA.gov)

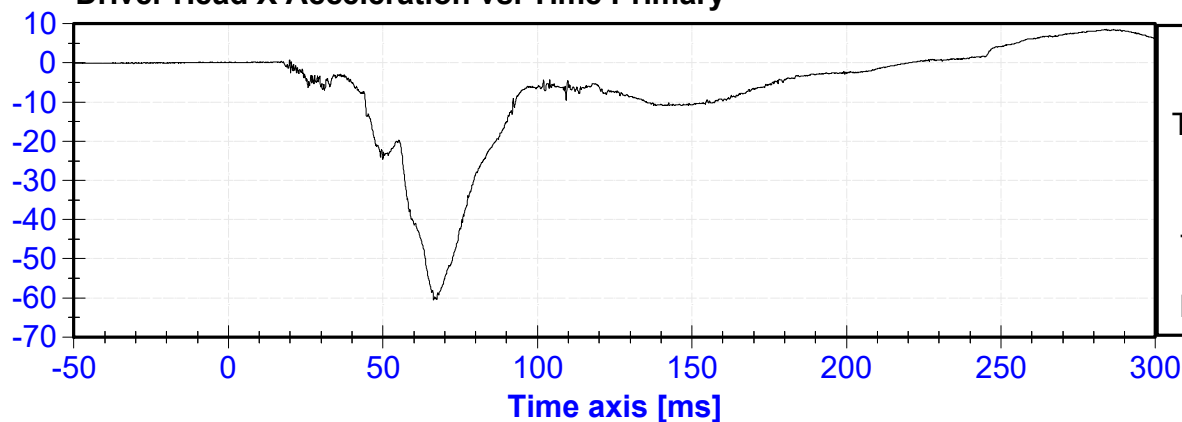
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- Driver Head Y Acceleration Redundant
- Driver Head Z Acceleration Redundant
- Driver Upper Neck Force Y
- Driver Upper Neck Moment X
- Driver Upper Neck Moment Z
- Driver Chest X Acceleration Redundant
- Driver Chest Y Acceleration Redundant
- Driver Chest Z Acceleration Redundant
- Driver Pelvis X
- Driver Pelvis Y
- Driver Pelvis Z
- Driver Left Femur Redundant
- Driver Right Femur Redundant
- Driver Left Upper Tibia Moment X
- Driver Left Upper Tibia Moment Y



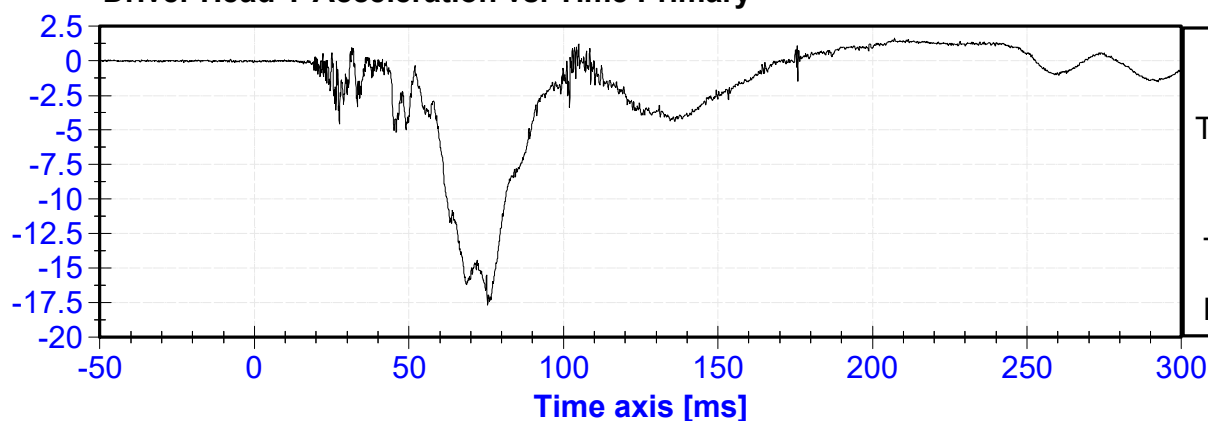
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Driver Left Lower Tibia Moment X  
Driver Left Lower Tibia Moment Y  
Driver Left Lower Tibia Force Z  
Driver Right Upper Tibia Moment X  
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Driver Right Upper Tibia Force Z  
Driver Right Lower Tibia Moment X  
Driver Right Lower Tibia Moment Y  
Driver Right Lower Tibia Force Z  
Driver Left Foot Fore Z  
Driver Left Foot Aft X  
Driver Left Foot Aft Z  
Driver Right Foot Fore Z  
Driver Right Foot Aft X  
Driver Right Foot Aft Z  
Driver Shoulder Belt Force  
Driver Lap Belt Force  
Driver Head Angular Velocity X  
Driver Head Angular Velocity Y  
Driver Head Angular Velocity Z  
Passenger Head X Acceleration Redundant  
Passenger Head Y Acceleration Redundant  
Passenger Head Z Acceleration Redundant  
Passenger Upper Neck Force X  
Passenger Upper Neck Force Z  
Passenger Upper Neck Moment Y  
Passenger Chest X Acceleration Redundant  
Passenger Chest Y Acceleration Redundant  
Passenger Chest Z Acceleration Redundant  
Passenger Pelvis X  
Passenger Pelvis Y  
Passenger Pelvis Z  
Passenger Left Femur Redundant  
Passenger Right Femur Redundant  
Passenger Left Upper Tibia Moment X  
Passenger Left Upper Tibia Moment Y  
Passenger Left Upper Tibia Force Z  
Passenger Left Lower Tibia Moment X  
Passenger Left Lower Tibia Moment Y  
Passenger Left Lower Tibia Force Z  
Passenger Right Upper Tibia Moment X  
Passenger Right Upper Tibia Moment Y  
Passenger Right Upper Tibia Force Z  
Passenger Right Lower Tibia Moment X  
Passenger Right Lower Tibia Moment Y  
Passenger Right Lower Tibia Force Z  
Passenger Left Foot Fore Z  
Passenger Left Foot Aft X  
Passenger Left Foot Aft Z

Passenger Right Foot Fore Z  
Passenger Right Foot Aft X  
Passenger Right Foot Aft Z  
Passenger Shoulder Belt Force  
Passenger Lap Belt Force  
Passenger Head Angular Velocity X  
Passenger Head Angular Velocity Y  
Passenger Head Angular Velocity Z  
Left Rear Seat Crossmember X  
Left Rear Seat Crossmember Z  
Right Rear Seat Crossmember X  
Right Rear Seat Crossmember Z  
Left Rear Seat Crossmember X Redundant  
Right Rear Seat Crossmember X Redundant  
Vehicle Engine Top X  
Vehicle Engine Bottom X  
Load Cell Barrier Forces and Moments

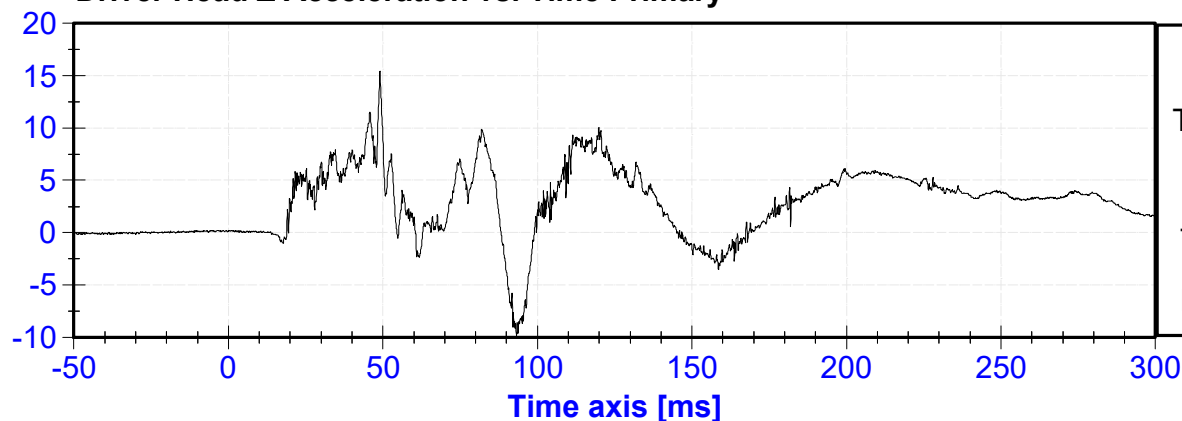
Driver Head X Acceleration vs. Time Primary



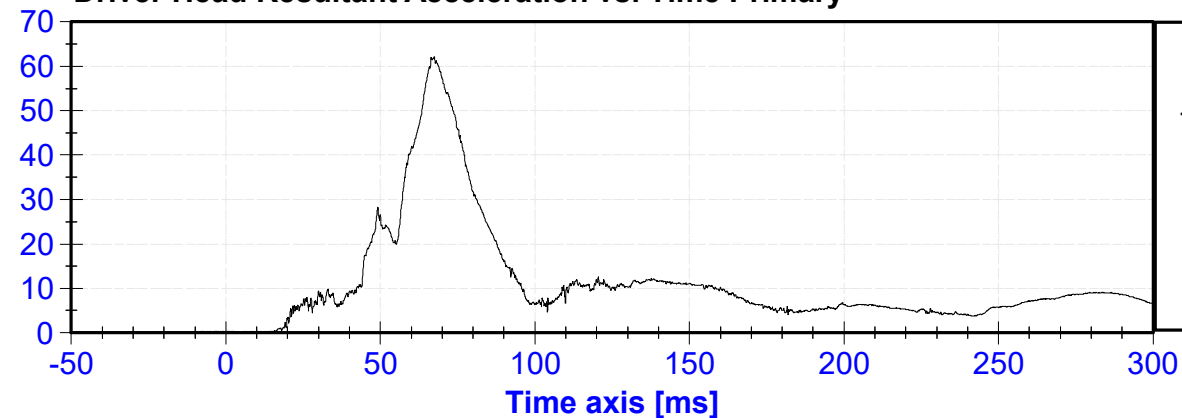
Driver Head Y Acceleration vs. Time Primary



Driver Head Z Acceleration vs. Time Primary

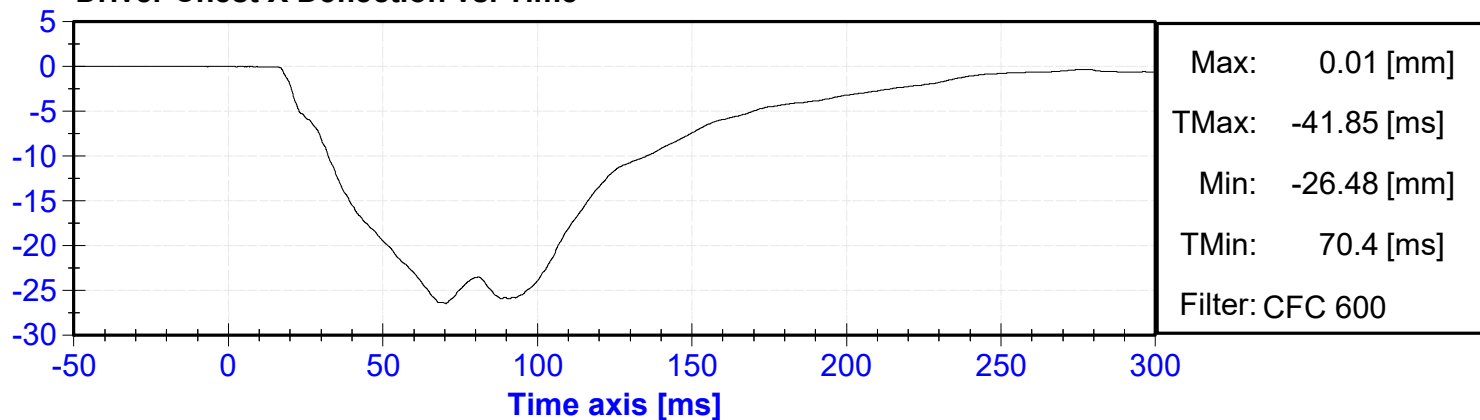


Driver Head Resultant Acceleration vs. Time Primary

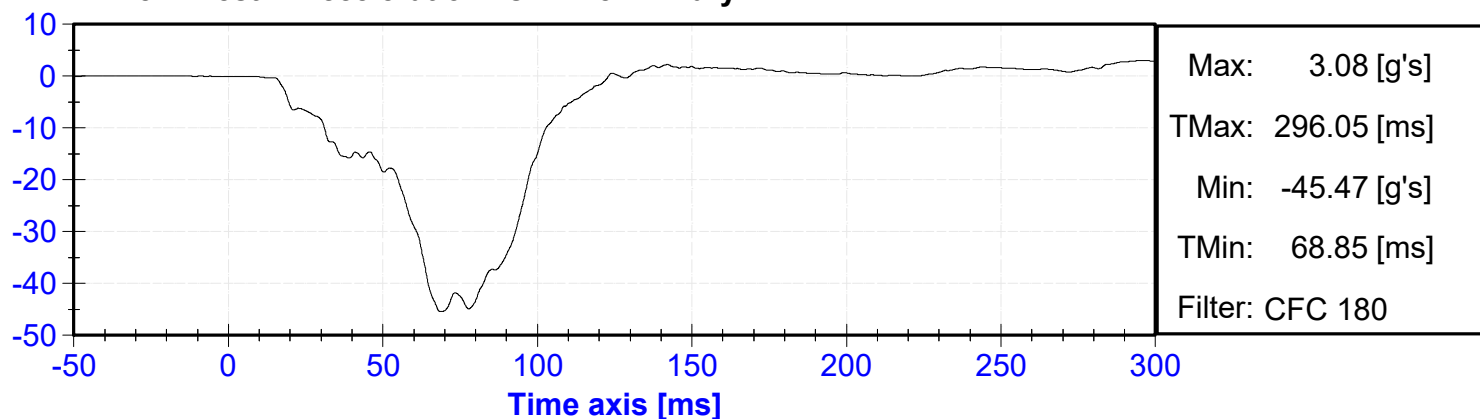




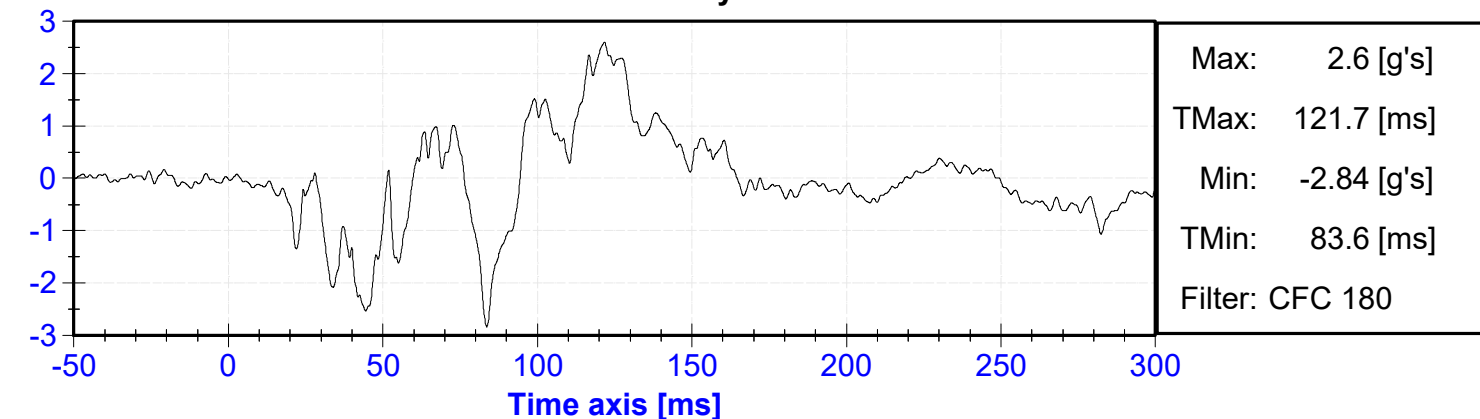
Driver Chest X Deflection vs. Time



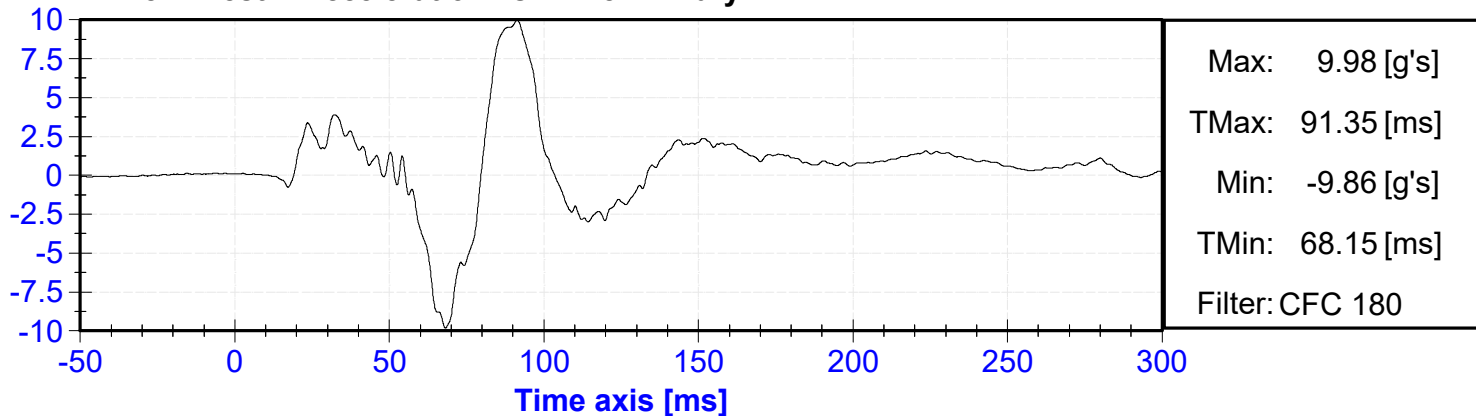
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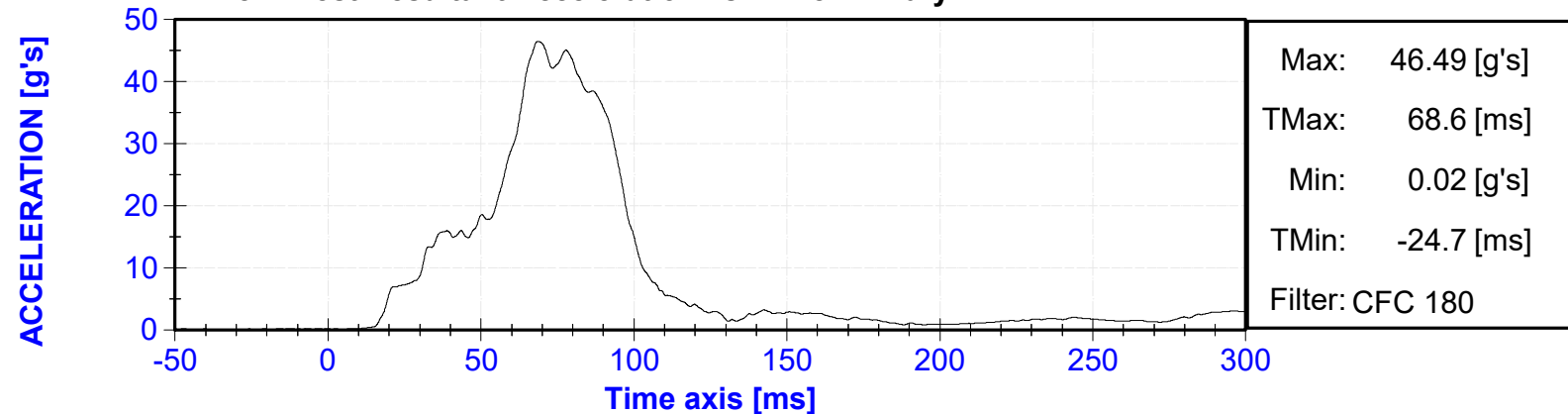
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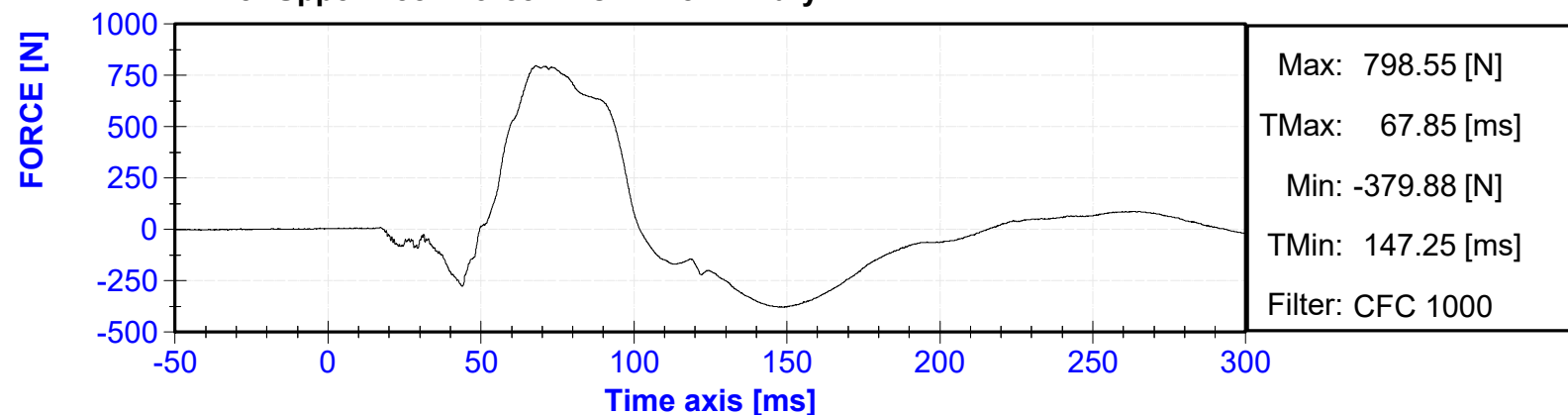
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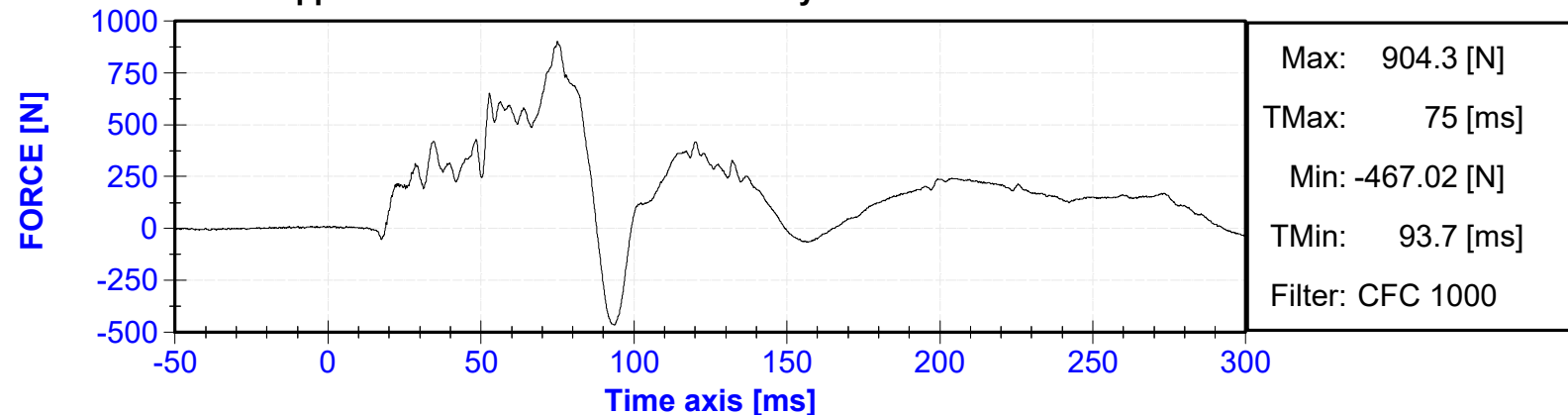
Driver Chest Resultant Acceleration vs. Time Primary



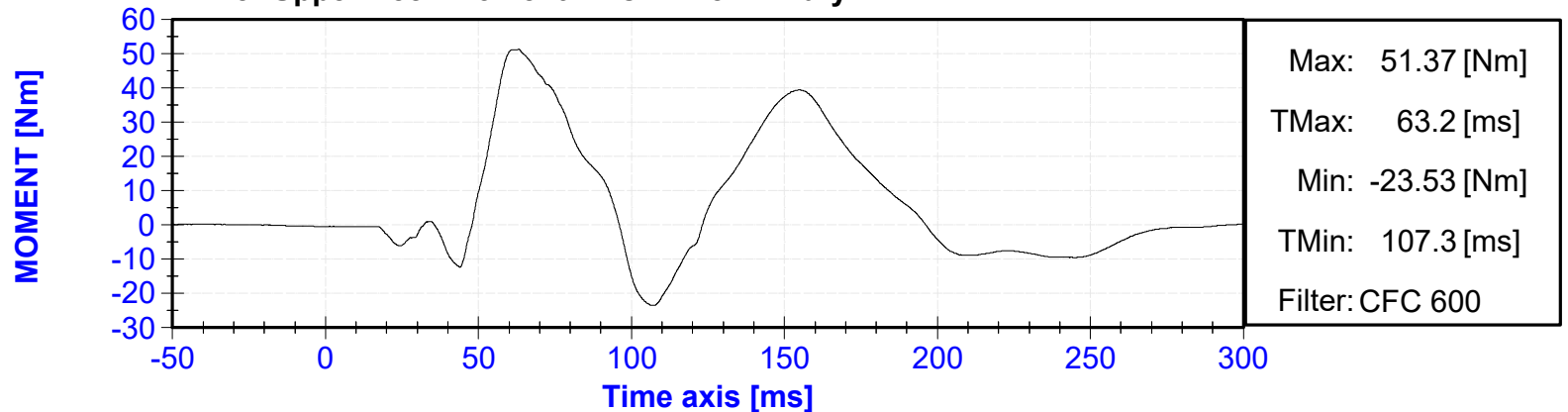
Driver Upper Neck Force X vs. Time Primary



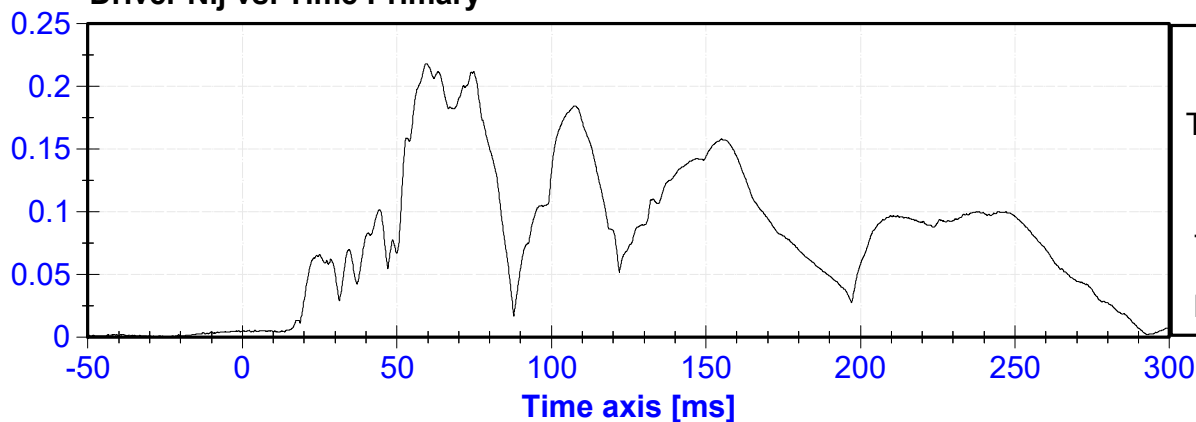
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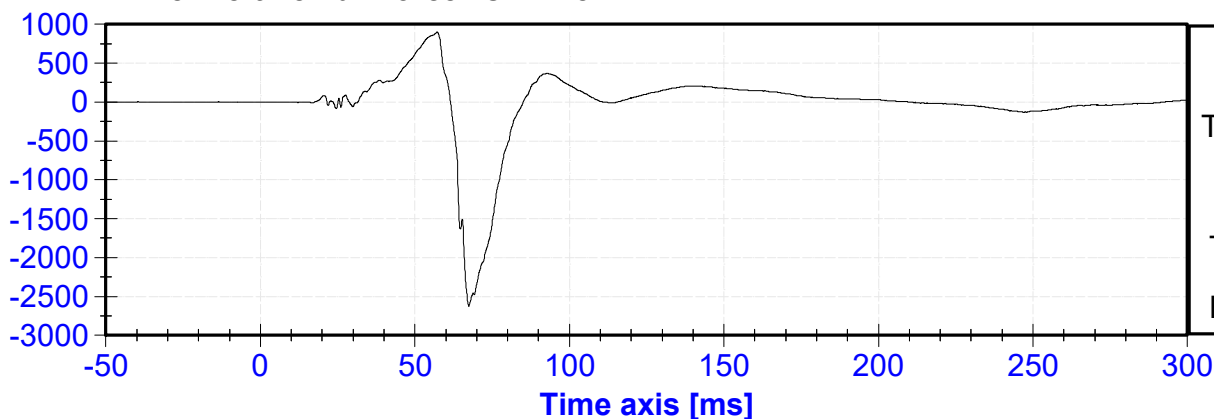
Driver Upper Neck Moment Y vs. Time Primary



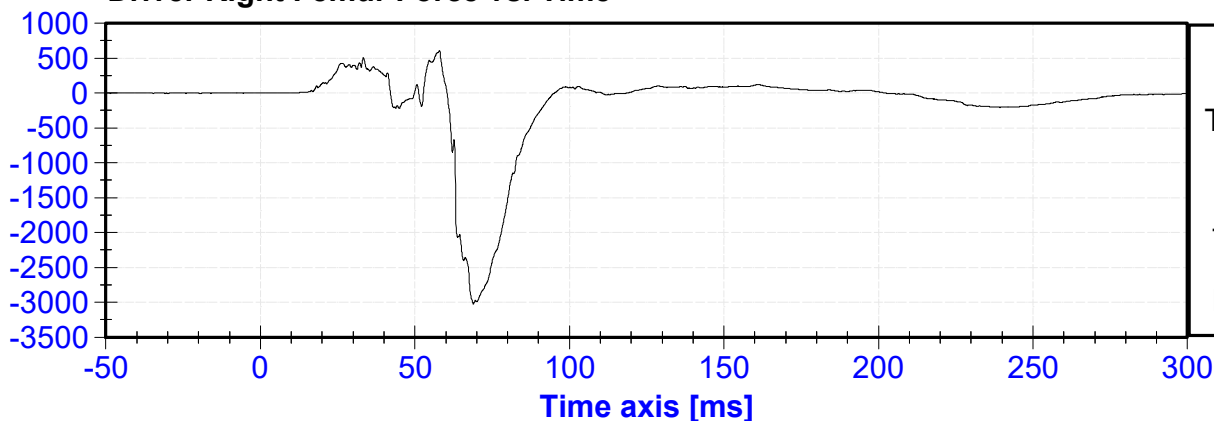
Driver Nij vs. Time Primary



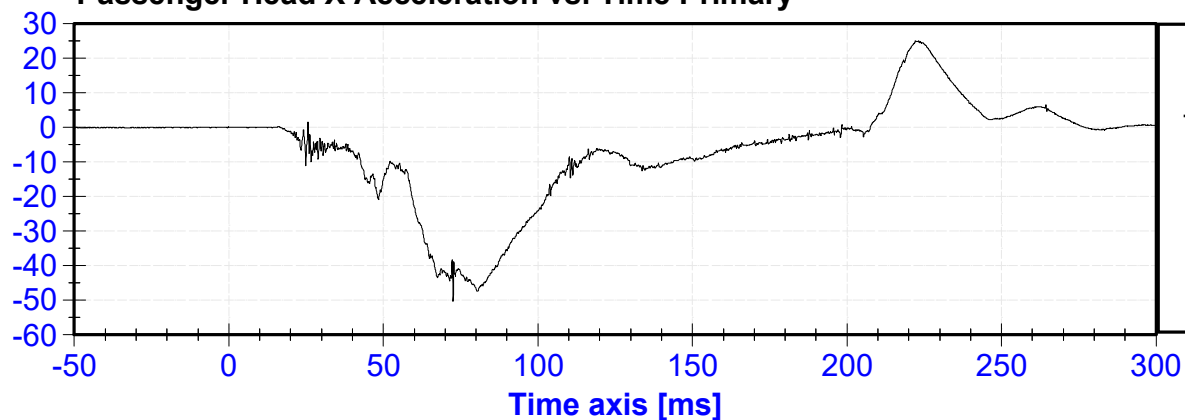
Driver Left Femur Force vs. Time



Driver Right Femur Force vs. Time

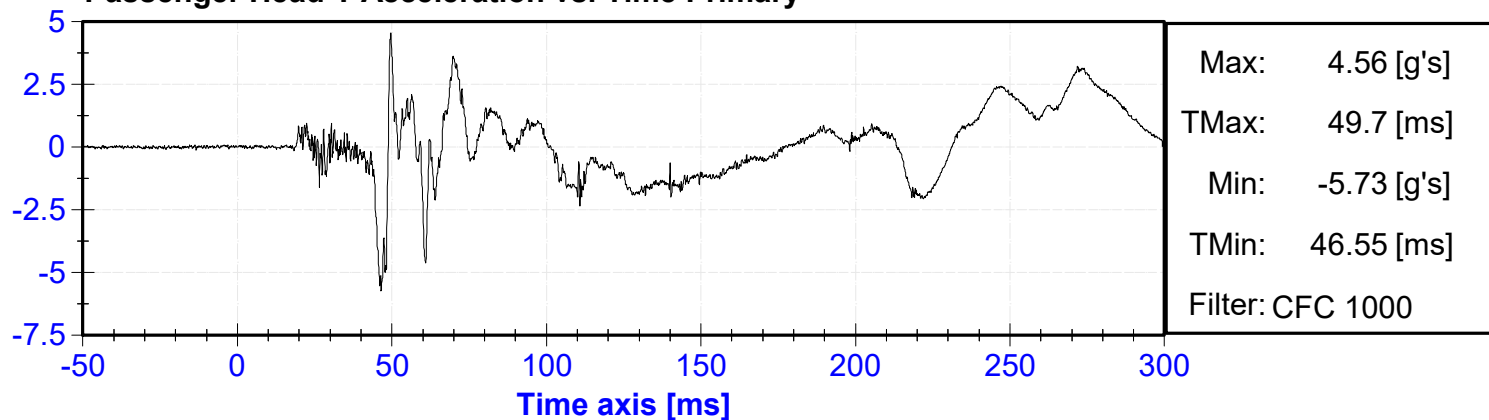


Passenger Head X Acceleration vs. Time Primary

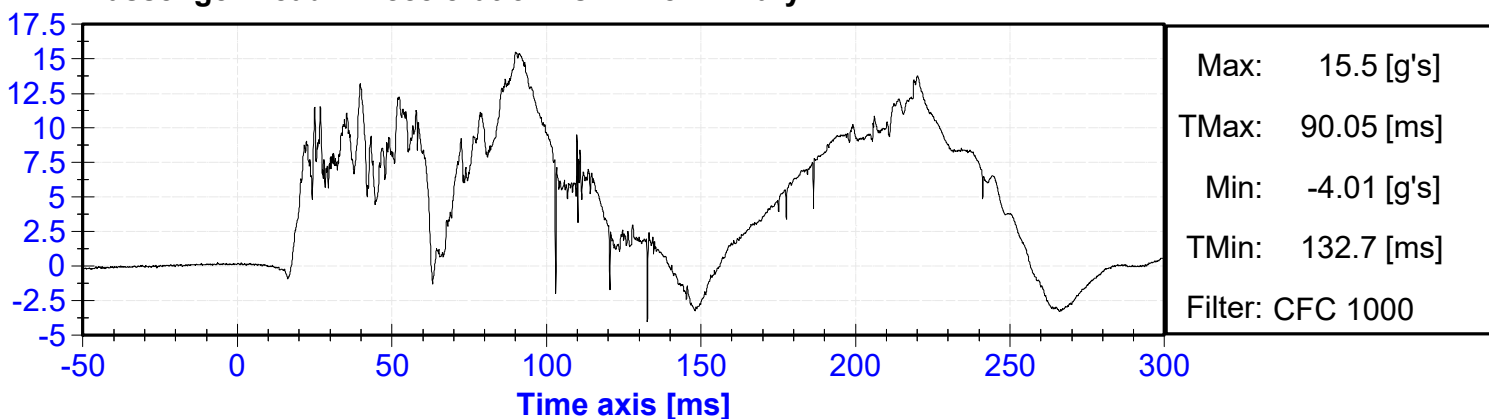




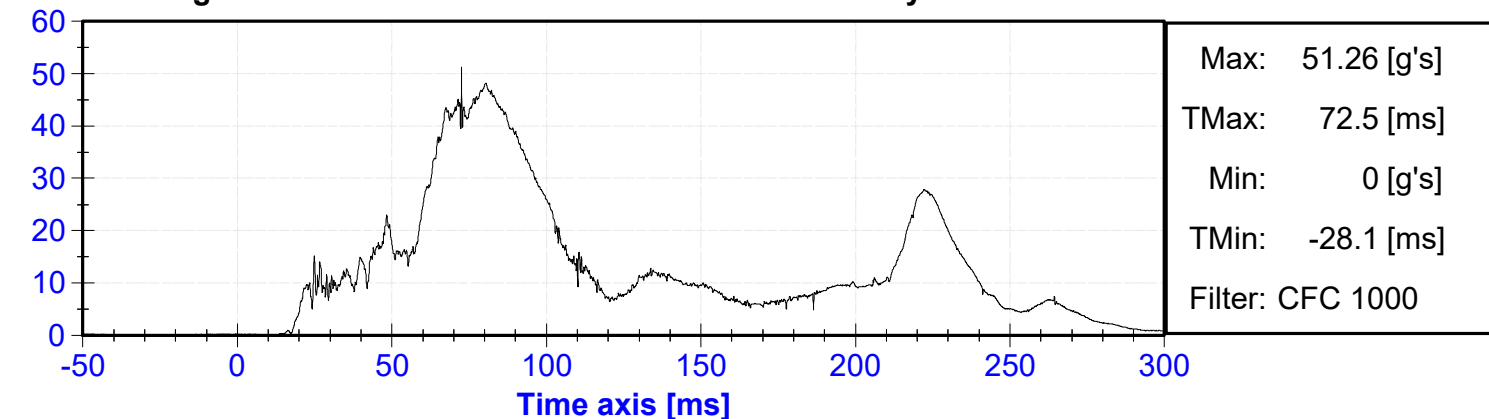
Passenger Head Y Acceleration vs. Time Primary



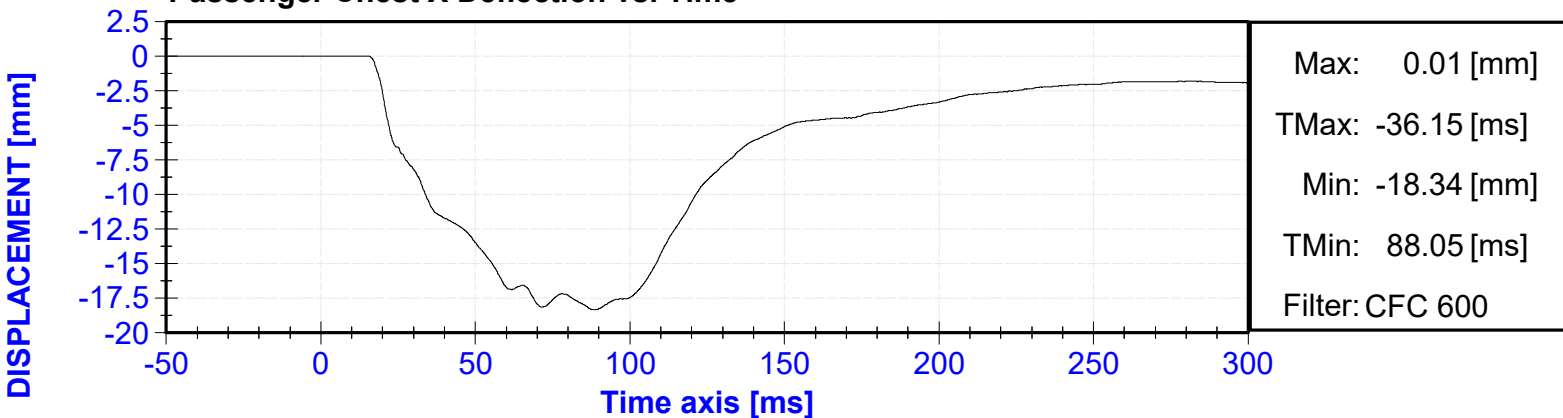
Passenger Head Z Acceleration vs. Time Primary



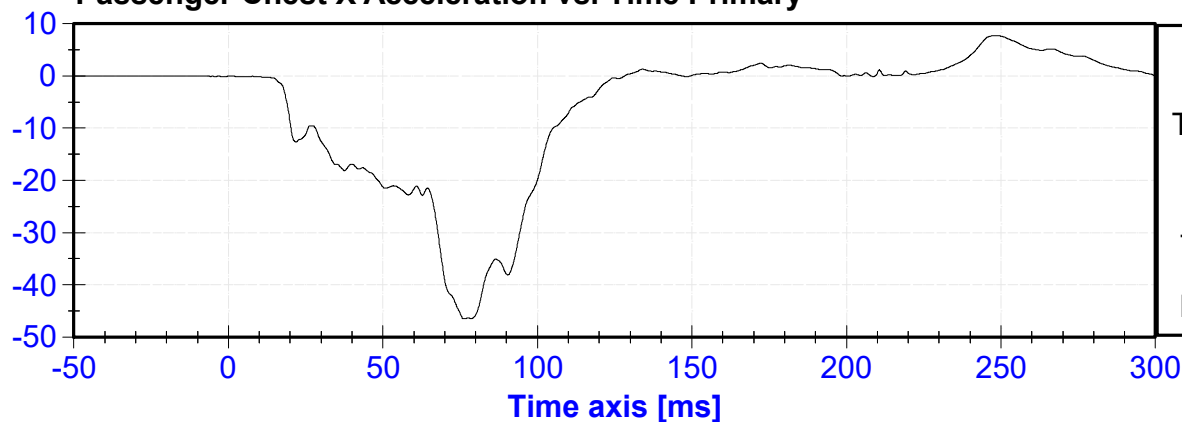
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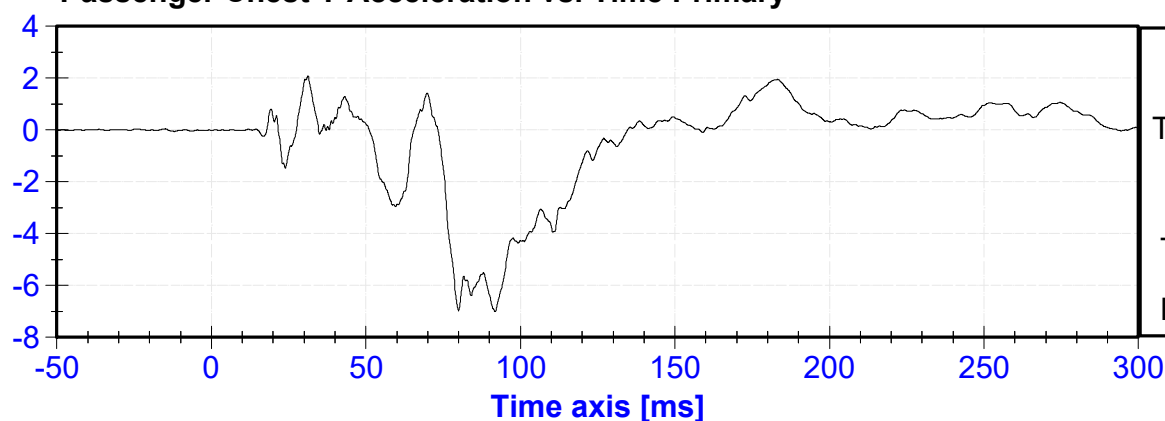
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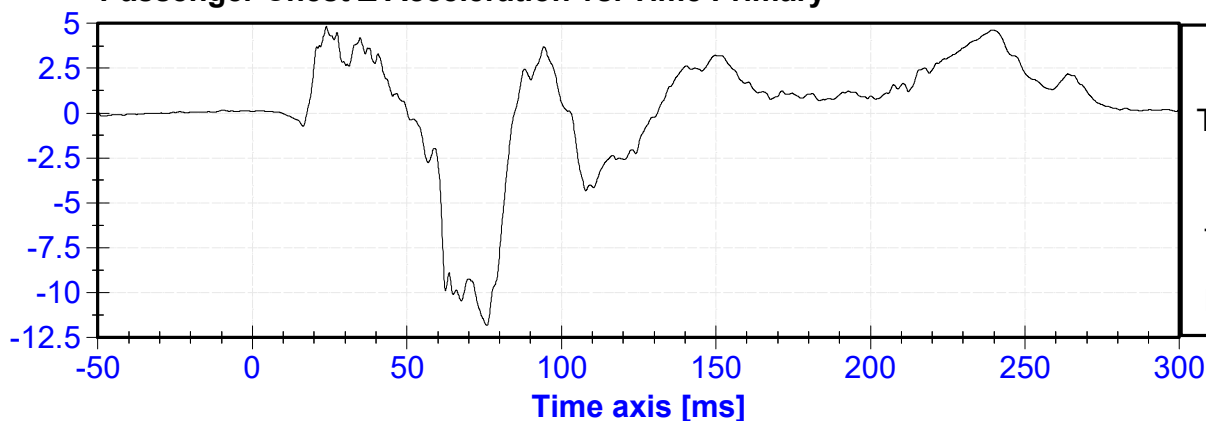
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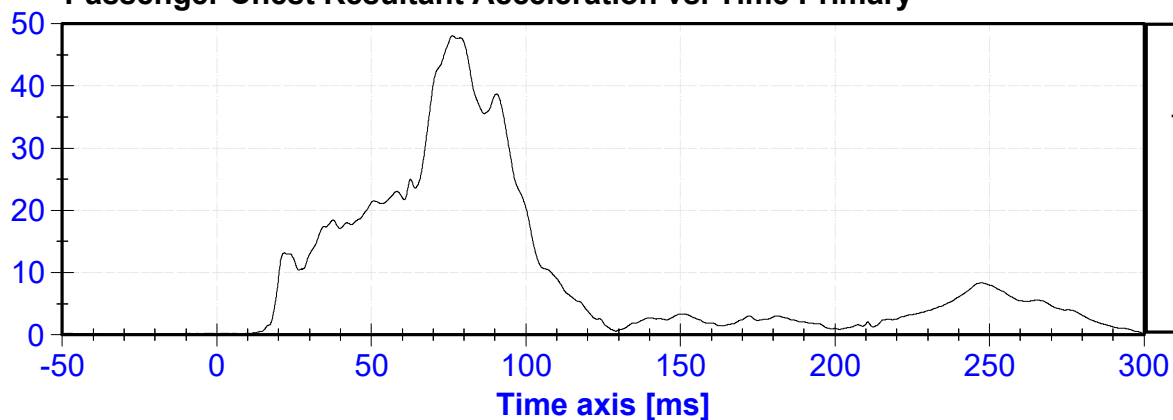
Passenger Chest Y Acceleration vs. Time Primary



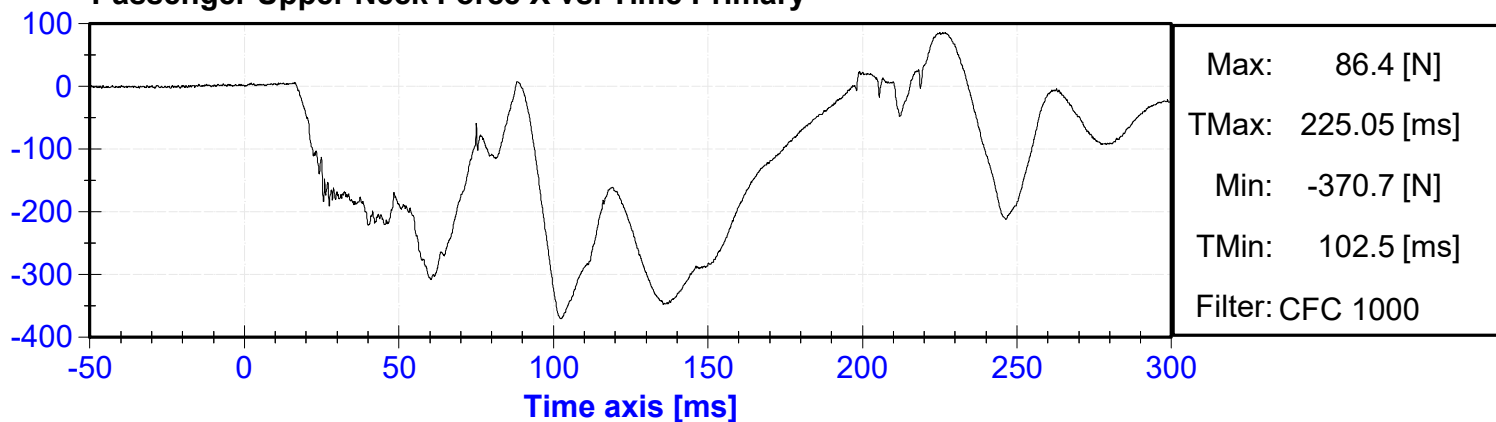
Passenger Chest Z Acceleration vs. Time Primary



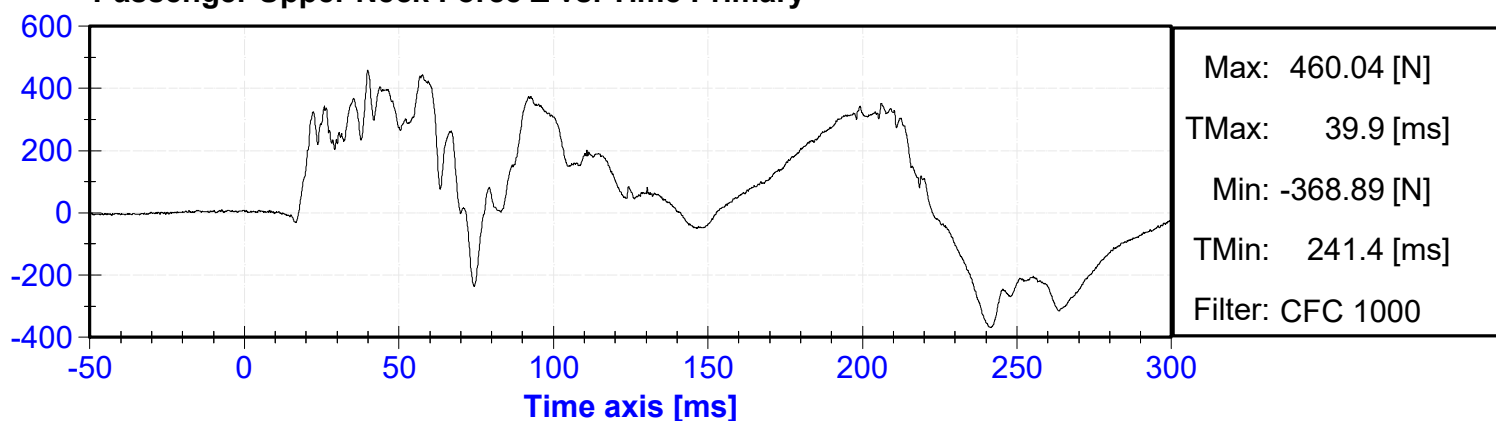
Passenger Chest Resultant Acceleration vs. Time Primary



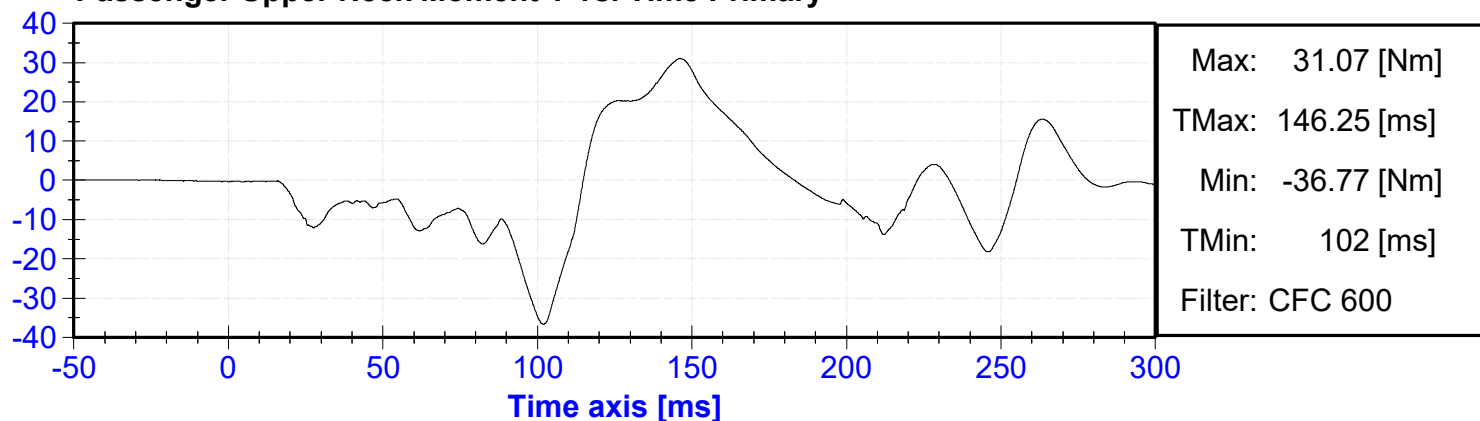
Passenger Upper Neck Force X vs. Time Primary



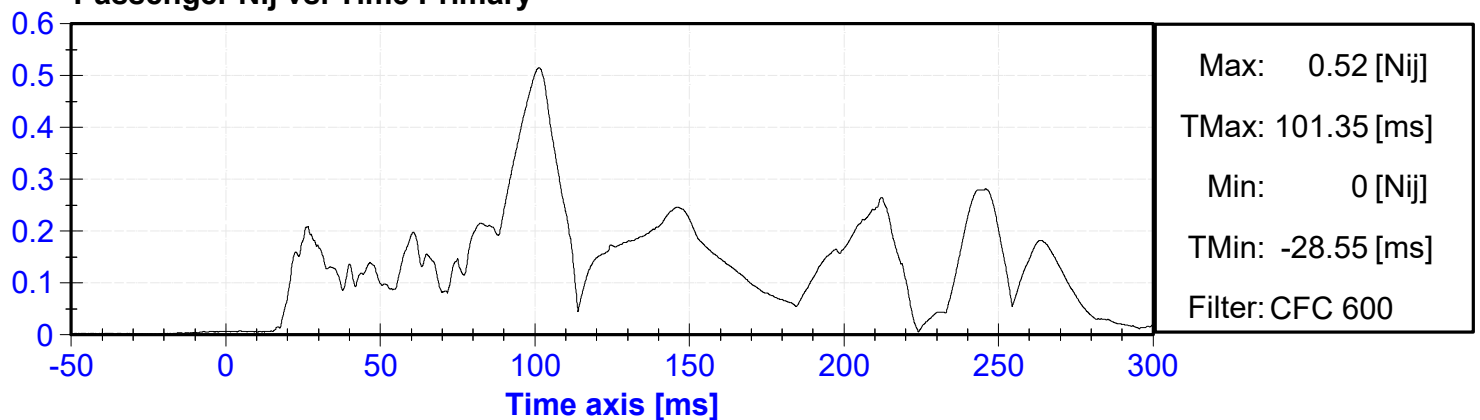
Passenger Upper Neck Force Z vs. Time Primary



Passenger Upper Neck Moment Y vs. Time Primary

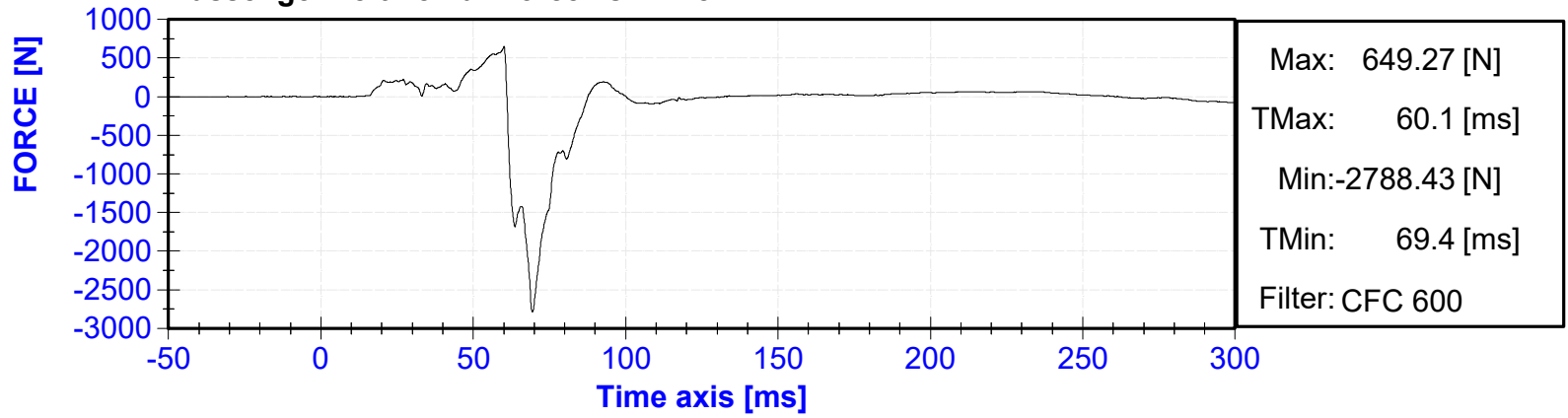


Passenger Nij vs. Time Primary

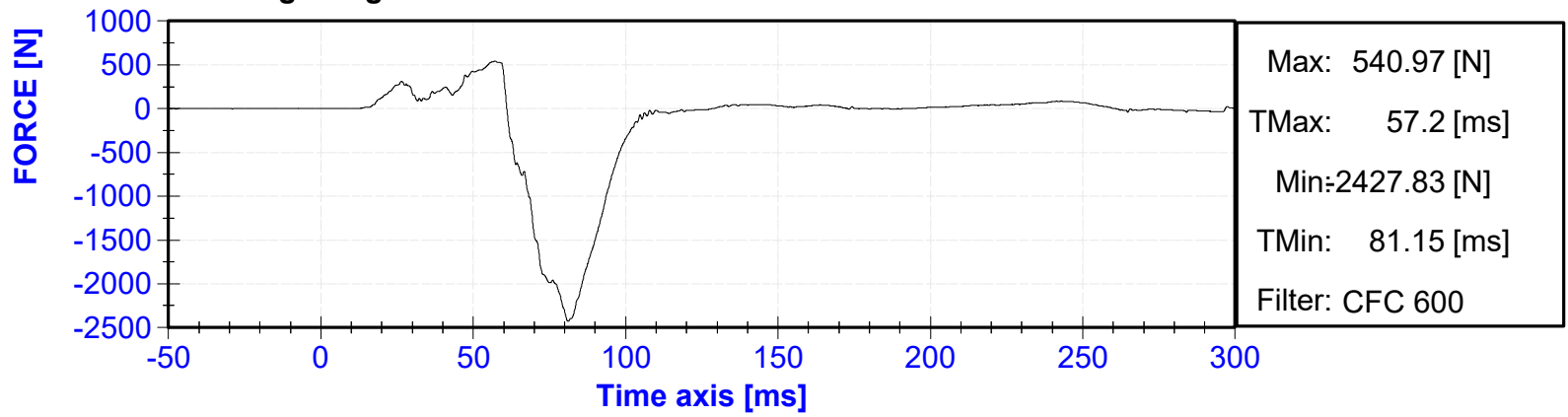




Passenger Left Femur Force vs. Time



Passenger Right Femur Force vs. Time



## **APPENDIX C**

### **DUMMY CALIBRATION AND PERFORMANCE VERIFICATION DATA**

**CALIBRATION TEST RESULTS**

**PRE-TEST**

**HYBRID III 50<sup>TH</sup> PERCENTILE MALE - DRIVER ATD**

**SERIAL NO: 142**



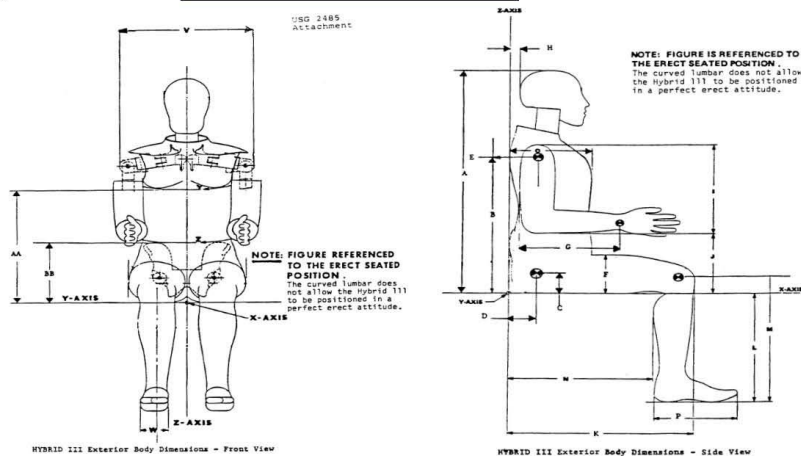


## External Measurements - Hybrid 3 - 50th Male

Technician: K. Brogan

Date: 05/17/2022

Dummy Serial Number: 142



| Symbol | Description                              | Specification (in) |      | Result (in) | Pass/Fail |
|--------|------------------------------------------|--------------------|------|-------------|-----------|
| A      | Sitting Height                           | 34.6               | 35.0 | 34.8        | Pass      |
| B      | Shoulder Pivot Height                    | 19.9               | 20.5 | 20.2        | Pass      |
| C      | H-Point Height                           | 3.3                | 3.5  | 3.4         | Pass      |
| D      | H-Point from Backline                    | 5.3                | 5.5  | 5.4         | Pass      |
| E      | Shoulder Pivot from Backline             | 3.3                | 3.7  | 3.5         | Pass      |
| F      | Thigh Clearance                          | 5.5                | 6.1  | 5.8         | Pass      |
| G      | Back of Elbow to Wrist Pivot             | 11.4               | 12.0 | 11.6        | Pass      |
| H      | Head Back to Backline                    | 1.6                | 1.8  | 1.7         | Pass      |
| I      | Shoulder to Elbow Length                 | 13.0               | 13.6 | 13.5        | Pass      |
| J      | Elbow Rest Height                        | 7.5                | 8.3  | 8.1         | Pass      |
| K      | Buttock to Knee Length                   | 22.8               | 23.8 | 23.0        | Pass      |
| L      | Popliteal Height                         | 16.9               | 17.9 | 17.2        | Pass      |
| M      | Knee Pivot Height                        | 19.1               | 19.7 | 19.5        | Pass      |
| N      | Buttock Popliteal Length                 | 17.8               | 18.8 | 18.3        | Pass      |
| O      | Chest Depth without Jacket               | 8.4                | 9.0  | 8.8         | Pass      |
| P      | Foot Length (right)                      | 9.9                | 10.5 | 10.2        | Pass      |
| V      | Shoulder Breadth                         | 16.3               | 17.2 | 16.8        | Pass      |
| W      | Foot Breadth                             | 3.6                | 4.2  | 4.0         | Pass      |
| Y      | Chest Circumference with Jacket          | 38.2               | 39.4 | 39.0        | Pass      |
| Z      | Waist Circumference                      | 32.9               | 34.1 | 33.5        | Pass      |
| AA     | Reference Location (Chest Circumference) | 16.9               | 17.1 | 17.0        | Pass      |
| BB     | Reference Location (Waist Circumference) | 8.9                | 9.1  | 9.0         | Pass      |

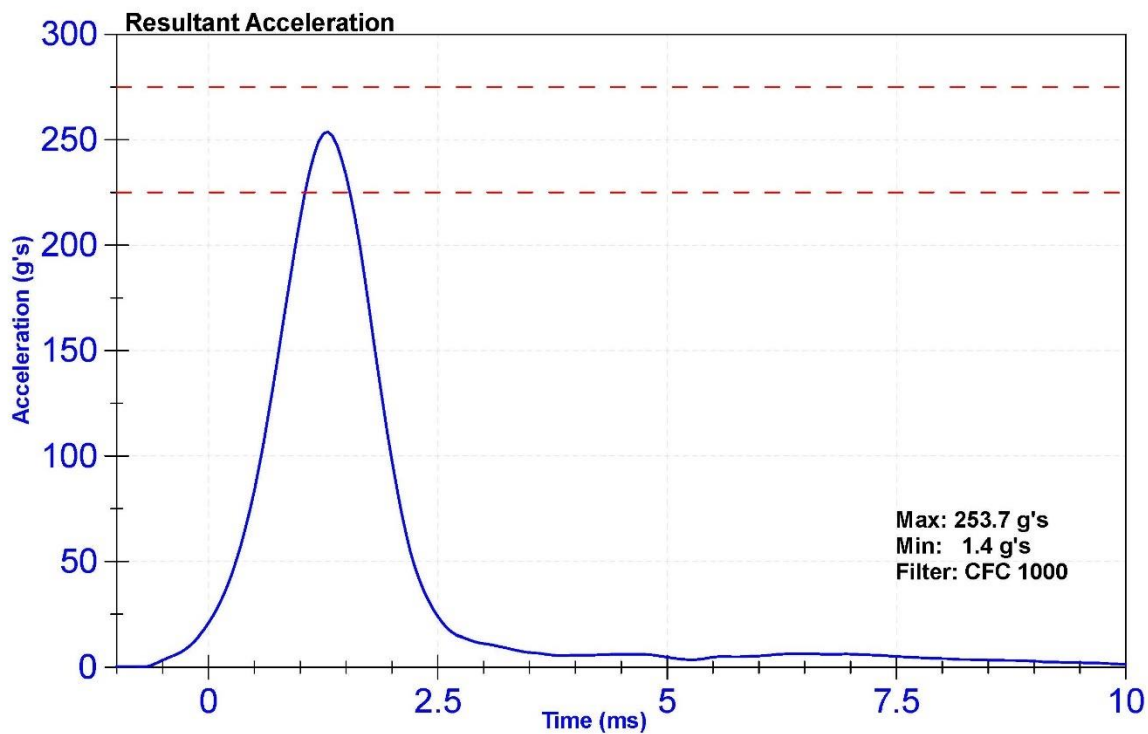
|                   |            |                       |            |
|-------------------|------------|-----------------------|------------|
| ATD Manufacturer  | Humanetics | Test Technician       | C. Mantell |
| ATD Serial Number | 142        | Laboratory Supervisor | K. Brogan  |

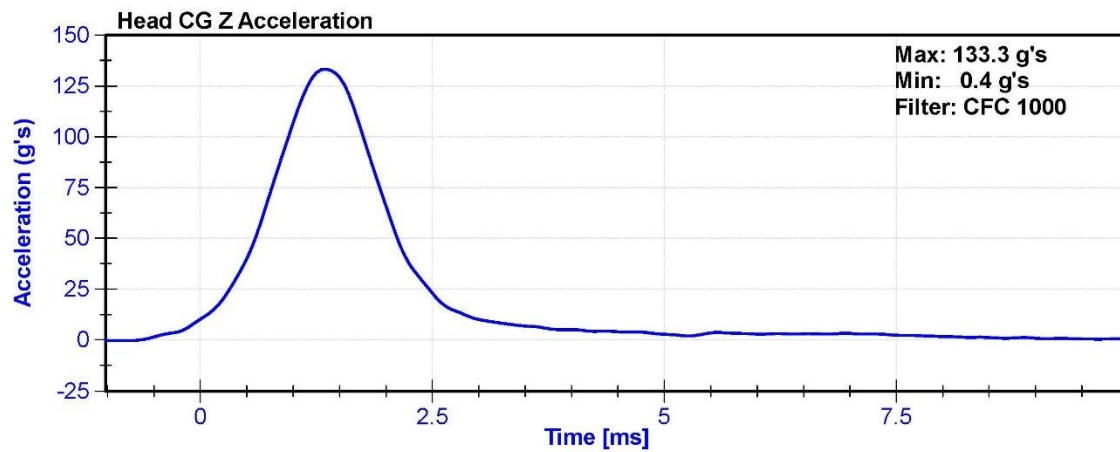
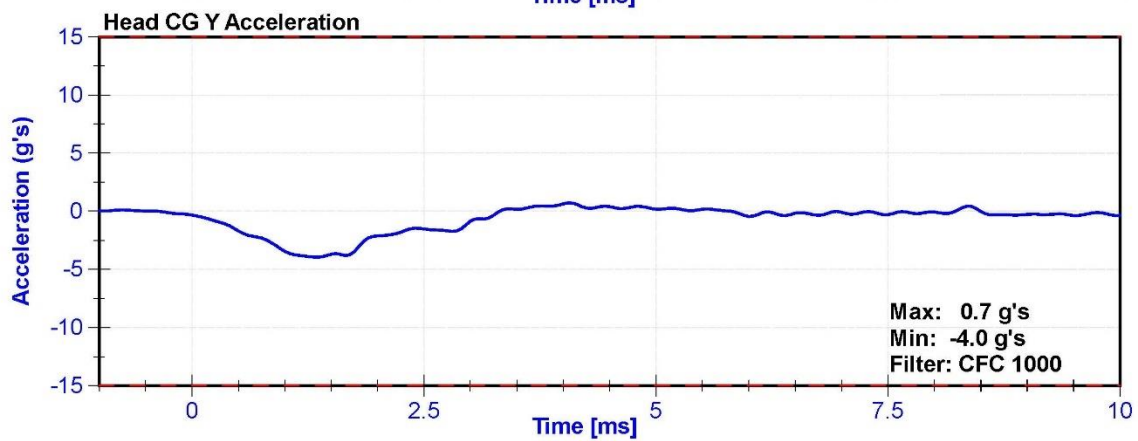
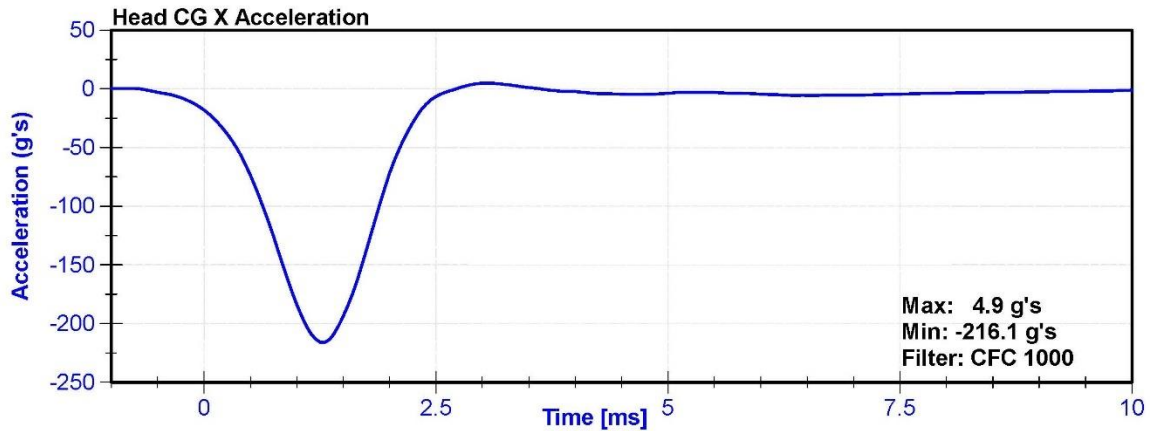
#### Results

| Test Parameter         | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|------------------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature            | 18.9                  | 25.6                  | °C   | 21.4   | Pass      |
| Humidity               | 10                    | 70                    | %    | 40.1   | Pass      |
| Resultant Acceleration | 225                   | 275                   | g's  | 253.7  | Pass      |
| Oscillation            | 0                     | 10                    | %    | 2.5    | Pass      |
| Lateral Acceleration   | -15                   | 15                    | g's  | -4.0   | Pass      |

#### Transducer Calibrations

| Channel         | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|-----------------|--------------|---------------|------------------|----------------------|
| X Accelerometer | Endevco      | P51681        | 5/10/2022        | 11/6/2022            |
| Y Accelerometer | Endevco      | P64151        | 5/10/2022        | 11/6/2022            |
| Z Accelerometer | Endevco      | P52114        | 5/10/2022        | 11/6/2022            |







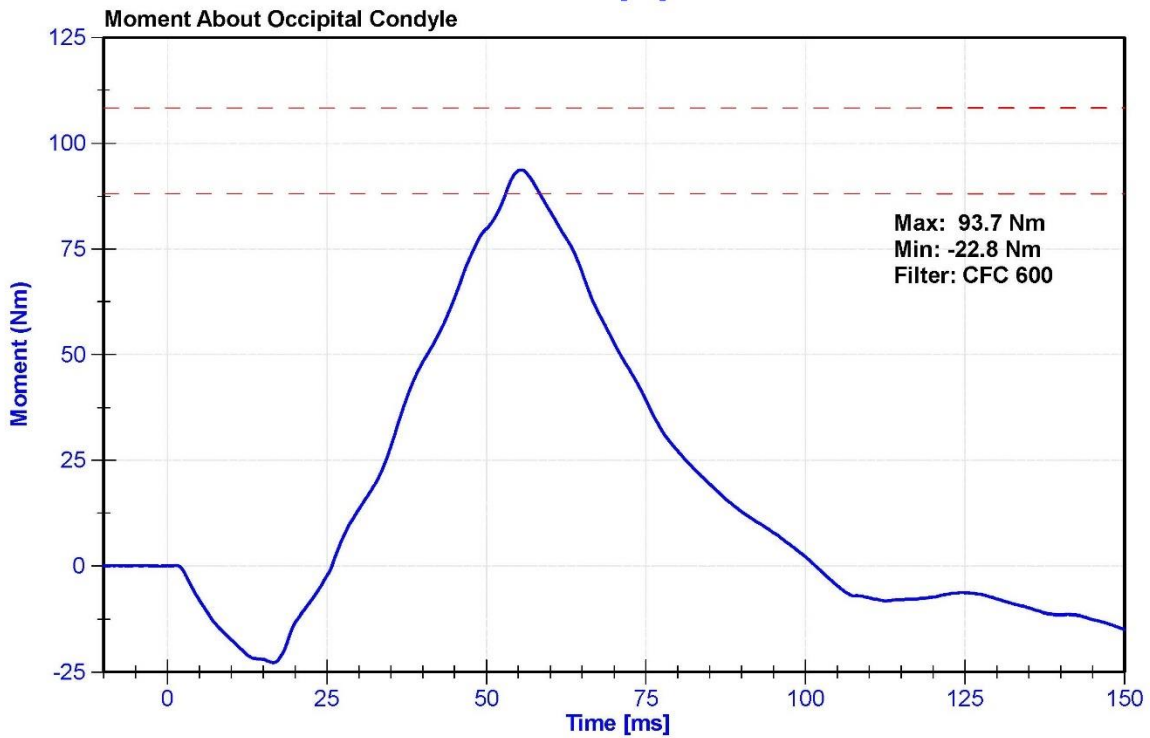
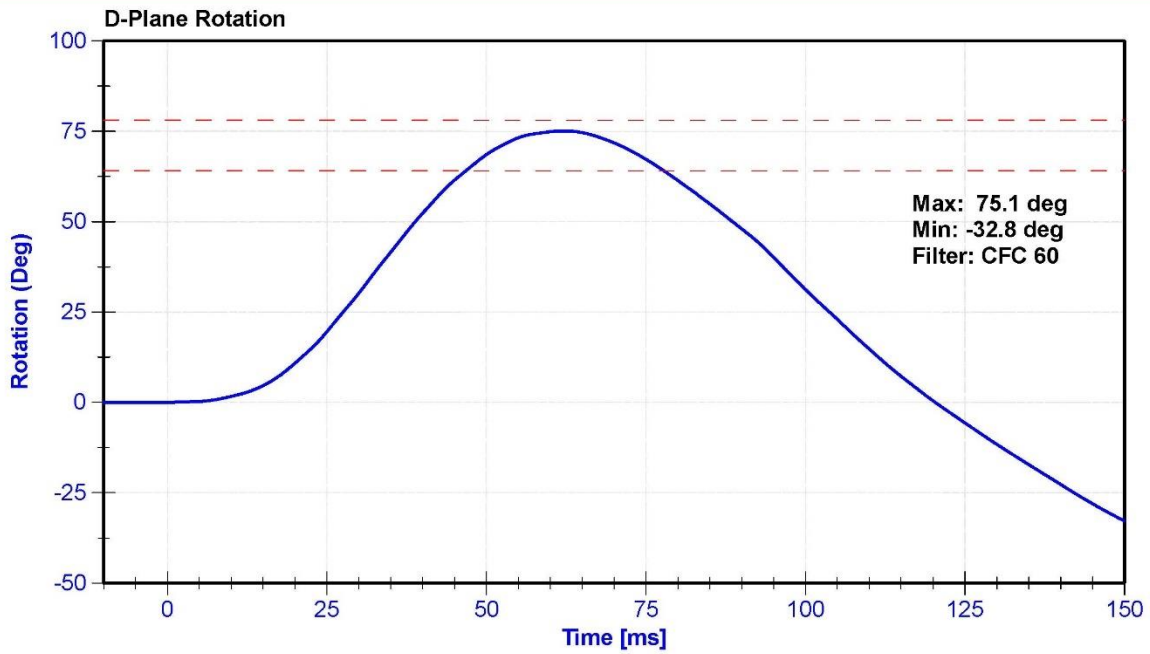
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|-------------------|------------|-----------------------|------------|
| ATD Manufacturer  | Humanetics | Test Technician       | C. Mantell |
| ATD Serial Number | 142        | Laboratory Supervisor | C. Mantell |

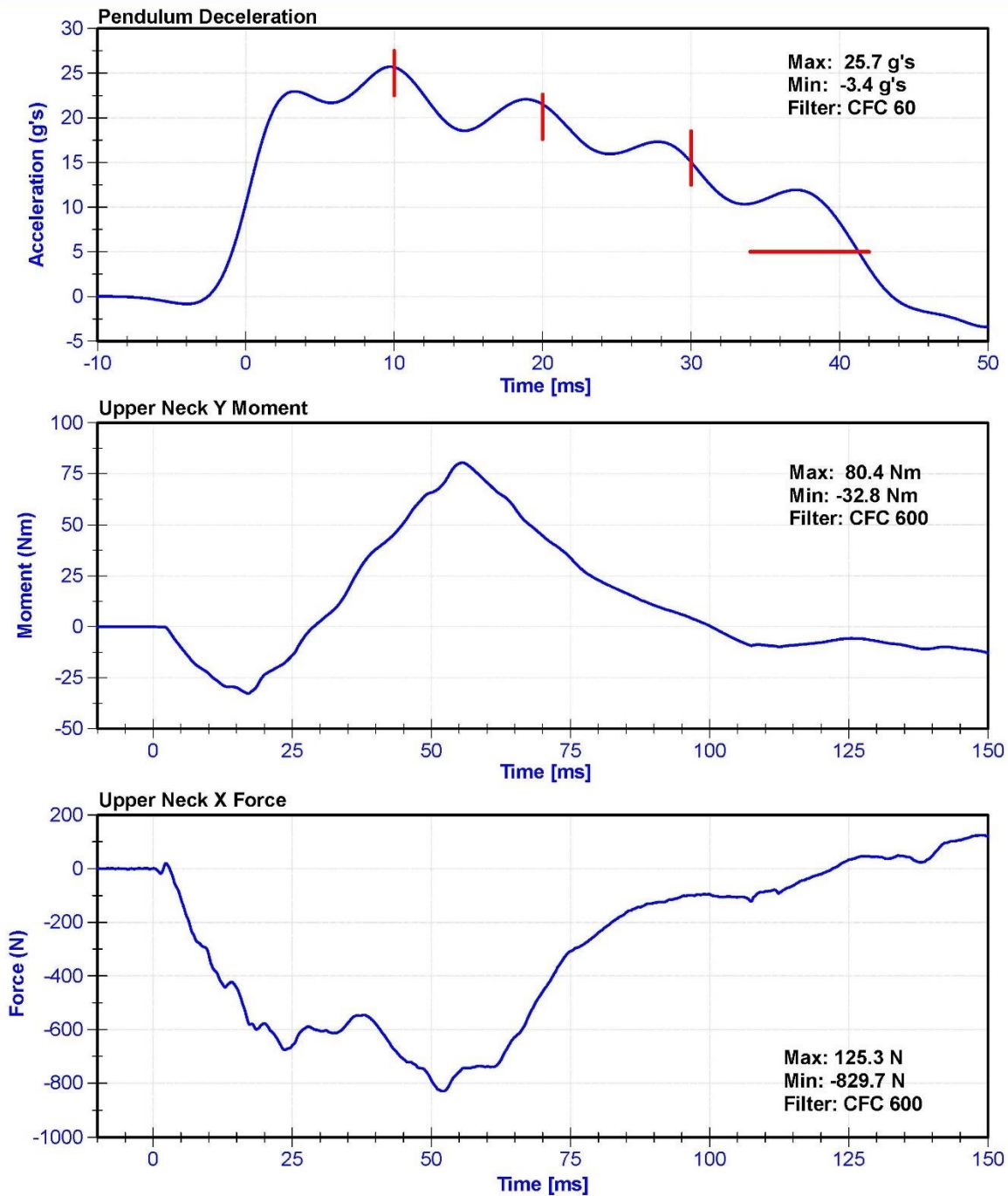
#### Results

| Test Parameter                        | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---------------------------------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature                           | 20.6                  | 22.2                  | °C   | 21.2   | Pass      |
| Humidity                              | 10                    | 70                    | %    | 45.6   | Pass      |
| Velocity                              | 6.89                  | 7.13                  | m/s  | 6.922  | Pass      |
| Pendulum Deceleration at 10ms         | 22.5                  | 27.5                  | g's  | 25.65  | Pass      |
| Pendulum Deceleration at 20ms         | 17.6                  | 22.6                  | g's  | 21.49  | Pass      |
| Pendulum Deceleration at 30ms         | 12.5                  | 18.5                  | g's  | 15.03  | Pass      |
| Max. Pendulum Deceleration After 30ms | 0                     | 29                    | g's  | 25.7   | Pass      |
| Pendulum Deceleration Time to 5 g's   | 34                    | 42                    | ms   | 41.3   | Pass      |
| Maximum D Plane Rotation              | 64                    | 78                    | deg  | 75.1   | Pass      |
| Time to Maximum Rotation              | 57                    | 64                    | ms   | 62.1   | Pass      |
| Rotation Decay to Zero                | 113                   | 127                   | ms   | 120.4  | Pass      |
| Moment About Occipital Condyle        | 88.1                  | 108.4                 | Nm   | 93.70  | Pass      |
| Time to Maximum Moment                | 47                    | 58                    | ms   | 55.4   | Pass      |
| Moment Decay to Zero                  | 97                    | 107                   | ms   | 101.6  | Pass      |

#### Transducer Calibrations

| Channel                | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|------------------------|--------------|---------------|------------------|----------------------|
| Pendulum Accelerometer | Endevco      | 7231CT        | 10/28/2021       | 10/28/2022           |
| Pendulum Potentiometer | ETI          | LABPOT1       | 5/9/2022         | 5/9/2023             |
| Condyle Potentiometer  | ETI          | LABPOT2       | 5/9/2022         | 5/9/2023             |
| Upper Neck Load Cell   | FTSS         | 280-FX        | 9/14/2021        | 9/14/2022            |







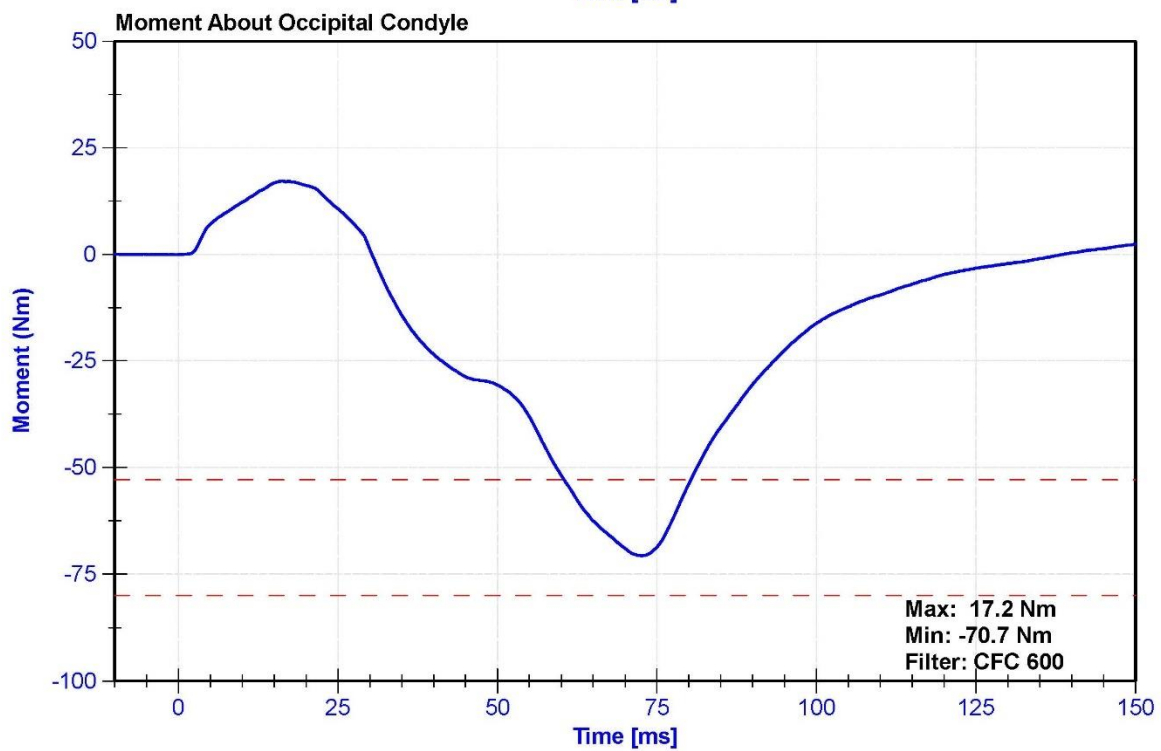
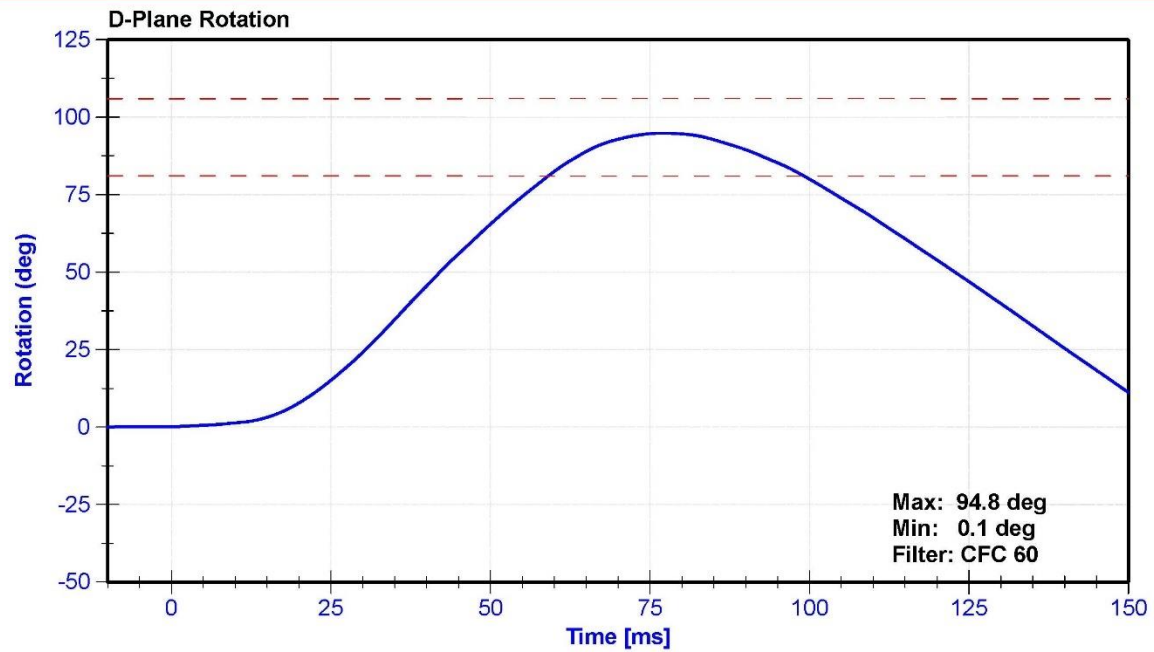
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|-------------------|------------|-----------------------|------------|
| ATD Manufacturer  | Humanetics | Test Technician       | C. Mantell |
| ATD Serial Number | 142        | Laboratory Supervisor | C. Mantell |

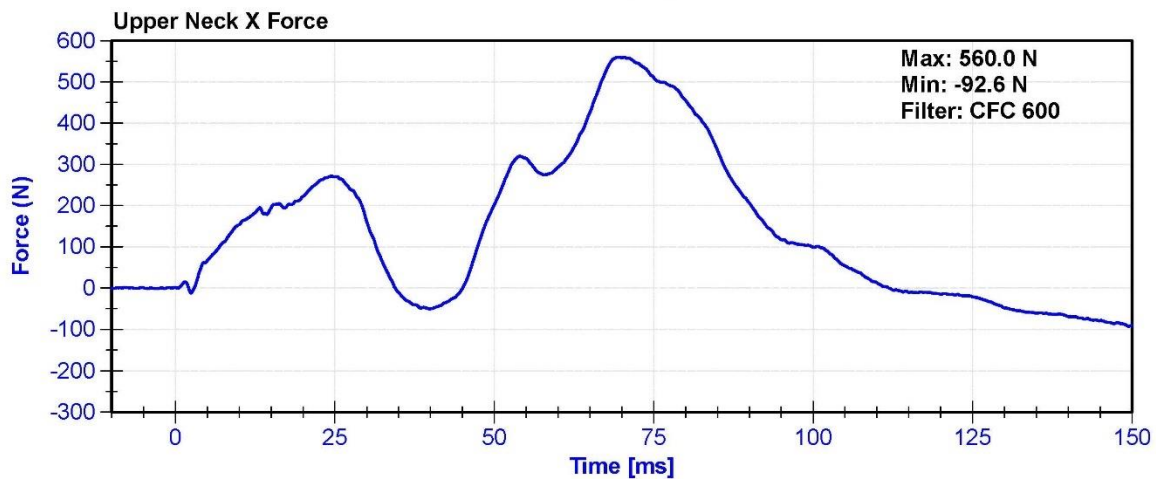
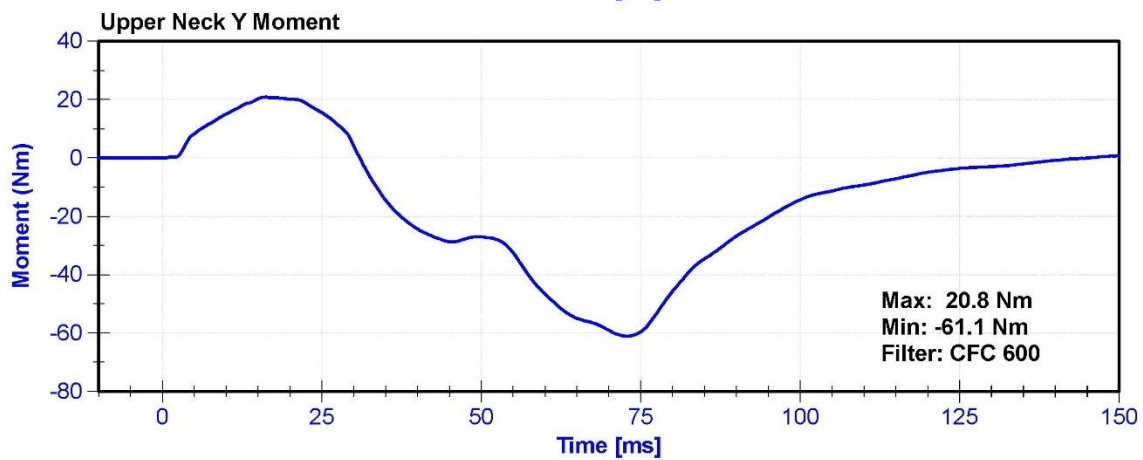
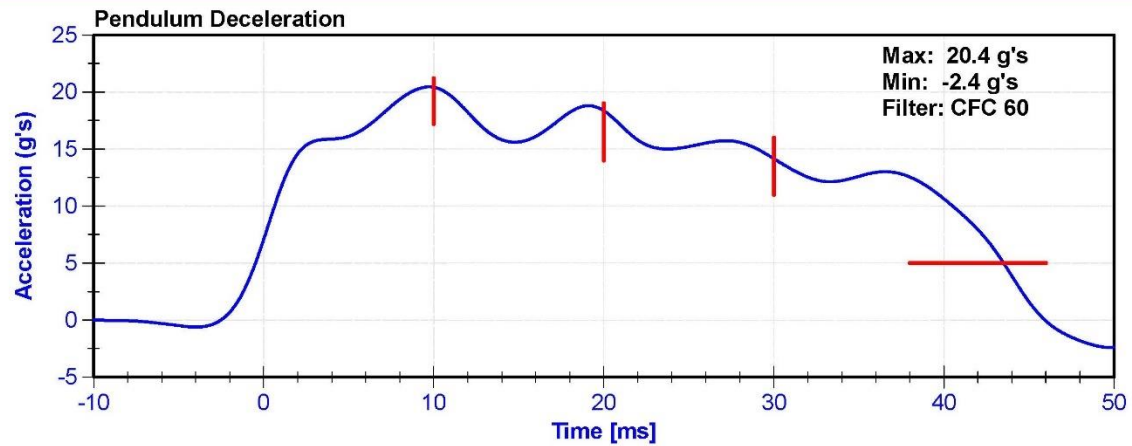
#### Results

| Test Parameter                        | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---------------------------------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature                           | 20.6                  | 22.2                  | °C   | 21.5   | Pass      |
| Humidity                              | 10                    | 70                    | %    | 45.1   | Pass      |
| Velocity                              | 5.94                  | 6.19                  | m/s  | 6.080  | Pass      |
| Pendulum Deceleration at 10ms         | 17.2                  | 21.2                  | g's  | 20.40  | Pass      |
| Pendulum Deceleration at 20ms         | 14                    | 19                    | g's  | 18.3   | Pass      |
| Pendulum Deceleration at 30ms         | 11                    | 16                    | g's  | 14.1   | Pass      |
| Max. Pendulum Deceleration After 30ms | 0                     | 22                    | g's  | 20.4   | Pass      |
| Pendulum Deceleration Time to 5 g's   | 38                    | 46                    | ms   | 43.5   | Pass      |
| Maximum D Plane Rotation              | 81                    | 106                   | deg  | 94.8   | Pass      |
| Time to Maximum Rotation              | 72                    | 82                    | ms   | 77.0   | Pass      |
| Rotation Decay to Zero                | 147                   | 174                   | ms   | 158.1  | Pass      |
| Minimum Moment About OC               | -80                   | -52.9                 | Nm   | -70.71 | Pass      |
| Time to Minimum Moment                | 65                    | 79                    | ms   | 72.6   | Pass      |
| Moment Decay to Zero                  | 120                   | 148                   | ms   | 138.7  | Pass      |

#### Transducer Calibrations

| Channel                | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|------------------------|--------------|---------------|------------------|----------------------|
| Pendulum Accelerometer | Endevco      | C16503        | 10/28/2021       | 10/28/2022           |
| Pendulum Potentiometer | ETI          | LABPOT1       | 5/9/2022         | 5/9/2023             |
| Condyle Potentiometer  | ETI          | LABPOT2       | 5/9/2022         | 5/9/2023             |
| Upper Neck Load Cell   | FTSS         | 280-FX        | 9/14/2021        | 9/14/2022            |







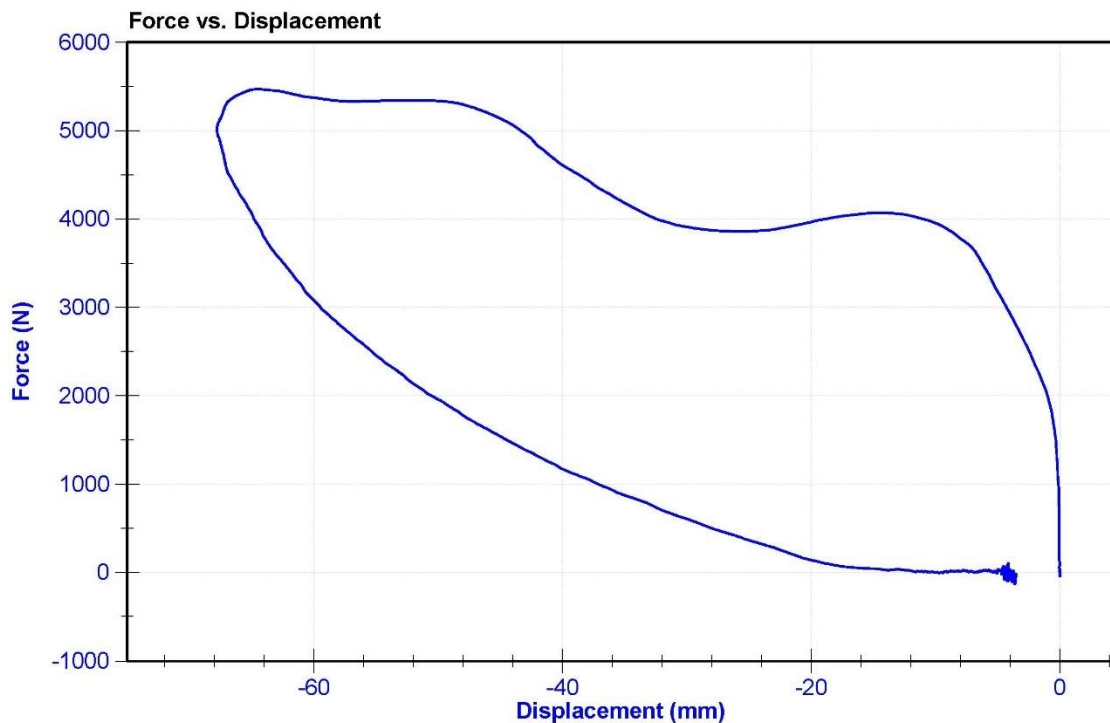
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|-------------------|------------|-----------------------|------------|
| ATD Manufacturer  | Humanetics | Test Technician       | S. Vacanti |
| ATD Serial Number | 142        | Laboratory Supervisor | K. Brogan  |

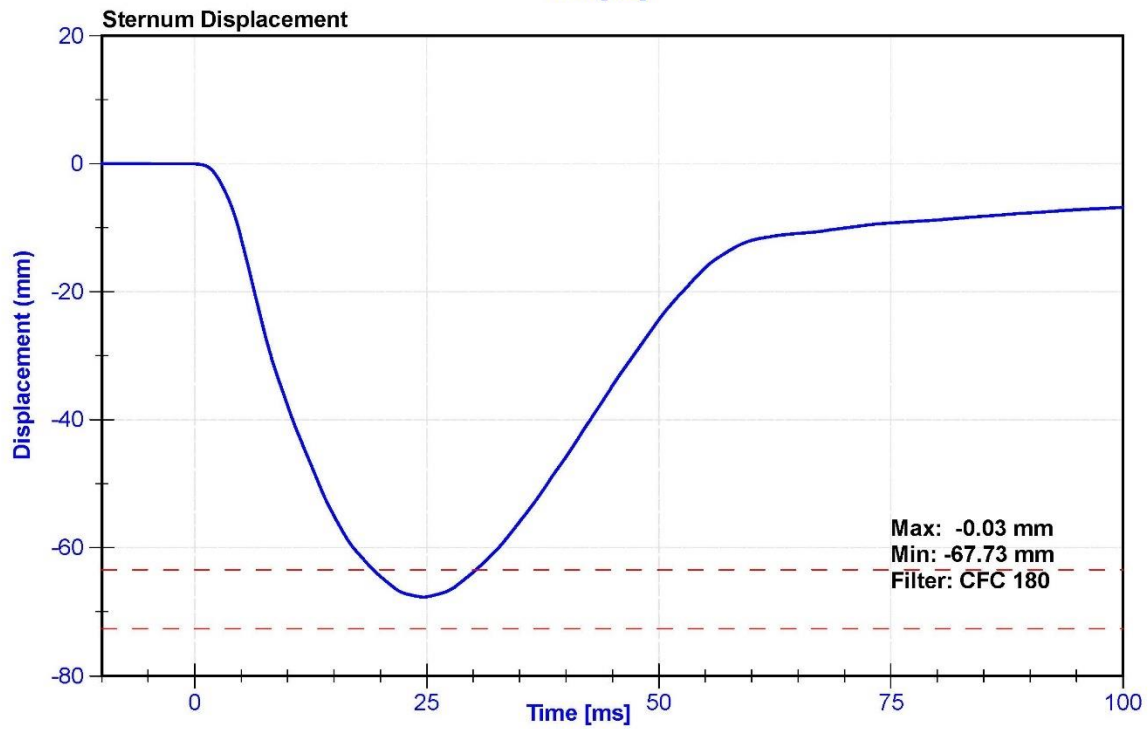
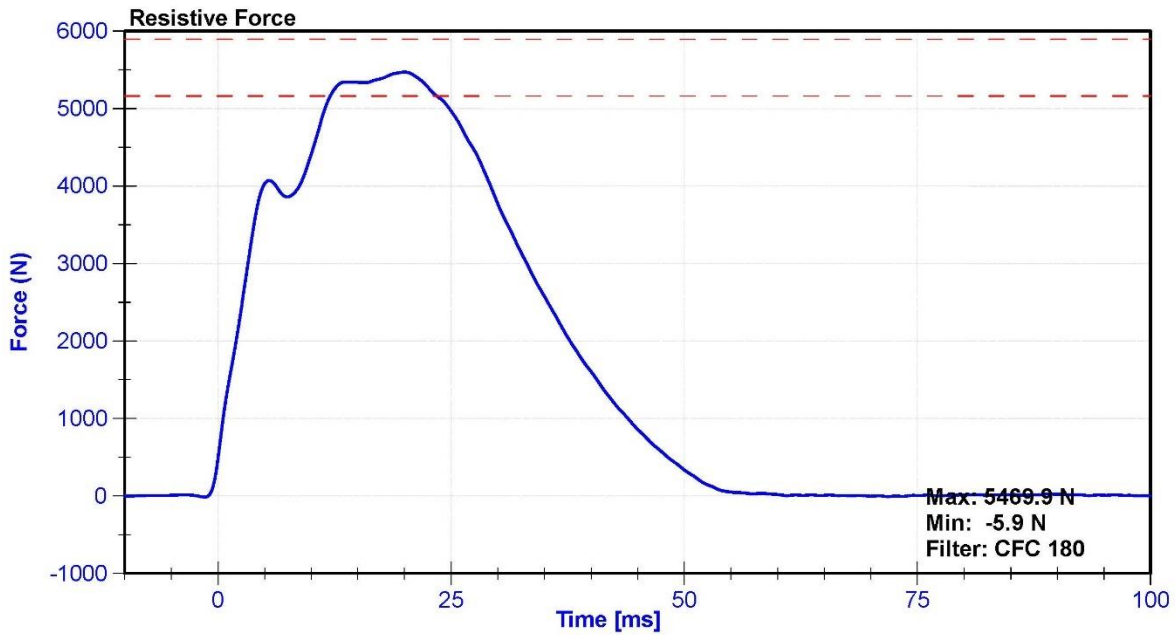
### Results

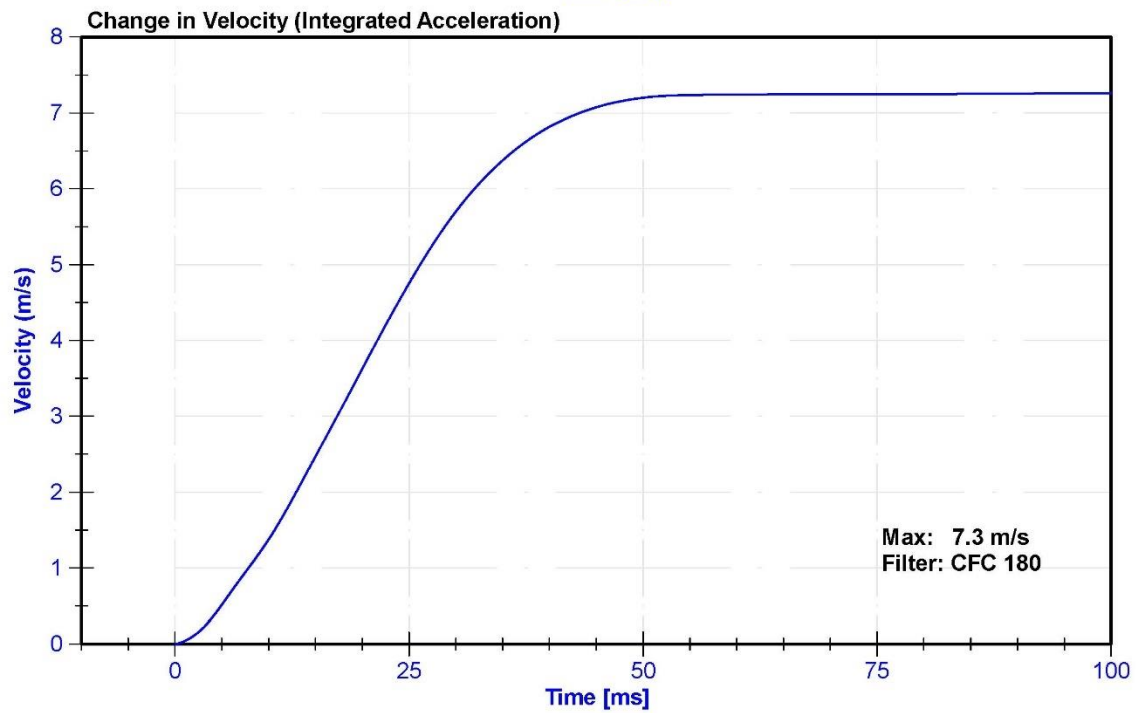
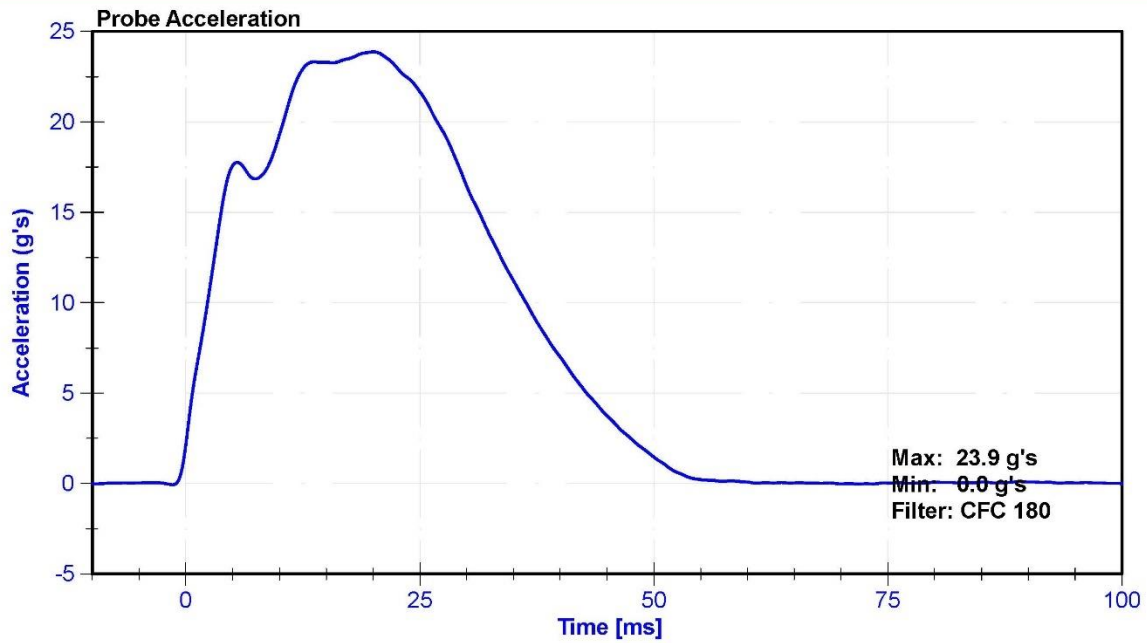
| Test Parameter     | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|--------------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature        | 20.6                  | 22.2                  | °C   | 21.4   | Pass      |
| Humidity           | 10                    | 70                    | %    | 45.5   | Pass      |
| Velocity           | 6.59                  | 6.83                  | m/s  | 6.682  | Pass      |
| Chest Displacement | -72.6                 | -63.5                 | mm   | -67.73 | Pass      |
| Resistive Force    | 5160                  | 5894                  | N    | 5469.9 | Pass      |
| Hysteresis         | 65                    | 85                    | %    | 72.1   | Pass      |

### Transducer Calibrations

| Channel                | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|------------------------|--------------|---------------|------------------|----------------------|
| Pendulum Accelerometer | Endevco      | T25885        | 10/25/2021       | 10/25/2022           |
| Chest Potentiometer    | JDK          | 0075          | 5/10/2022        | 11/8/2022            |





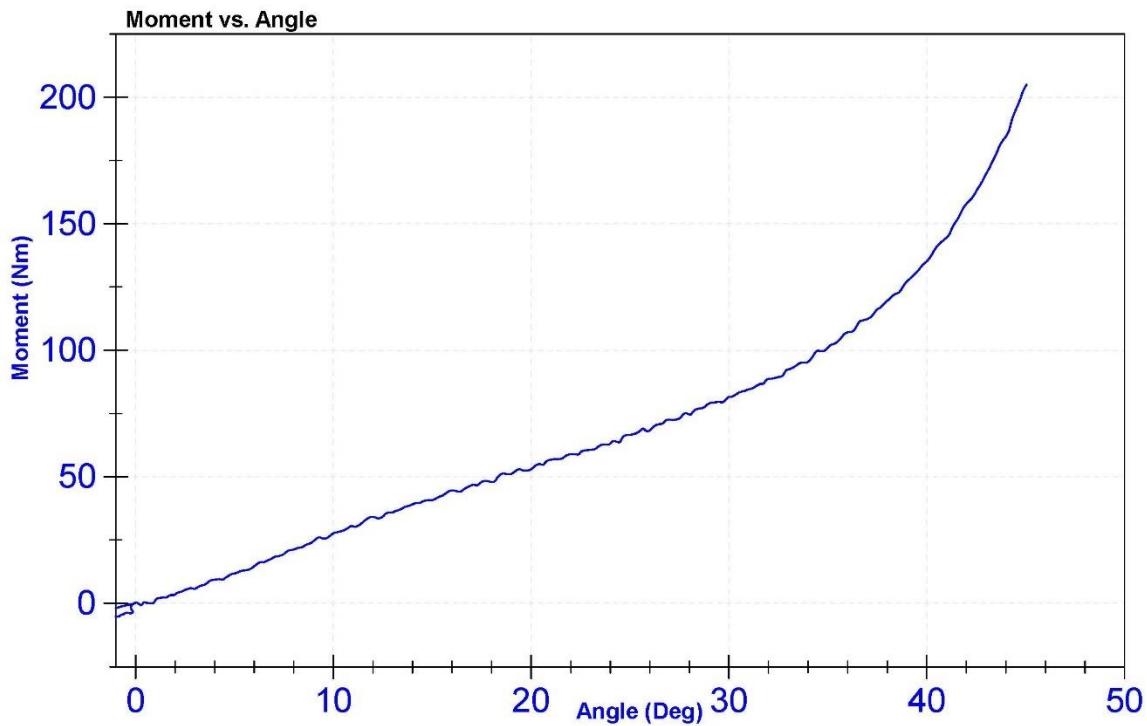




|                   |            |                       |            |
|-------------------|------------|-----------------------|------------|
| ATD Manufacturer  | Humanetics | Test Technician       | C. Mantell |
| ATD Serial Number | 142        | Laboratory Supervisor | K. Brogan  |

| Test Parameter       | Results               |                       | Unit  | Result | Pass/Fail |
|----------------------|-----------------------|-----------------------|-------|--------|-----------|
|                      | Minimum Specification | Maximum Specification |       |        |           |
| Temperature          | 18.9                  | 25.6                  | °C    | 21.6   | Pass      |
| Humidity             | 10                    | 70                    | %     | 42.6   | Pass      |
| Average Velocity     | 5                     | 10                    | deg/s | 7.6    | Pass      |
| Angle at 203Nm       | 40                    | 50                    | deg   | 44.9   | Pass      |
| Moment at 30 degrees | 0                     | 94.9                  | Nm    | 81.6   | Pass      |

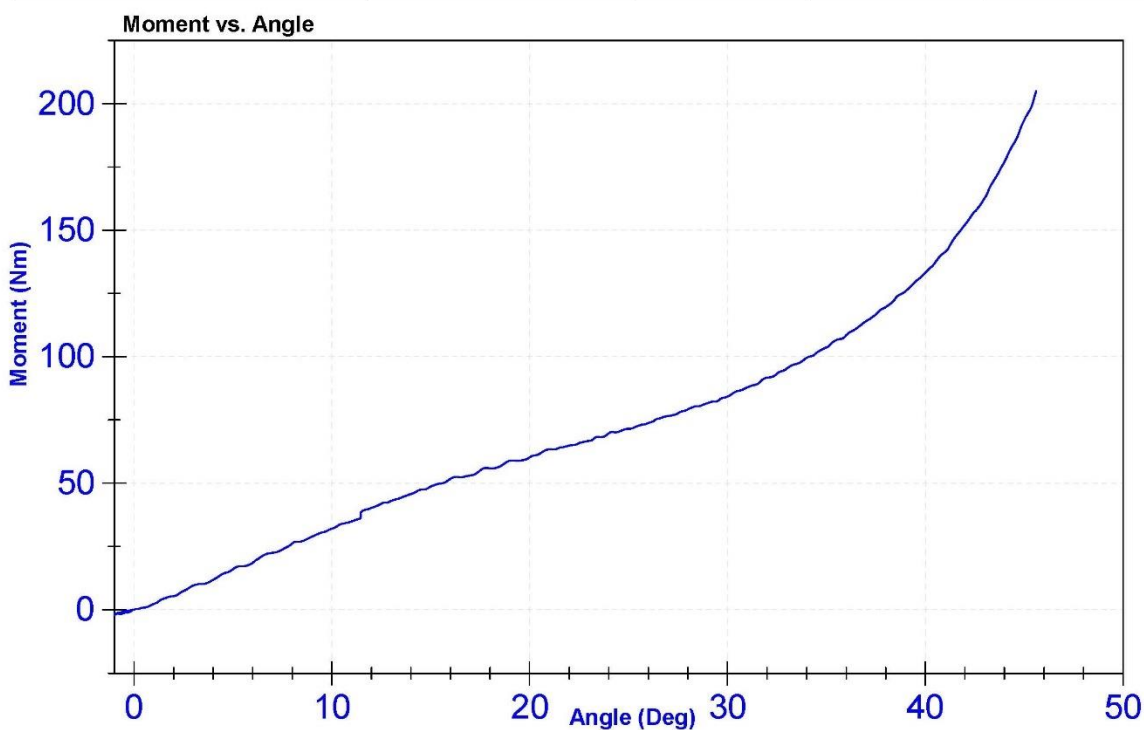
| Transducer Calibrations |                   |               |                  |                      |
|-------------------------|-------------------|---------------|------------------|----------------------|
| Channel                 | Manufacturer      | Serial Number | Calibration Date | Calibration Due Date |
| Potentiometer           | ETI SP22          | DS-0008       | 9/27/2021        | 9/27/2022            |
| Load Cell               | Key Trans 2301-02 | LC-115 My     | 2021-08-13       | 2022-08-13           |



|                   |            |                       |            |
|-------------------|------------|-----------------------|------------|
| ATD Manufacturer  | Humanetics | Test Technician       | C. Mantell |
| ATD Serial Number | 142        | Laboratory Supervisor | K. Brogan  |

| Results              |                       |                       |       |        |           |
|----------------------|-----------------------|-----------------------|-------|--------|-----------|
| Test Parameter       | Minimum Specification | Maximum Specification | Unit  | Result | Pass/Fail |
| Temperature          | 18.9                  | 25.6                  | °C    | 21.6   | Pass      |
| Humidity             | 10                    | 70                    | %     | 42.6   | Pass      |
| Average Velocity     | 5                     | 10                    | deg/s | 7.4    | Pass      |
| Angle at 203Nm       | 40                    | 50                    | deg   | 45.5   | Pass      |
| Moment at 30 degrees | 0                     | 94.9                  | Nm    | 84.2   | Pass      |

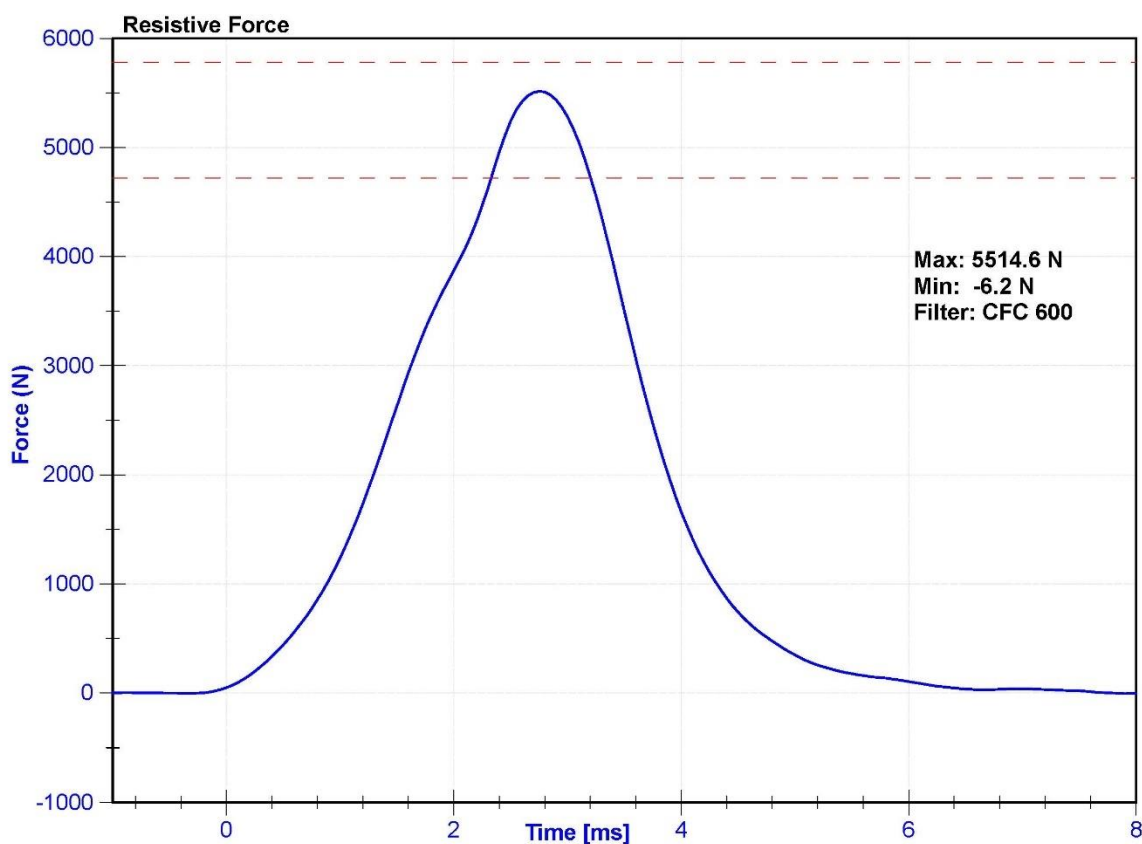
| Transducer Calibrations |                   |               |                  |                      |
|-------------------------|-------------------|---------------|------------------|----------------------|
| Channel                 | Manufacturer      | Serial Number | Calibration Date | Calibration Due Date |
| Potentiometer           | ETI SP22          | DS-0008       | 9/27/2021        | 9/27/2022            |
| Load Cell               | Key Trans 2301-02 | LC-115 My     | 2021-08-13       | 2022-08-13           |



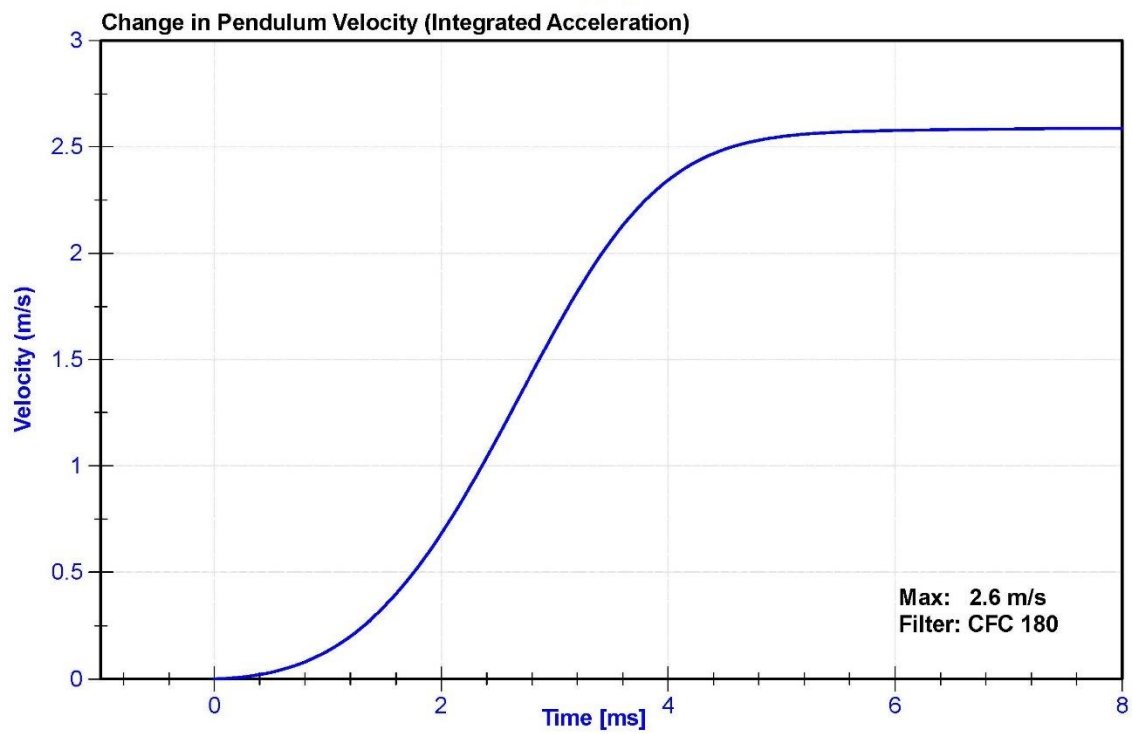
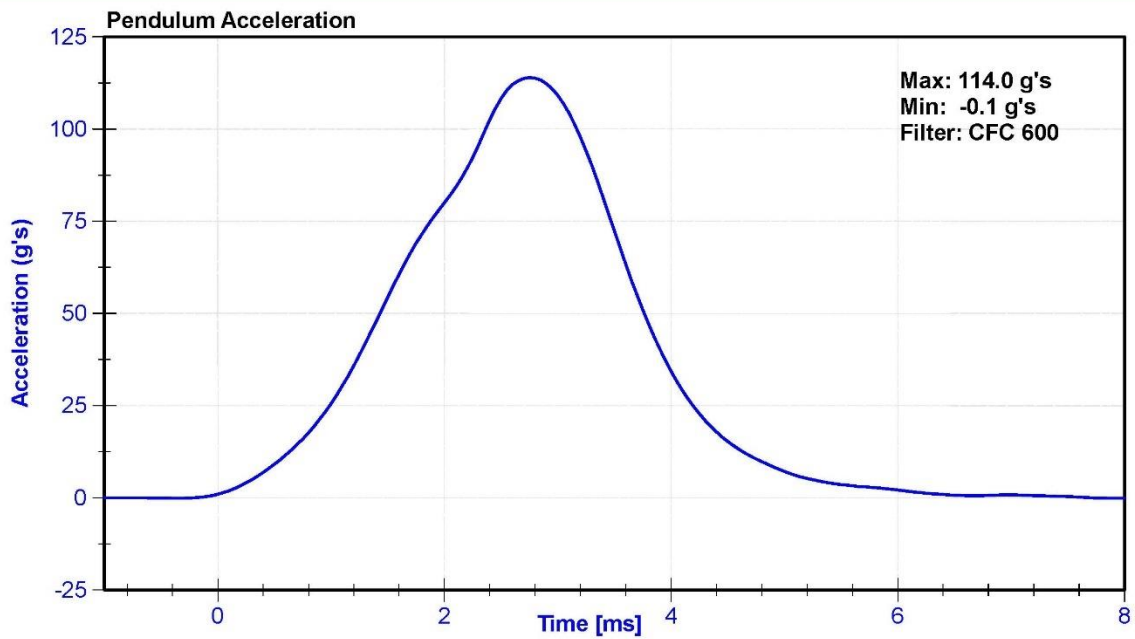
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|-------------------|------------|-----------------------|------------|
| ATD Manufacturer  | Humanetics | Test Technician       | T. Roseman |
| ATD Serial Number | 142        | Laboratory Supervisor | K. Brogan  |

| Results                 |                       |                       |      |        |           |
|-------------------------|-----------------------|-----------------------|------|--------|-----------|
| Test Parameter          | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
| Temperature             | 18.9                  | 25.6                  | °C   | 21.2   | Pass      |
| Humidity                | 10                    | 70                    | %    | 26.0   | Pass      |
| Velocity                | 2.07                  | 2.13                  | m/s  | 2.113  | Pass      |
| Maximum Resistive Force | 4720                  | 5780                  | N    | 5514.6 | Pass      |

| Transducer Calibrations |              |               |                  |                      |
|-------------------------|--------------|---------------|------------------|----------------------|
| Channel                 | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
| Pendulum Accelerometer  | Endevco      | T25885        | 10/25/2021       | 10/25/2022           |







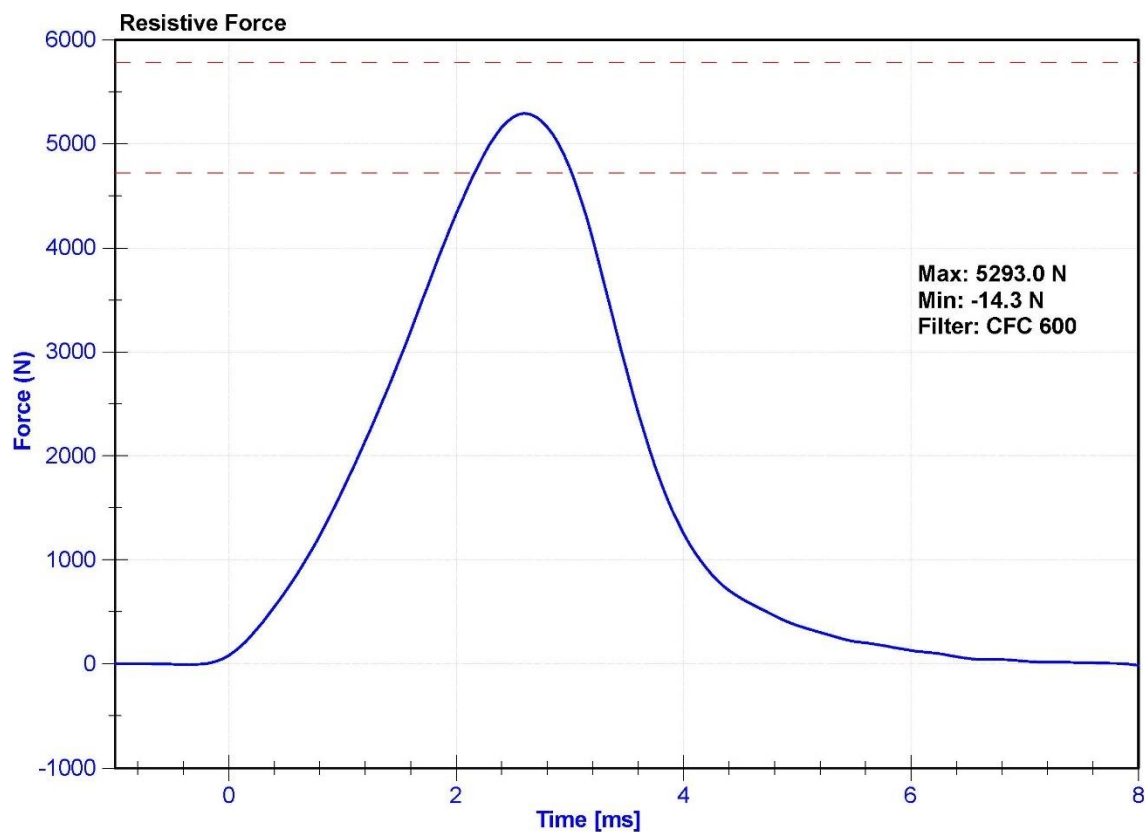
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|-------------------|------------|-----------------------|------------|
| ATD Manufacturer  | Humanetics | Test Technician       | T. Roseman |
| ATD Serial Number | 142        | Laboratory Supervisor | K. Brogan  |

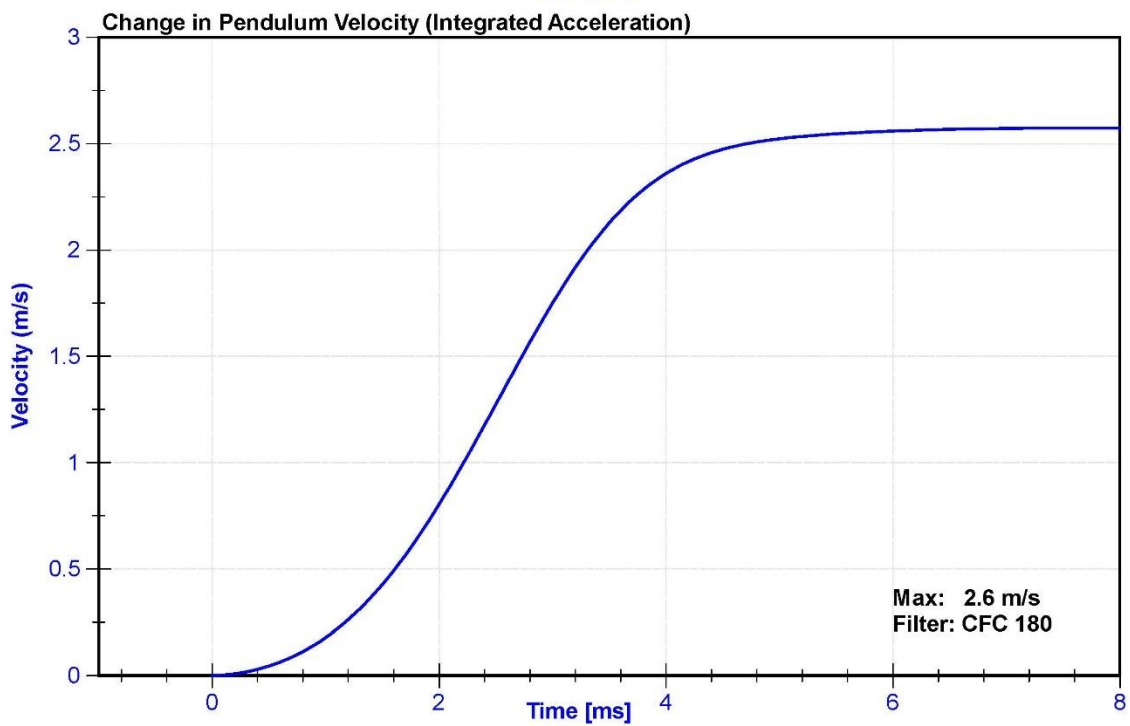
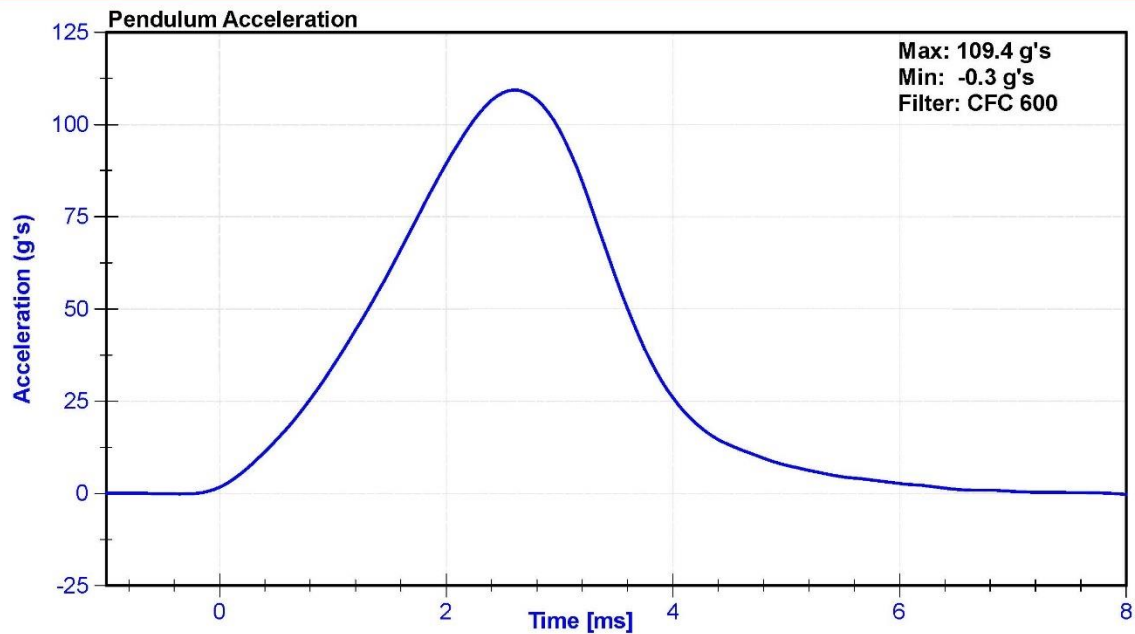
#### Results

| Test Parameter          | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|-------------------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature             | 18.9                  | 25.6                  | °C   | 21.2   | Pass      |
| Humidity                | 10                    | 70                    | %    | 26.0   | Pass      |
| Velocity                | 2.07                  | 2.13                  | m/s  | 2.111  | Pass      |
| Maximum Resistive Force | 4720                  | 5780                  | N    | 5293.0 | Pass      |

#### Transducer Calibrations

| Channel                | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|------------------------|--------------|---------------|------------------|----------------------|
| Pendulum Accelerometer | Endevco      | T25885        | 10/25/2021       | 10/25/2022           |







**CALIBRATION TEST RESULTS**

**PRE-TEST**

**HYBRID III 5<sup>TH</sup> PERCENTILE - PASSENGER ATD**

**SERIAL NO: 137**

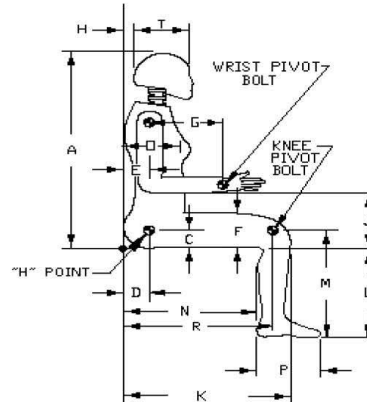
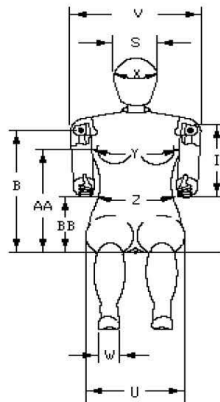


# External Measurements - Hybrid 3 - 5th Female

Technician: K. Brogan

Date: 05-18-2022

Dummy Serial Number: 137



| Symbol | Description                              | Specification (mm) |     | Result (mm) | Pass/Fail |
|--------|------------------------------------------|--------------------|-----|-------------|-----------|
| A      | Sitting Height                           | 775                | 800 | 785         | Pass      |
| B      | Shoulder Pivot Height                    | 432                | 457 | 445         | Pass      |
| C      | H-Point Height                           | 81                 | 86  | 85          | Pass      |
| D      | H-Point from Backline                    | 145                | 150 | 147         | Pass      |
| E      | Shoulder Pivot from Backline             | 69                 | 84  | 75          | Pass      |
| F      | Thigh Clearance                          | 119                | 135 | 125         | Pass      |
| G      | Back of Elbow to Wrist Pivot             | 244                | 259 | 250         | Pass      |
| H      | Head Back to Backline                    | 43                 | 48  | 45          | Pass      |
| I      | Shoulder to Elbow Length                 | 277                | 297 | 287         | Pass      |
| J      | Elbow Rest Height                        | 183                | 203 | 195         | Pass      |
| K      | Buttock to Knee Length                   | 521                | 546 | 541         | Pass      |
| L      | Popliteal Height                         | 356                | 376 | 365         | Pass      |
| M      | Knee Pivot Height                        | 394                | 419 | 410         | Pass      |
| N      | Buttock Popliteal Length                 | 414                | 439 | 425         | Pass      |
| O      | Chest Depth without Jacket               | 175                | 191 | 182         | Pass      |
| P      | Foot Length (right)                      | 219                | 234 | 228         | Pass      |
| R      | Buttock To Knee Pivot Length             | 457                | 483 | 465         | Pass      |
| S      | Head Breadth                             | 137                | 147 | 143         | Pass      |
| T      | Head Depth                               | 178                | 188 | 180         | Pass      |
| U      | Hip Breadth                              | 300                | 315 | 310         | Pass      |
| V      | Shoulder Breadth                         | 351                | 366 | 359         | Pass      |
| W      | Foot Breadth                             | 79                 | 94  | 85          | Pass      |
| X      | Head Circumference                       | 528                | 549 | 540         | Pass      |
| Y      | Chest Circumference with Jacket          | 851                | 881 | 870         | Pass      |
| Z      | Waist Circumference                      | 460                | 790 | 650         | Pass      |
| AA     | Reference Location (Chest Circumference) | 333                | 358 | 345         | Pass      |
| BB     | Reference Location (Waist Circumference) | 160                | 170 | 165         | Pass      |

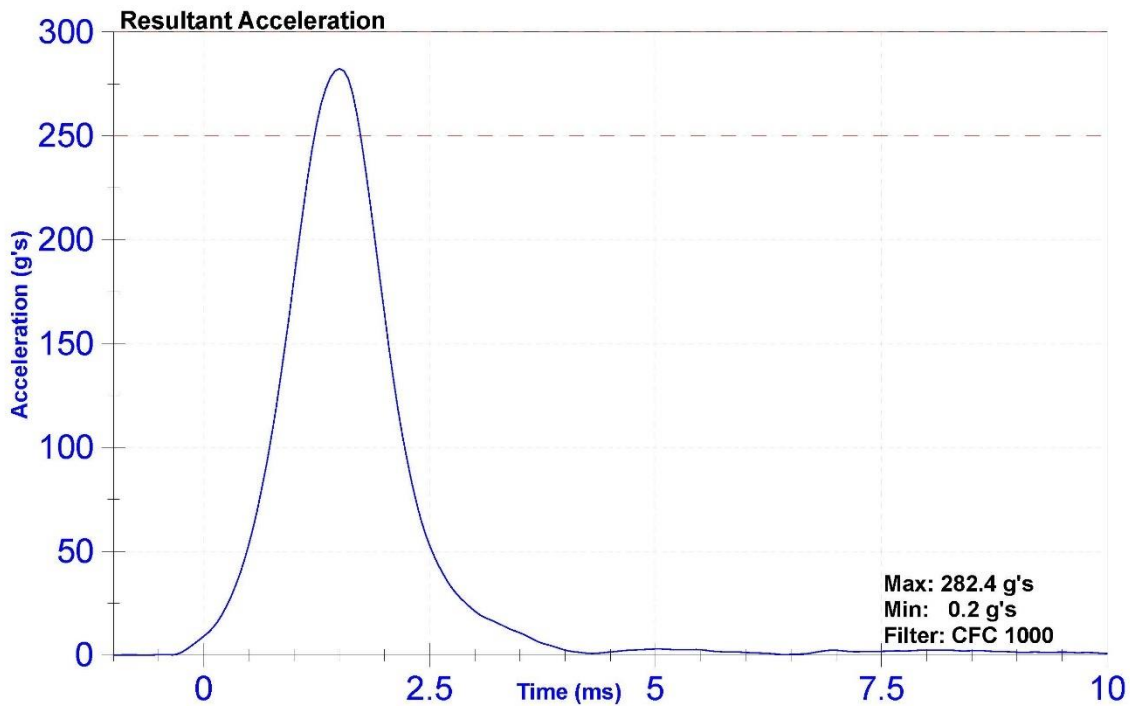
|                   |            |                       |            |
|-------------------|------------|-----------------------|------------|
| ATD Manufacturer  | Humanetics | Test Technician       | T. Roseman |
| ATD Serial Number | 137        | Laboratory Supervisor | K. Brogan  |

#### Results

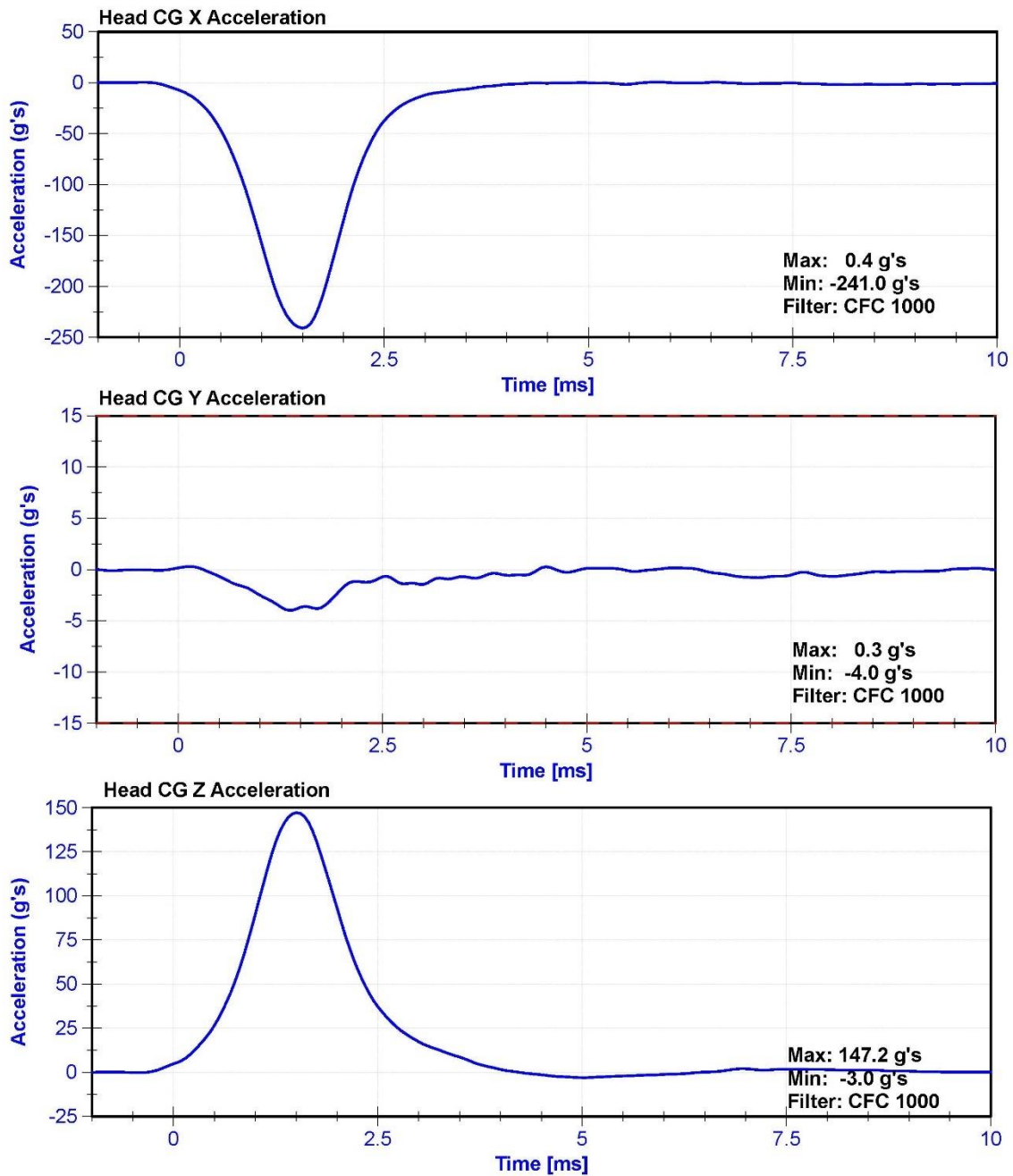
| Test Parameter         | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|------------------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature            | 18.9                  | 25.6                  | °C   | 21.2   | Pass      |
| Humidity               | 10                    | 70                    | %    | 26.0   | Pass      |
| Resultant Acceleration | 250                   | 300                   | g's  | 282.4  | Pass      |
| Oscillation            | 0                     | 10                    | %    | 1.3    | Pass      |
| Lateral Acceleration   | -15                   | 15                    | g's  | -4.0   | Pass      |

#### Transducer Calibrations

| Channel         | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|-----------------|--------------|---------------|------------------|----------------------|
| X Accelerometer | Endevco      | P79417        | 2/1/2022         | 7/31/2022            |
| Y Accelerometer | Endevco      | P83335        | 2/1/2022         | 7/31/2022            |
| Z Accelerometer | Endevco      | P64149        | 2/1/2022         | 7/31/2022            |







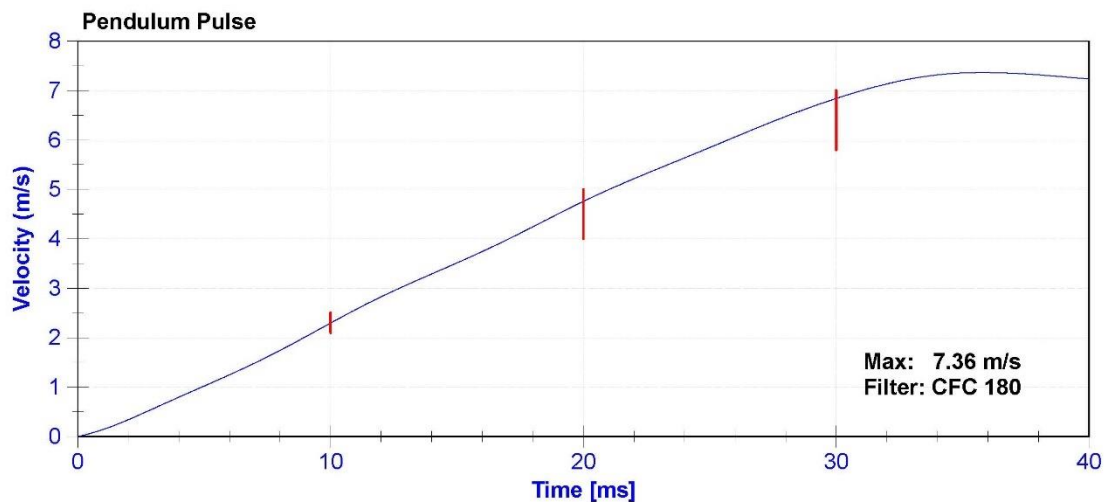
|                   |            |                       |            |
|-------------------|------------|-----------------------|------------|
| ATD Manufacturer  | Humanetics | Test Technician       | T. Roseman |
| ATD Serial Number | 137        | Laboratory Supervisor | K. Brogan  |

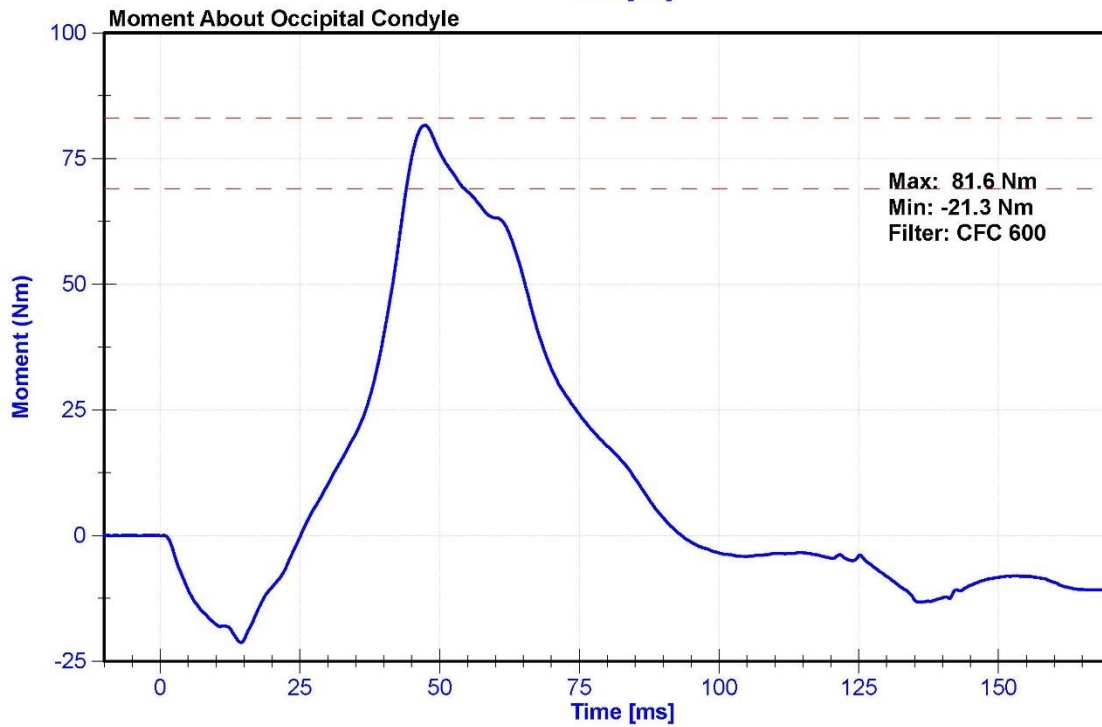
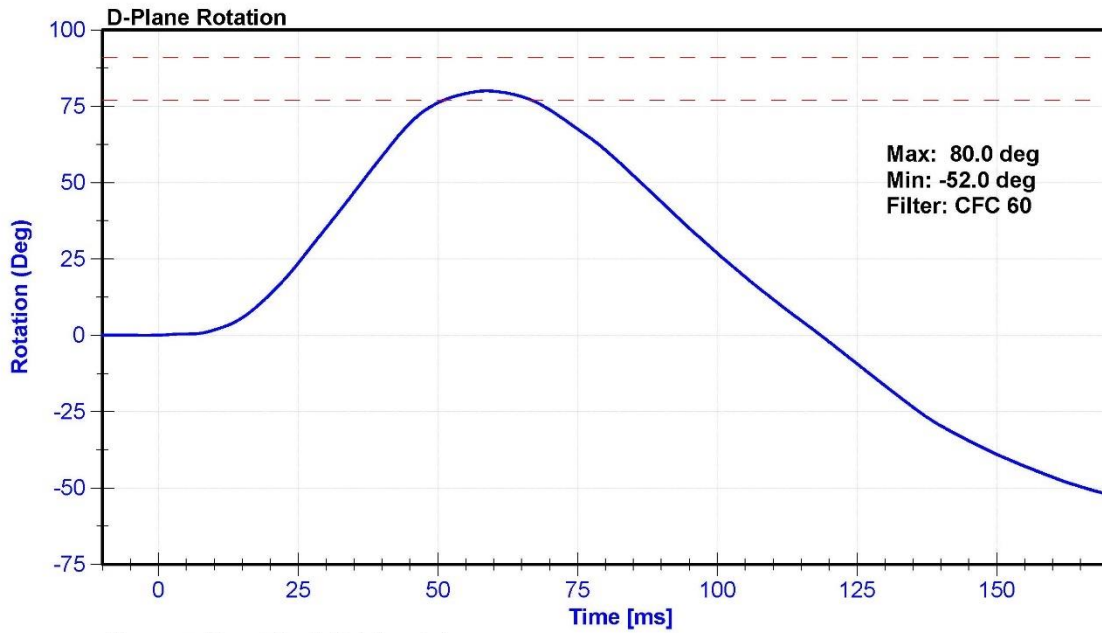
### Results

| Test Parameter                      | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|-------------------------------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature                         | 20.6                  | 22.2                  | °C   | 21.2   | Pass      |
| Humidity                            | 10                    | 70                    | %    | 26.0   | Pass      |
| Velocity                            | 6.89                  | 7.13                  | m/s  | 7.020  | Pass      |
| Pendulum Impulse at 10ms            | 2.1                   | 2.5                   | m/s  | 2.30   | Pass      |
| Pendulum Impulse at 20ms            | 4.0                   | 5.0                   | m/s  | 4.76   | Pass      |
| Pendulum Impulse at 30ms            | 5.8                   | 7.0                   | m/s  | 6.84   | Pass      |
| Max D Plane Rotation                | 77                    | 91                    | deg  | 80.0   | Pass      |
| Max Moment During Rotation Interval | 69                    | 83                    | Nm   | 81.6   | Pass      |
| Moment Decay to 10.0 Nm             | 80                    | 100                   | ms   | 85.9   | Pass      |

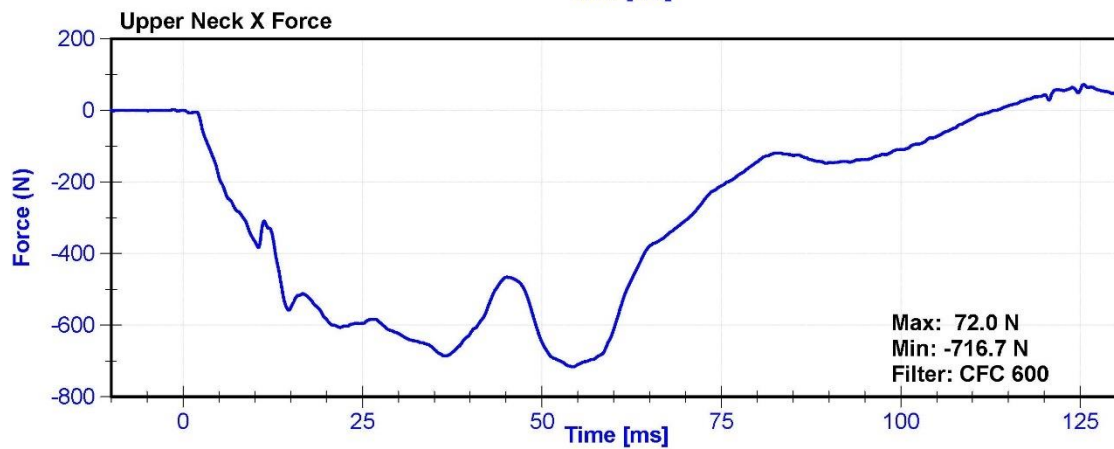
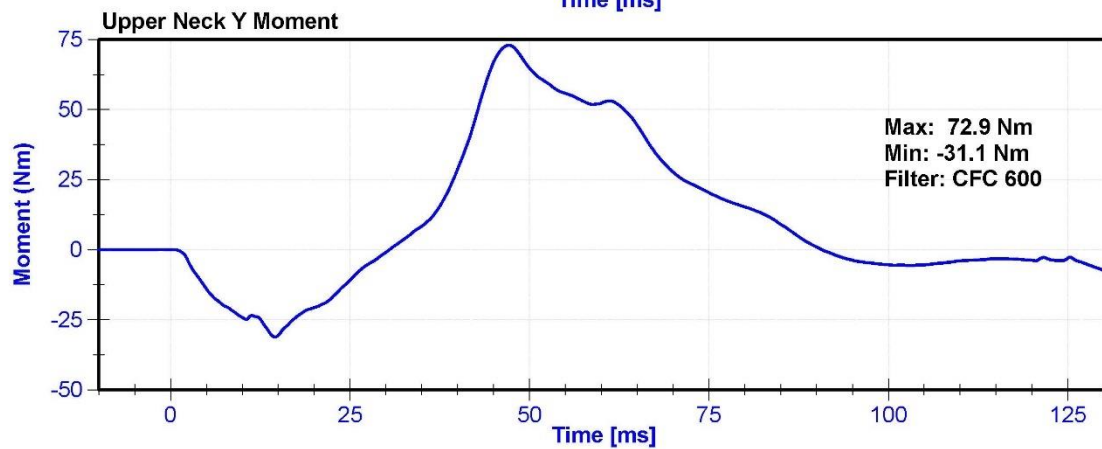
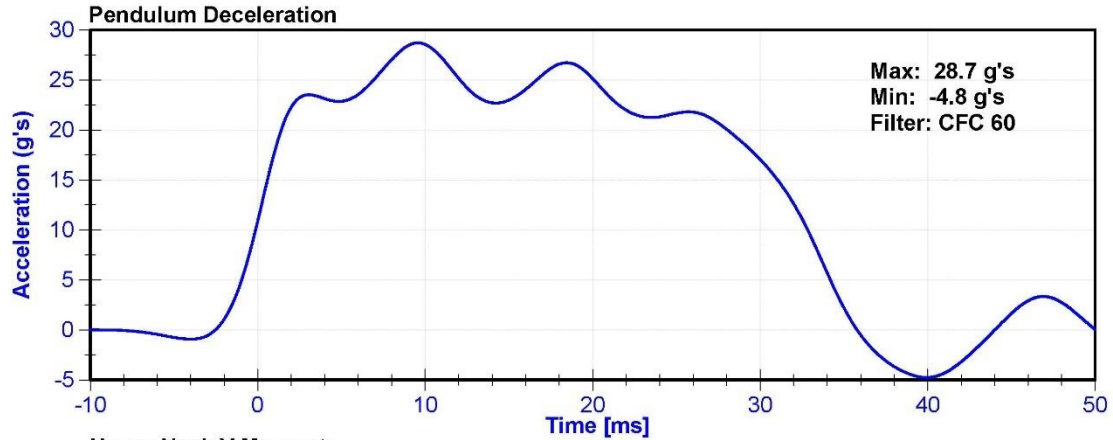
### Transducer Calibrations

| Channel                | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|------------------------|--------------|---------------|------------------|----------------------|
| Pendulum Accelerometer | Endevco      | 7231CT        | 10/28/2021       | 10/28/2022           |
| Pendulum Potentiometer | ETI          | LABPOT1       | 5/9/2022         | 5/9/2023             |
| Condyle Potentiometer  | ETI          | LABPOT2       | 5/9/2022         | 5/9/2023             |
| Upper Neck Load Cell   | Denton       | 2184-FX       | 6/24/2021        | 6/24/2022            |









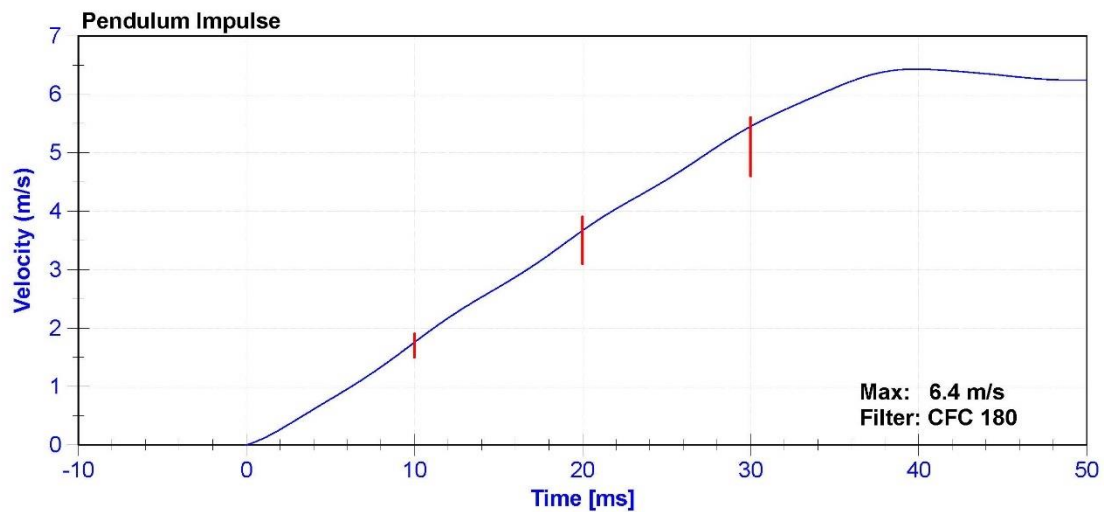
|                   |            |                       |            |
|-------------------|------------|-----------------------|------------|
| ATD Manufacturer  | Humanetics | Test Technician       | T. Roseman |
| ATD Serial Number | 137        | Laboratory Supervisor | K. Brogan  |

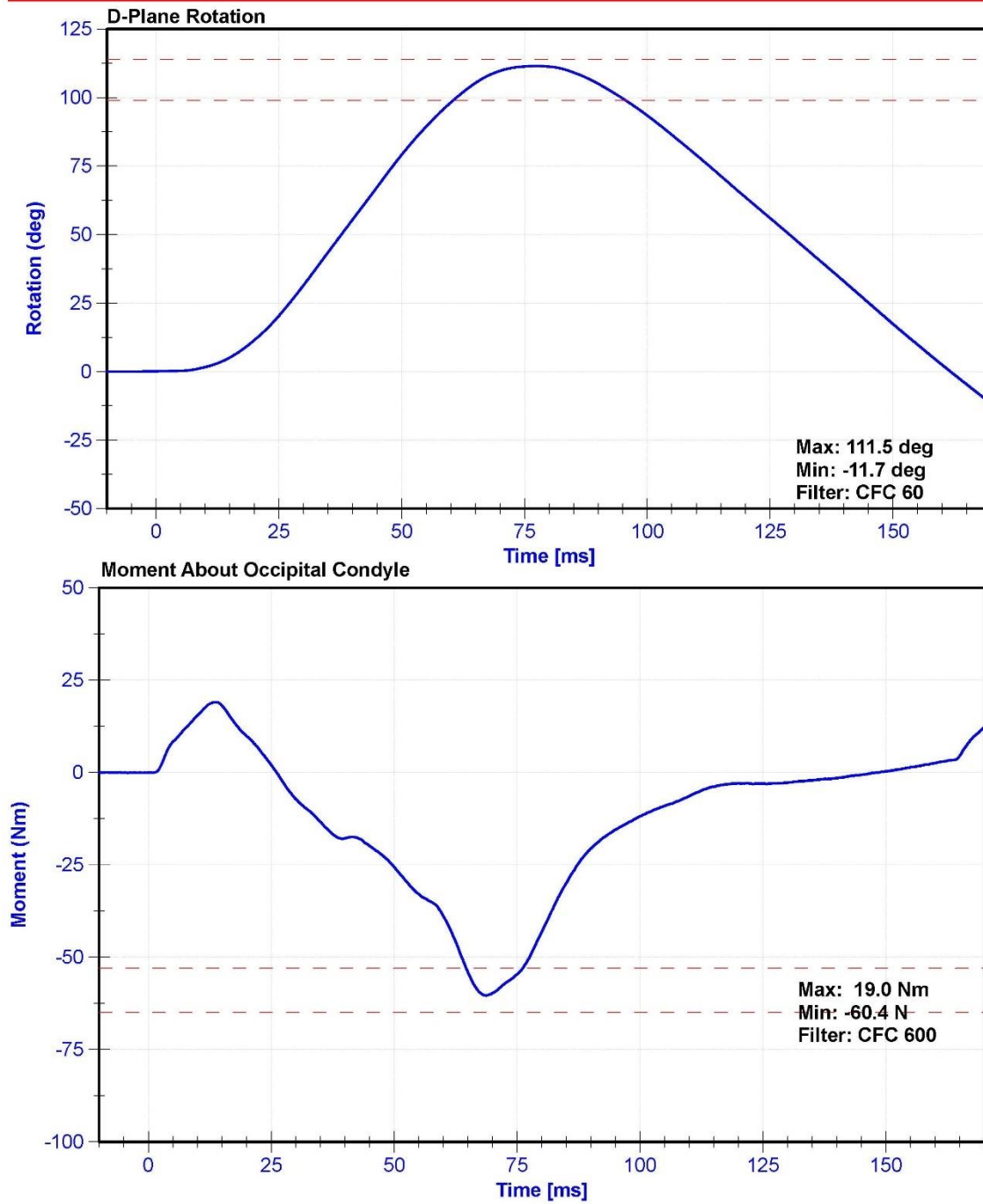
#### Results

| Test Parameter                  | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---------------------------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature                     | 20.6                  | 22.2                  | °C   | 21.2   | Pass      |
| Humidity                        | 10                    | 70                    | %    | 26.0   | Pass      |
| Velocity                        | 5.95                  | 6.19                  | m/s  | 6.132  | Pass      |
| Pendulum Impulse at 10ms        | 1.5                   | 1.9                   | m/s  | 1.76   | Pass      |
| Pendulum Impulse at 20ms        | 3.1                   | 3.9                   | m/s  | 3.67   | Pass      |
| Pendulum Impulse at 30ms        | 4.6                   | 5.6                   | m/s  | 5.45   | Pass      |
| D Plane Rotation                | 99                    | 114                   | deg  | 111.5  | Pass      |
| Moment During Rotation Interval | -65                   | -53                   | Nm   | -60.4  | Pass      |
| Moment Decay to -10Nm           | 94                    | 114                   | ms   | 103.1  | Pass      |

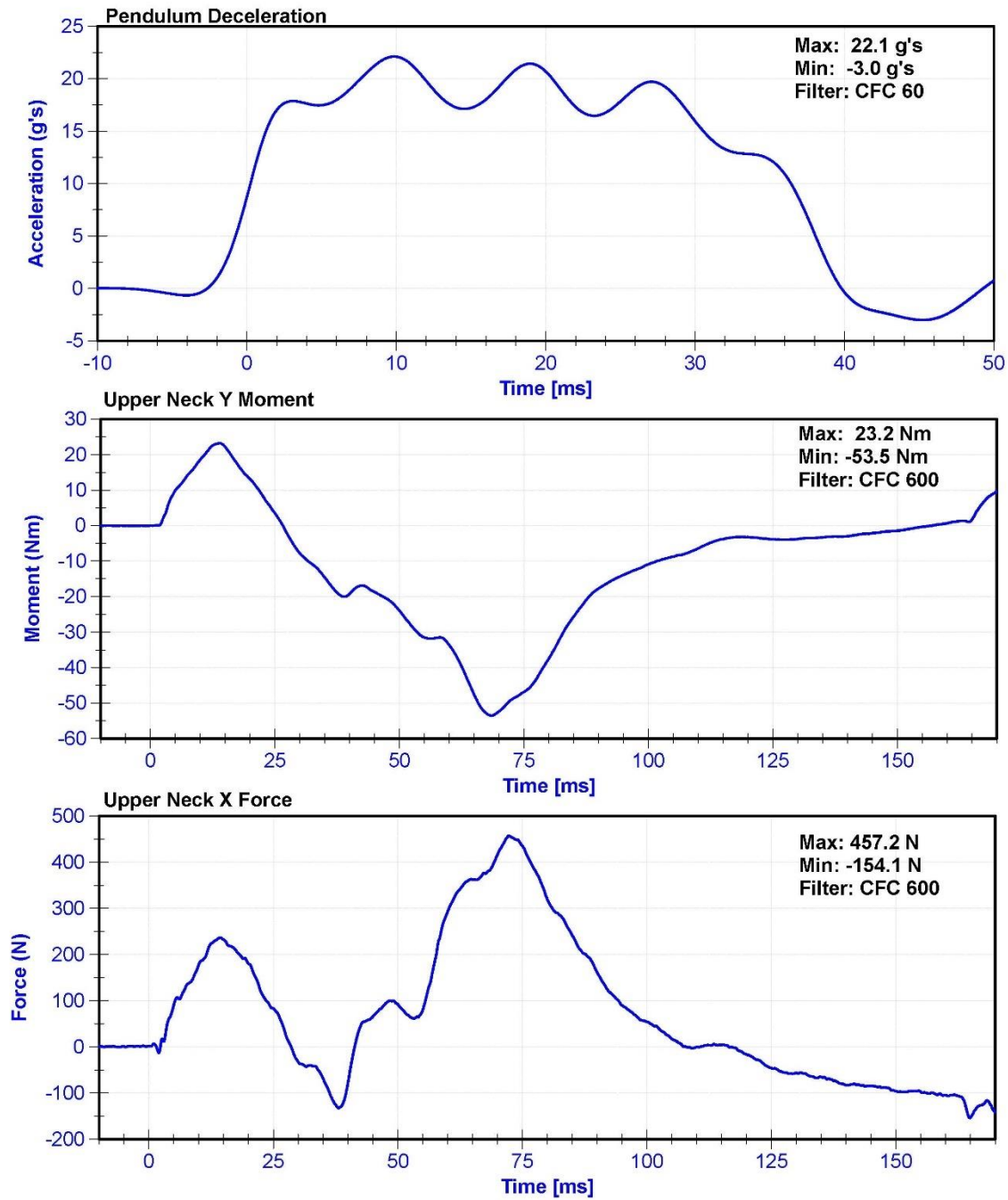
#### Transducer Calibrations

| Channel                | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|------------------------|--------------|---------------|------------------|----------------------|
| Pendulum Accelerometer | Endevco      | C16503        | 10/28/2021       | 10/28/2022           |
| Pendulum Potentiometer | ETI          | LABPOT1       | 5/9/2022         | 5/9/2023             |
| Condyle Potentiometer  | ETI          | LABPOT2       | 5/9/2022         | 5/9/2023             |
| Upper Neck Load Cell   | Denton       | 2184-FX       | 6/24/2021        | 6/24/2022            |







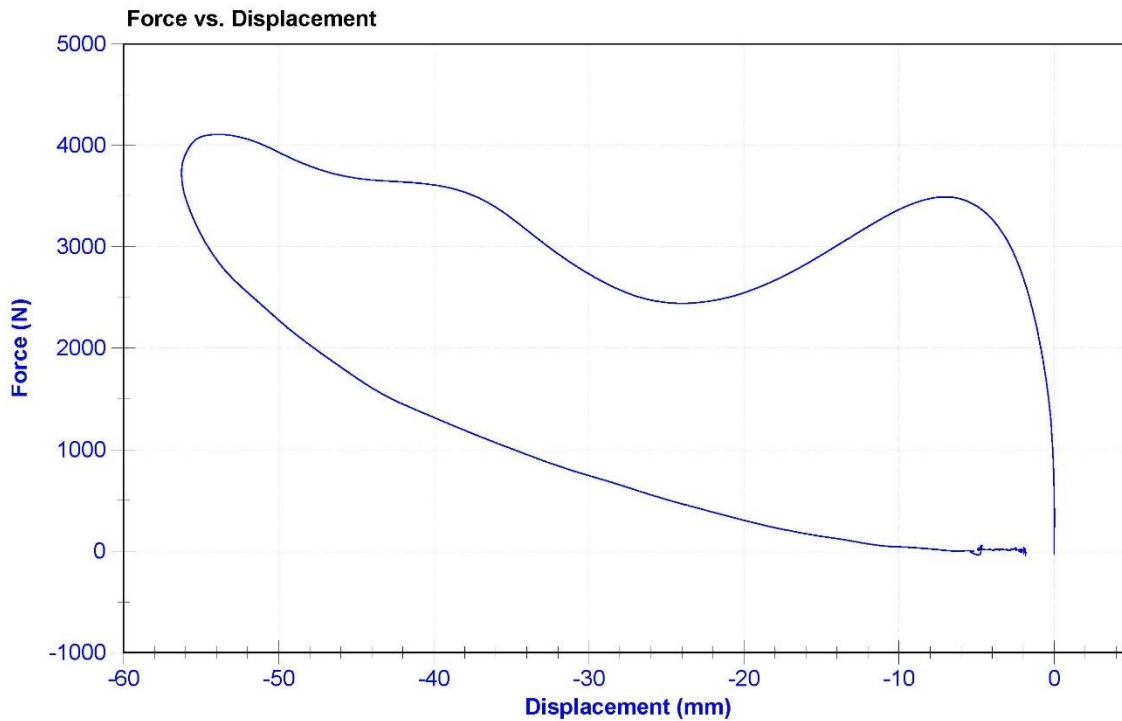


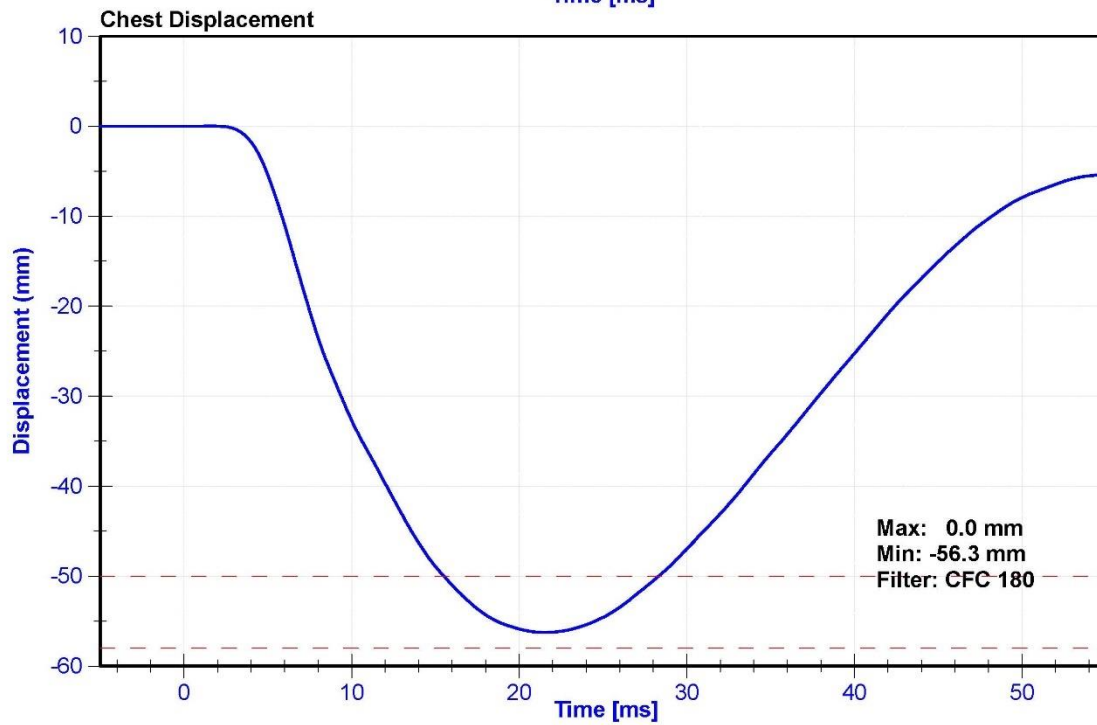
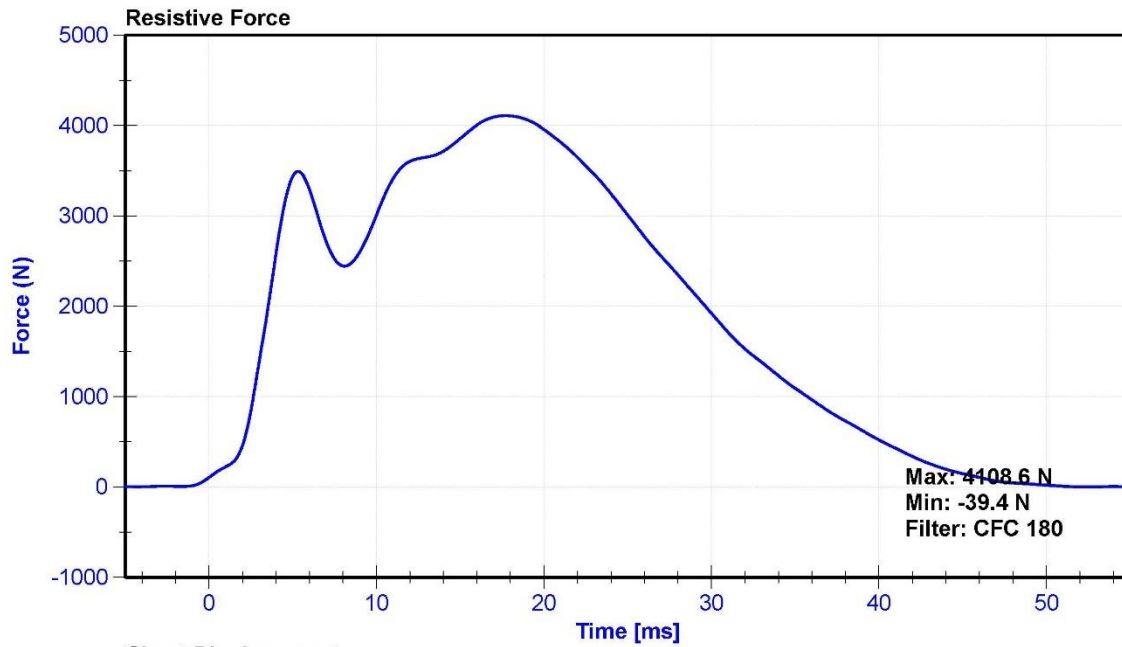
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|-------------------|------------|-----------------------|------------|
| ATD Manufacturer  | Humanetics | Test Technician       | T. Roseman |
| ATD Serial Number | 137        | Laboratory Supervisor | K. Brogan  |

| Test Parameter                       | Results               |                       | Unit | Result | Pass/Fail |
|--------------------------------------|-----------------------|-----------------------|------|--------|-----------|
|                                      | Minimum Specification | Maximum Specification |      |        |           |
| Temperature                          | 20.6                  | 22.2                  | °C   | 21.0   | Pass      |
| Humidity                             | 10                    | 70                    | %    | 26.0   | Pass      |
| Velocity                             | 6.59                  | 6.83                  | m/s  | 6.639  | Pass      |
| Chest Deflection                     | -58                   | -50                   | mm   | -56.3  | Pass      |
| Maximum Resistive Force (50 to 58mm) | 3900                  | 4400                  | N    | 4108.6 | Pass      |
| Maximum Resistive Force (18 to 50mm) | 0                     | 4600                  | N    | 3932.4 | Pass      |
| Hysteresis                           | 69                    | 85                    | %    | 71.3   | Pass      |

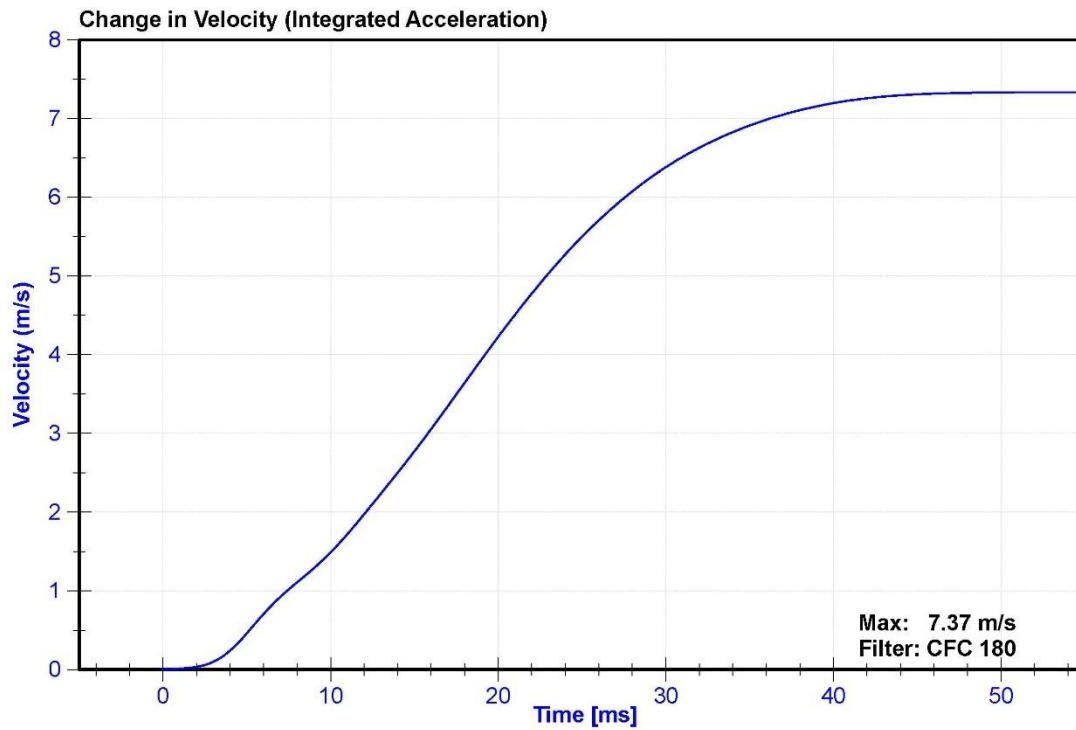
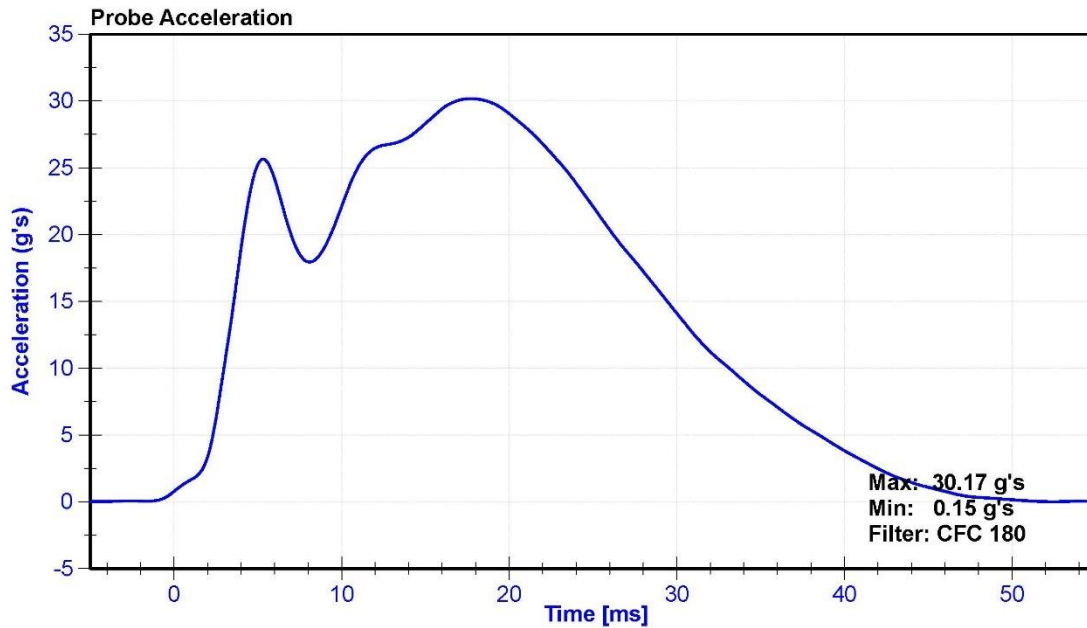
**Transducer Calibrations**

| Channel                | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|------------------------|--------------|---------------|------------------|----------------------|
| Pendulum Accelerometer | Endevco      | T25885        | 10/25/2021       | 10/25/2022           |
| Chest Potentiometer    | Servo        | 0720          | 4/18/2022        | 10/17/2022           |









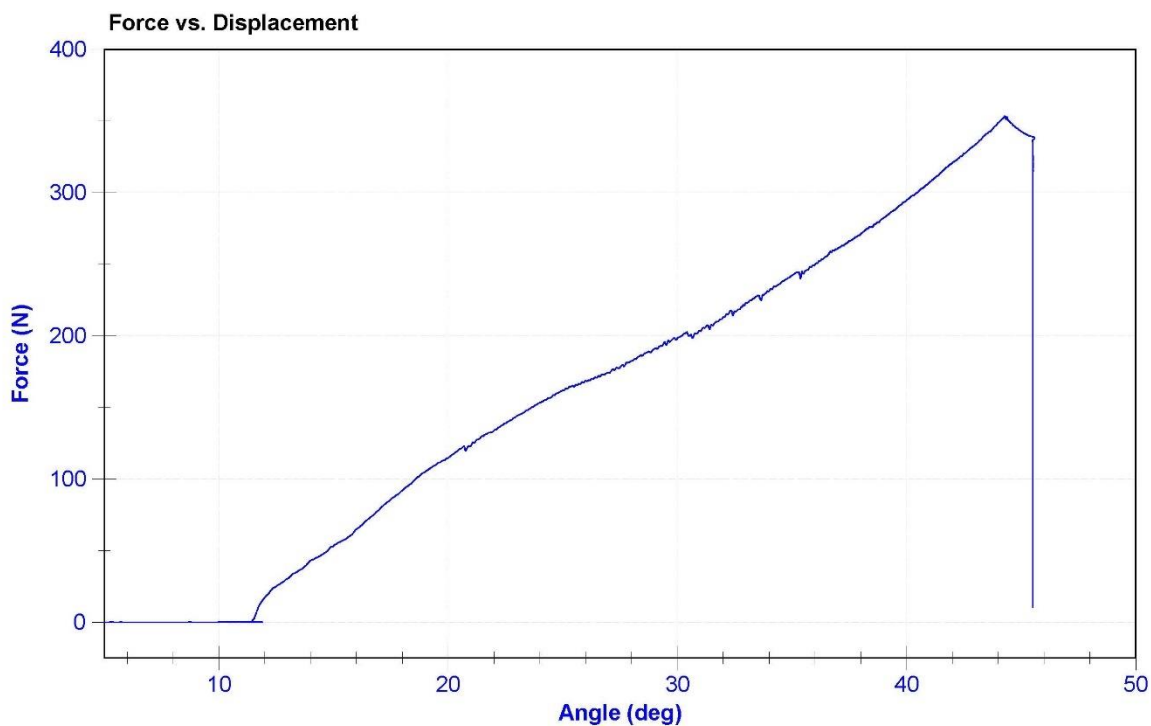
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|-------------------|------------|-----------------------|------------|
| ATD Manufacturer  | Humanetics | Test Technician       | T. Roseman |
| ATD Serial Number | 137        | Laboratory Supervisor | K. Brogan  |

#### Results

| Test Parameter                   | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|----------------------------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature                      | 18.6                  | 25.6                  | °C   | 21.2   | Pass      |
| Humidity                         | 10                    | 70                    | %    | 26.0   | Pass      |
| Initial Angle                    | 0                     | 20                    | deg  | 11.1   | Pass      |
| Force at 45 Degrees              | 320                   | 390                   | N    | 353.6  | Pass      |
| Return Angle Relative to Initial | 0                     | 8                     | deg  | 1.8    | Pass      |

#### Transducer Calibrations

| Channel       | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---------------|--------------|---------------|------------------|----------------------|
| Potentiometer | Rieker       | DS-1905226    | 2021-11-01       | 2022-11-01           |
| Load Cell     | Interface    | 1134516       | 2021-08-27       | 2022-08-27           |



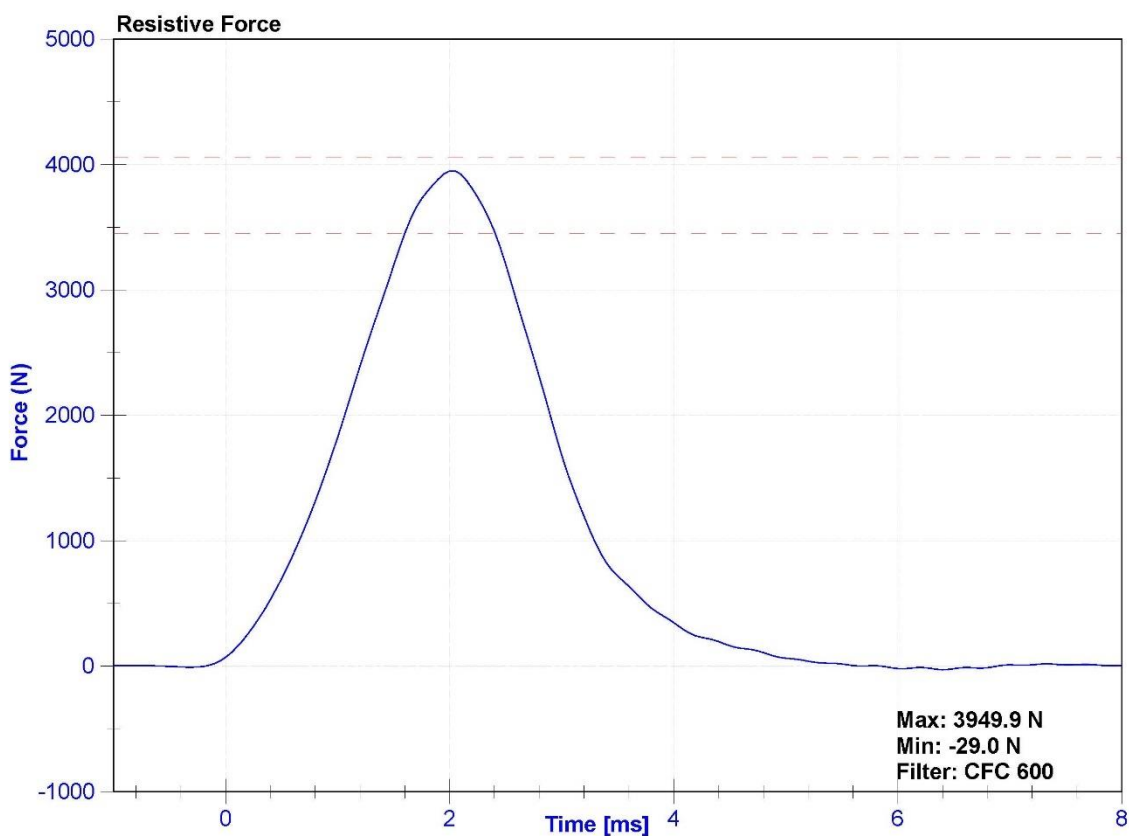
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|-------------------|------------|-----------------------|------------|
| ATD Manufacturer  | Humanetics | Test Technician       | T. Roseman |
| ATD Serial Number | 137        | Laboratory Supervisor | K. Brogan  |

#### Results

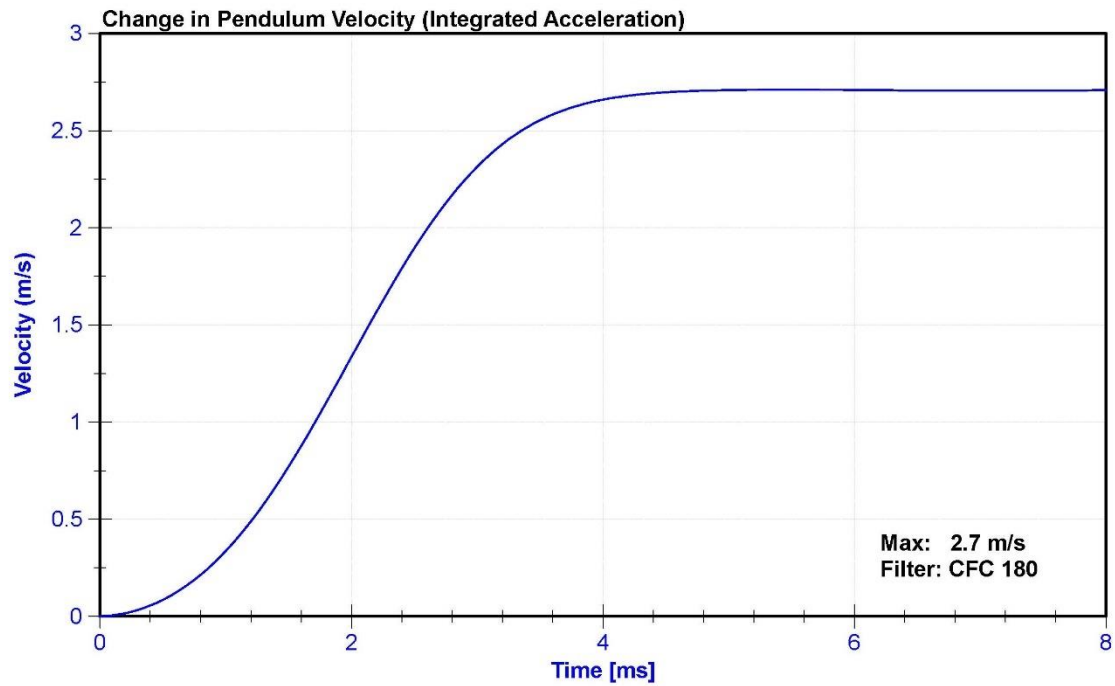
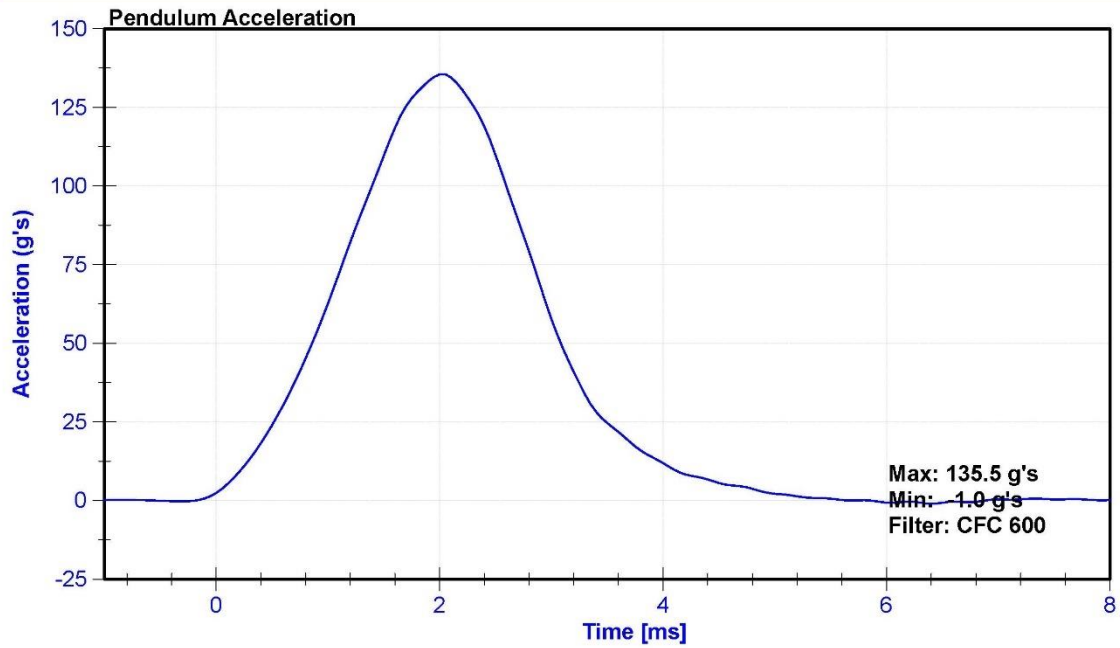
| Test Parameter  | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|-----------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature     | 18.9                  | 25.6                  | °C   | 21.2   | Pass      |
| Humidity        | 10                    | 70                    | %    | 26.0   | Pass      |
| Velocity        | 2.07                  | 2.13                  | m/s  | 2.113  | Pass      |
| Resistive Force | 3450                  | 4060                  | N    | 3949.9 | Pass      |

#### Transducer Calibrations

| Channel                | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|------------------------|--------------|---------------|------------------|----------------------|
| Pendulum Accelerometer | Endevco      | T25885        | 10/25/2021       | 10/25/2022           |







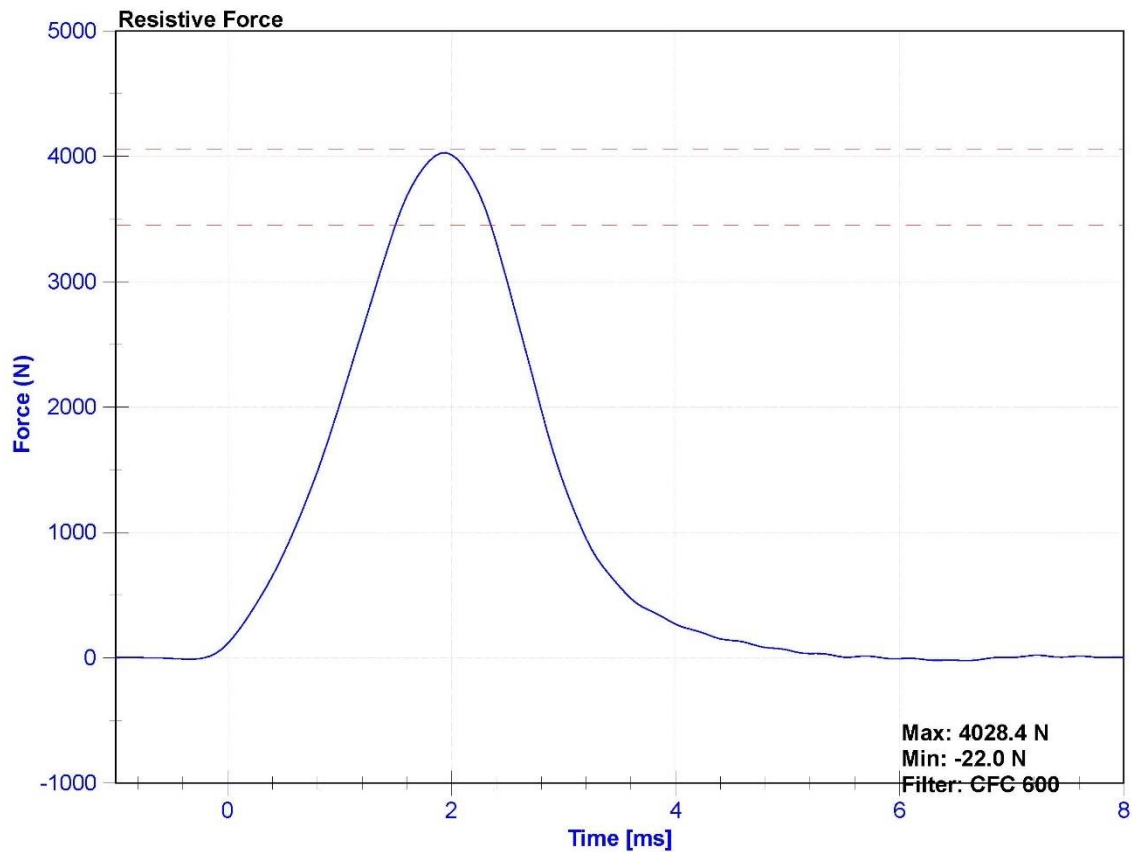
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|-------------------|------------|-----------------------|------------|
| ATD Manufacturer  | Humanetics | Test Technician       | T. Roseman |
| ATD Serial Number | 137        | Laboratory Supervisor | K. Brogan  |

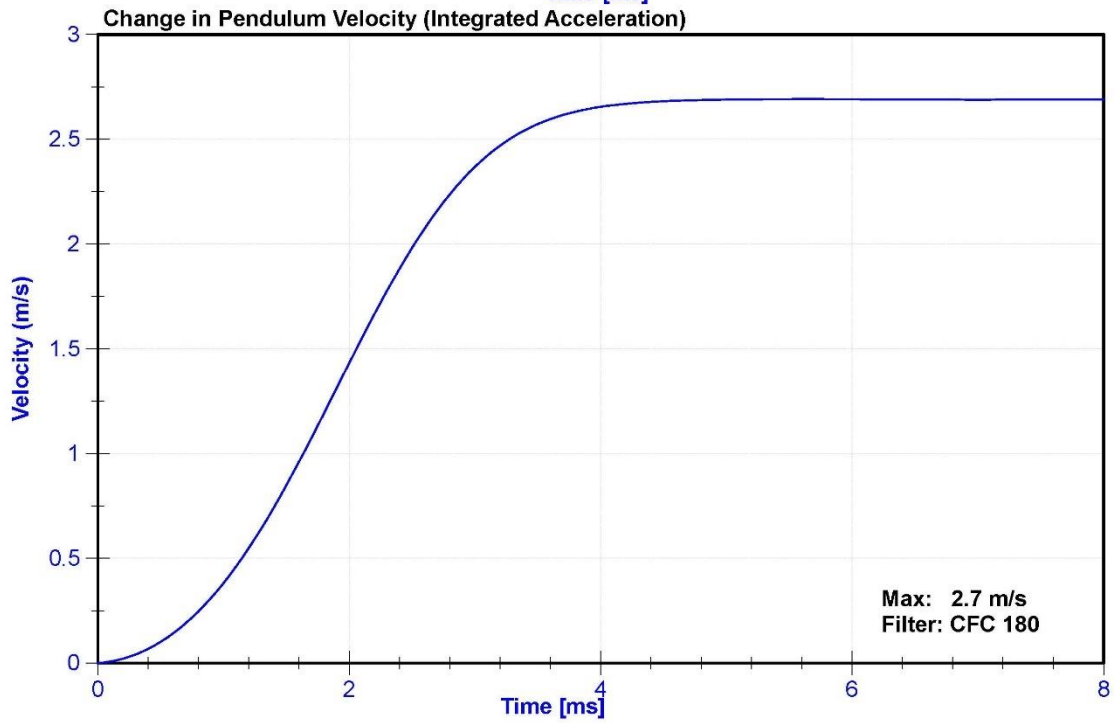
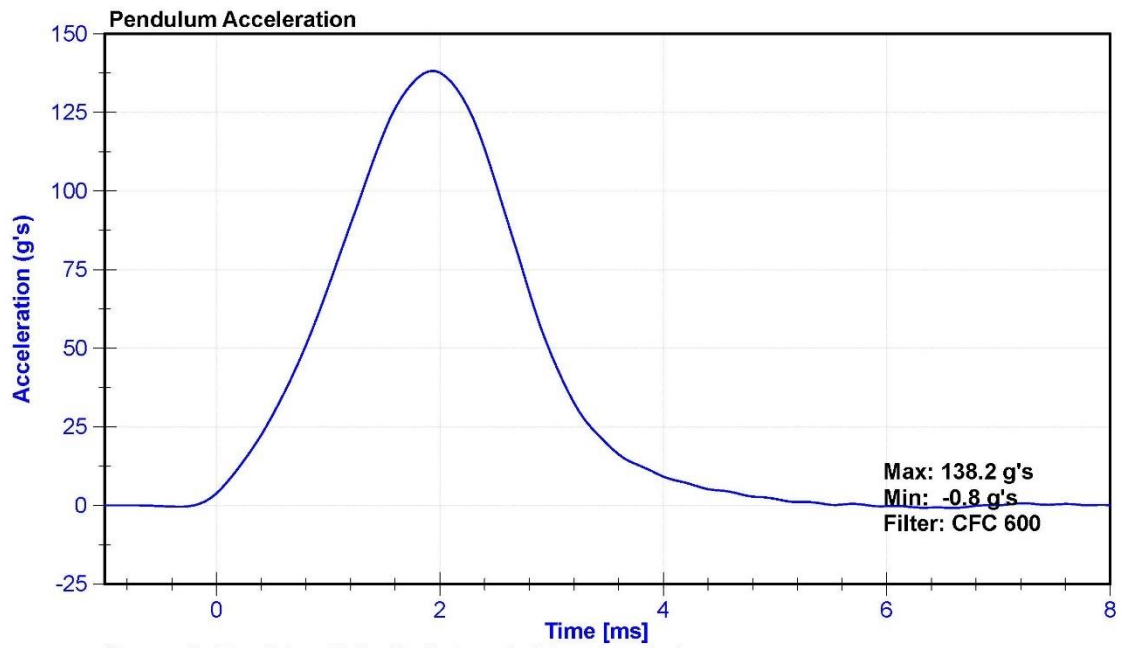
#### Results

| Test Parameter  | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|-----------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature     | 18.9                  | 25.6                  | °C   | 21.2   | Pass      |
| Humidity        | 10                    | 70                    | %    | 26.0   | Pass      |
| Velocity        | 2.07                  | 2.13                  | m/s  | 2.112  | Pass      |
| Resistive Force | 3450                  | 4060                  | N    | 4028.4 | Pass      |

#### Transducer Calibrations

| Channel                | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|------------------------|--------------|---------------|------------------|----------------------|
| Pendulum Accelerometer | Endevco      | T25885        | 10/25/2021       | 10/25/2022           |







**CALIBRATION TEST RESULTS**

**POST-TEST**

**HYBRID III 50<sup>TH</sup> PERCENTILE MALE - DRIVER ATD**

**SERIAL NO: 142**

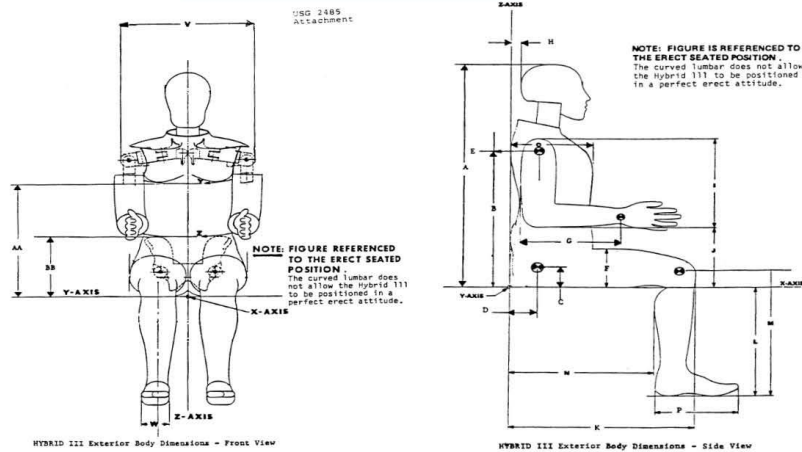


## External Measurements - Hybrid 3 - 50th Male

Technician: **K. Brogan**

Date: **05/26/2022**

Dummy Serial Number: **142**



| Symbol | Description                              | Specification (in) |      | Result (in) | Pass/Fail |
|--------|------------------------------------------|--------------------|------|-------------|-----------|
| A      | Sitting Height                           | 34.6               | 35.0 | 34.8        | Pass      |
| B      | Shoulder Pivot Height                    | 19.9               | 20.5 | 20.2        | Pass      |
| C      | H-Point Height                           | 3.3                | 3.5  | 3.4         | Pass      |
| D      | H-Point from Backline                    | 5.3                | 5.5  | 5.4         | Pass      |
| E      | Shoulder Pivot from Backline             | 3.3                | 3.7  | 3.5         | Pass      |
| F      | Thigh Clearance                          | 5.5                | 6.1  | 5.8         | Pass      |
| G      | Back of Elbow to Wrist Pivot             | 11.4               | 12.0 | 11.7        | Pass      |
| H      | Head Back to Backline                    | 1.6                | 1.8  | 1.7         | Pass      |
| I      | Shoulder to Elbow Length                 | 13.0               | 13.6 | 13.4        | Pass      |
| J      | Elbow Rest Height                        | 7.5                | 8.3  | 8.1         | Pass      |
| K      | Buttock to Knee Length                   | 22.8               | 23.8 | 23.2        | Pass      |
| L      | Popliteal Height                         | 16.9               | 17.9 | 17.5        | Pass      |
| M      | Knee Pivot Height                        | 19.1               | 19.7 | 19.4        | Pass      |
| N      | Buttock Popliteal Length                 | 17.8               | 18.8 | 18.3        | Pass      |
| O      | Chest Depth without Jacket               | 8.4                | 9.0  | 8.8         | Pass      |
| P      | Foot Length (right)                      | 9.9                | 10.5 | 10.1        | Pass      |
| V      | Shoulder Breadth                         | 16.3               | 17.2 | 16.8        | Pass      |
| W      | Foot Breadth                             | 3.6                | 4.2  | 3.8         | Pass      |
| Y      | Chest Circumference with Jacket          | 38.2               | 39.4 | 39.0        | Pass      |
| Z      | Waist Circumference                      | 32.9               | 34.1 | 33.7        | Pass      |
| AA     | Reference Location (Chest Circumference) | 16.9               | 17.1 | 17.0        | Pass      |
| BB     | Reference Location (Waist Circumference) | 8.9                | 9.1  | 9.0         | Pass      |

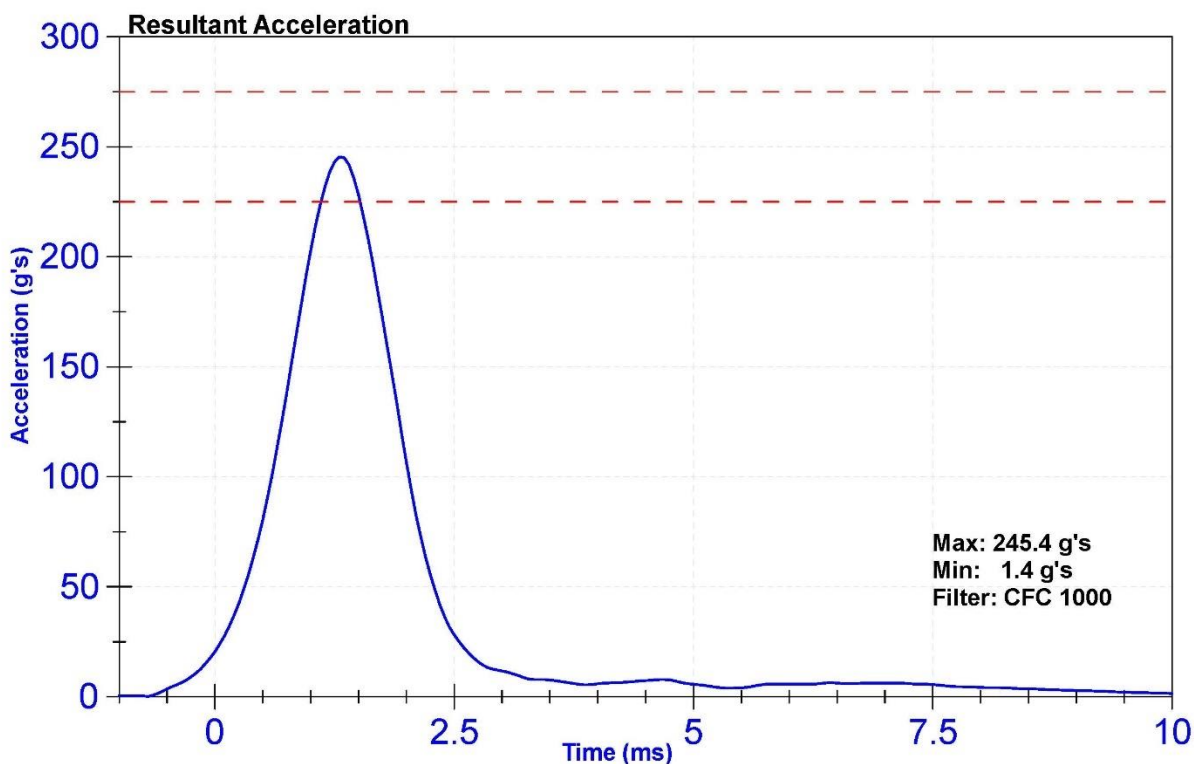
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|-------------------|------------|-----------------------|------------|
| ATD Manufacturer  | Humanetics | Test Technician       | S. Vacanti |
| ATD Serial Number | 142        | Laboratory Supervisor | K. Brogan  |

### Results

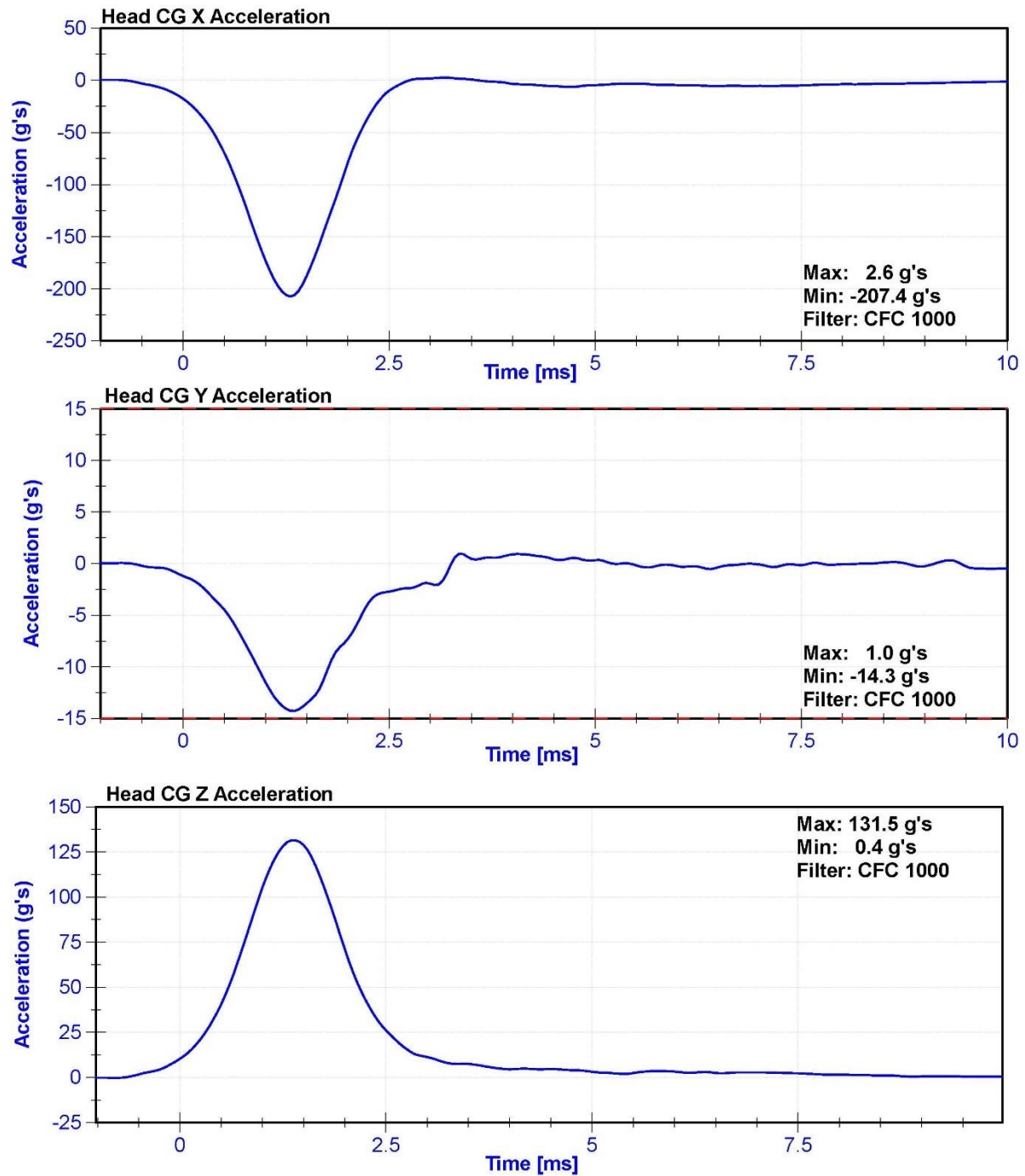
| Test Parameter         | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|------------------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature            | 18.9                  | 25.6                  | °C   | 21.5   | Pass      |
| Humidity               | 10                    | 70                    | %    | 46     | Pass      |
| Resultant Acceleration | 225                   | 275                   | g's  | 245.4  | Pass      |
| Oscillation            | 0                     | 10                    | %    | 3.1    | Pass      |
| Lateral Acceleration   | -15                   | 15                    | g's  | -14.3  | Pass      |

### Transducer Calibrations

| Channel         | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|-----------------|--------------|---------------|------------------|----------------------|
| X Accelerometer | Endevco      | P51681        | 5/10/2022        | 11/6/2022            |
| Y Accelerometer | Endevco      | P64151        | 5/10/2022        | 11/6/2022            |
| Z Accelerometer | Endevco      | P52114        | 5/10/2022        | 11/6/2022            |







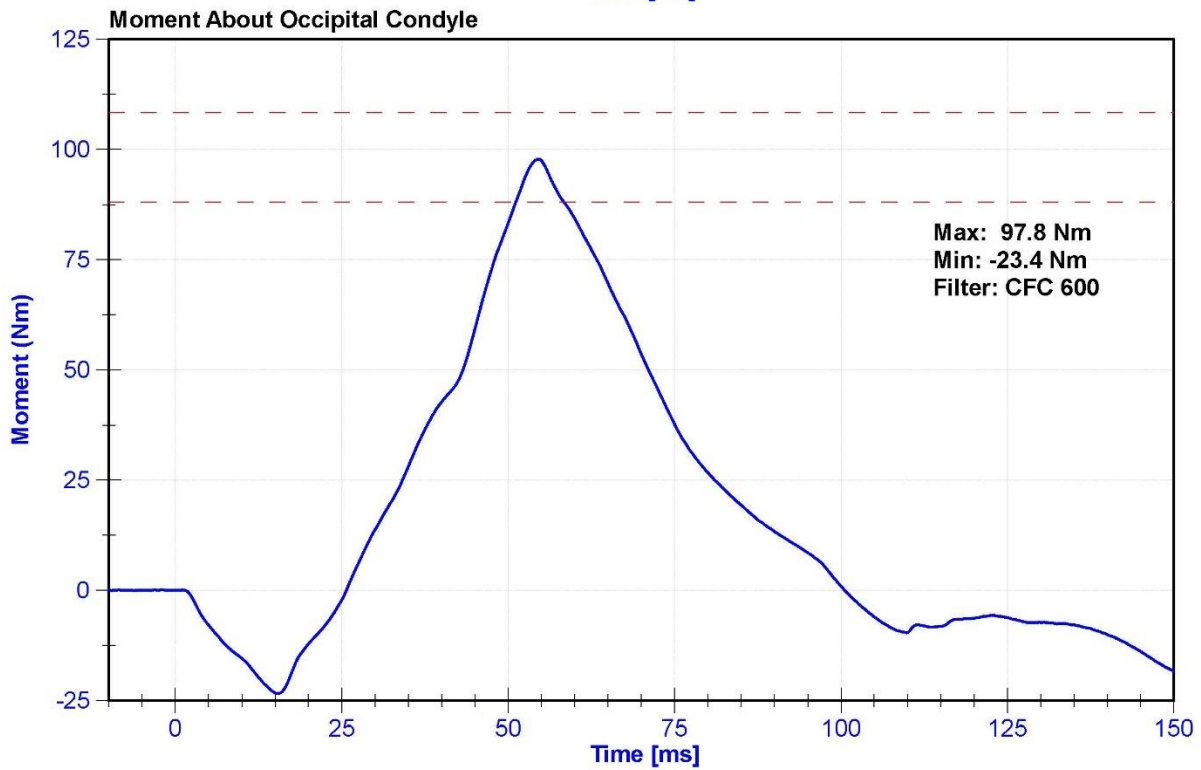
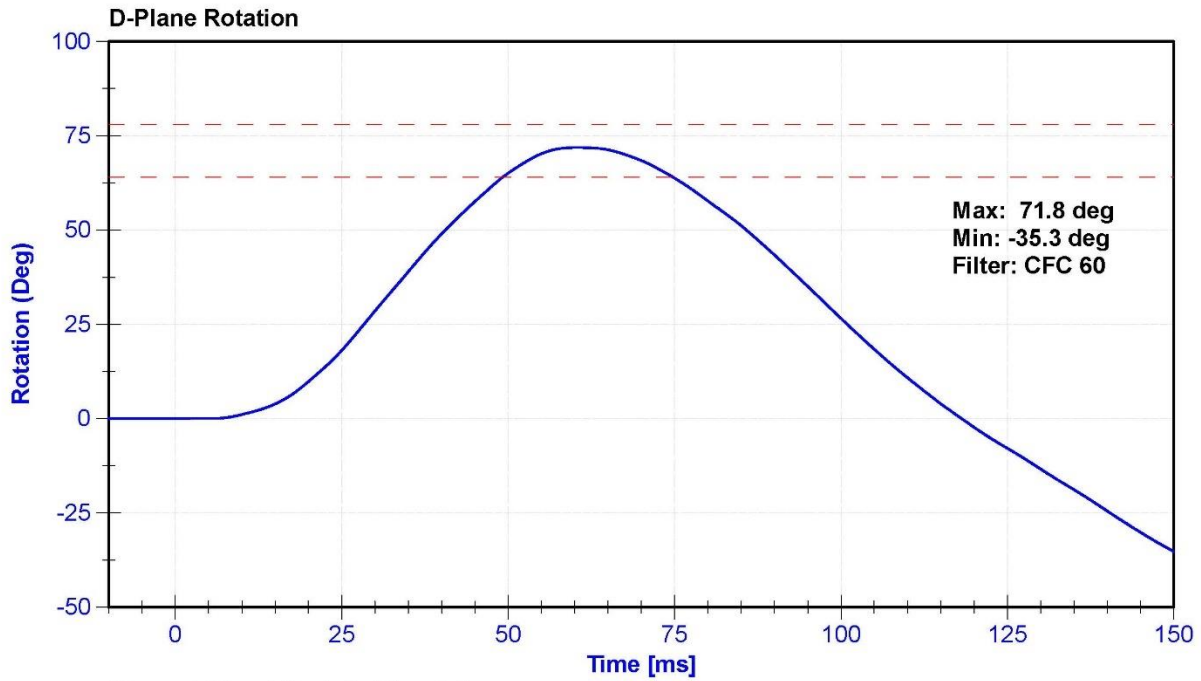
|                   |            |                       |            |
|-------------------|------------|-----------------------|------------|
| ATD Manufacturer  | Humanetics | Test Technician       | S. Vacanti |
| ATD Serial Number | 142        | Laboratory Supervisor | C. Mantell |

### Results

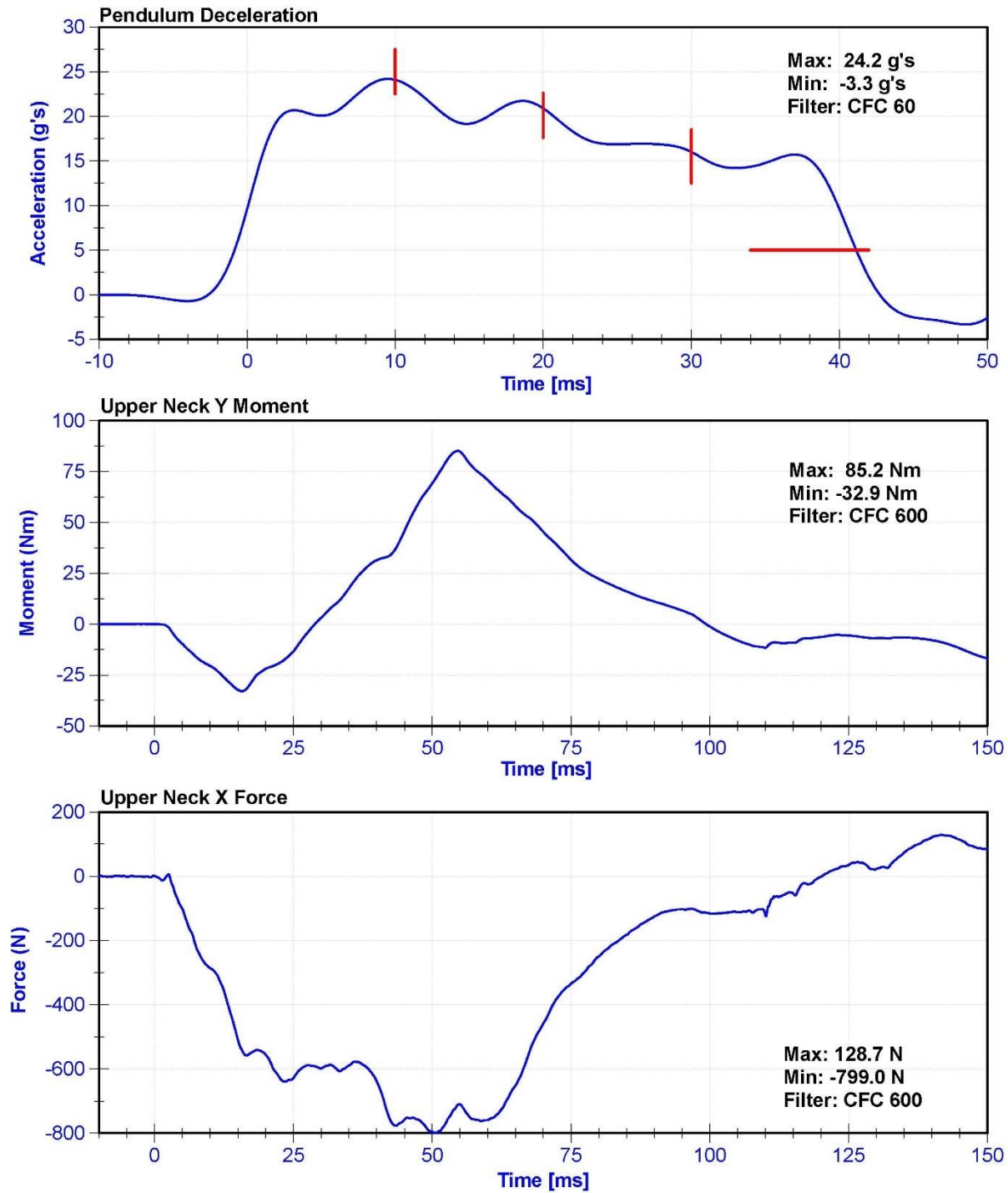
| Test Parameter                        | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---------------------------------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature                           | 20.6                  | 22.2                  | °C   | 21.2   | Pass      |
| Humidity                              | 10                    | 70                    | %    | 46.9   | Pass      |
| Velocity                              | 6.89                  | 7.13                  | m/s  | 6.971  | Pass      |
| Pendulum Deceleration at 10ms         | 22.5                  | 27.5                  | g's  | 24.10  | Pass      |
| Pendulum Deceleration at 20ms         | 17.6                  | 22.6                  | g's  | 20.90  | Pass      |
| Pendulum Deceleration at 30ms         | 12.5                  | 18.5                  | g's  | 16.01  | Pass      |
| Max. Pendulum Deceleration After 30ms | 0                     | 29                    | g's  | 24.2   | Pass      |
| Pendulum Deceleration Time to 5 g's   | 34                    | 42                    | ms   | 41.1   | Pass      |
| Maximum D Plane Rotation              | 64                    | 78                    | deg  | 71.8   | Pass      |
| Time to Maximum Rotation              | 57                    | 64                    | ms   | 60.3   | Pass      |
| Rotation Decay to Zero                | 113                   | 127                   | ms   | 118.1  | Pass      |
| Moment About Occipital Condyle        | 88.1                  | 108.4                 | Nm   | 97.82  | Pass      |
| Time to Maximum Moment                | 47                    | 58                    | ms   | 54.6   | Pass      |
| Moment Decay to Zero                  | 97                    | 107                   | ms   | 100.5  | Pass      |

### Transducer Calibrations

| Channel                | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|------------------------|--------------|---------------|------------------|----------------------|
| Pendulum Accelerometer | Endevco      | 7231CT        | 10/28/2021       | 10/28/2022           |
| Pendulum Potentiometer | ETI          | LABPOT1       | 5/9/2022         | 5/9/2023             |
| Condyle Potentiometer  | ETI          | LABPOT2       | 5/9/2022         | 5/9/2023             |
| Upper Neck Load Cell   | FTSS         | 280-FX        | 9/14/2021        | 9/14/2022            |







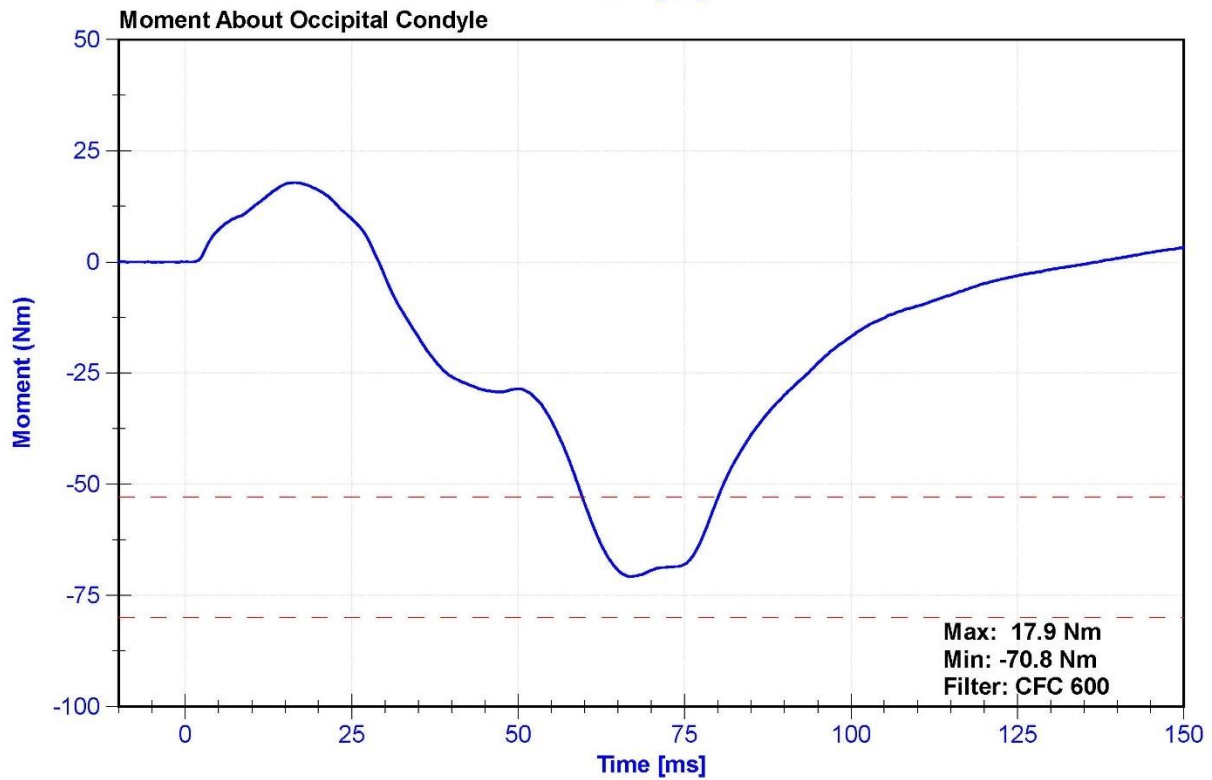
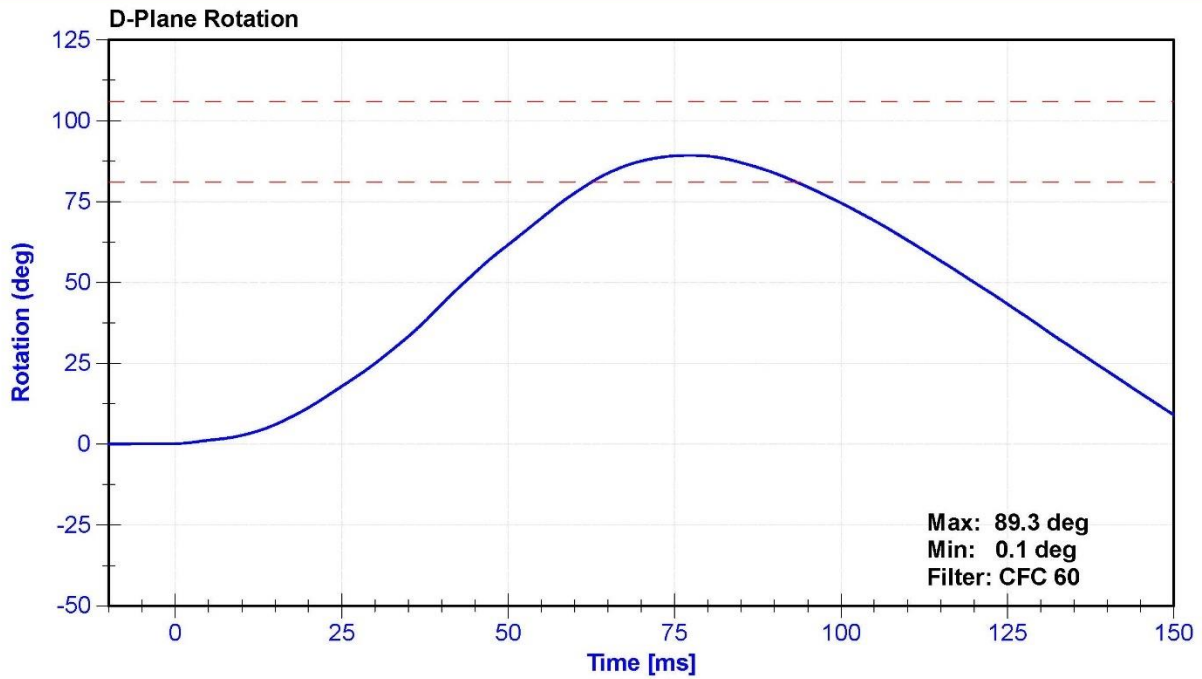
|                   |            |                       |            |
|-------------------|------------|-----------------------|------------|
| ATD Manufacturer  | Humanetics | Test Technician       | S. Vacanti |
| ATD Serial Number | 142        | Laboratory Supervisor | C. Mantell |

### Results

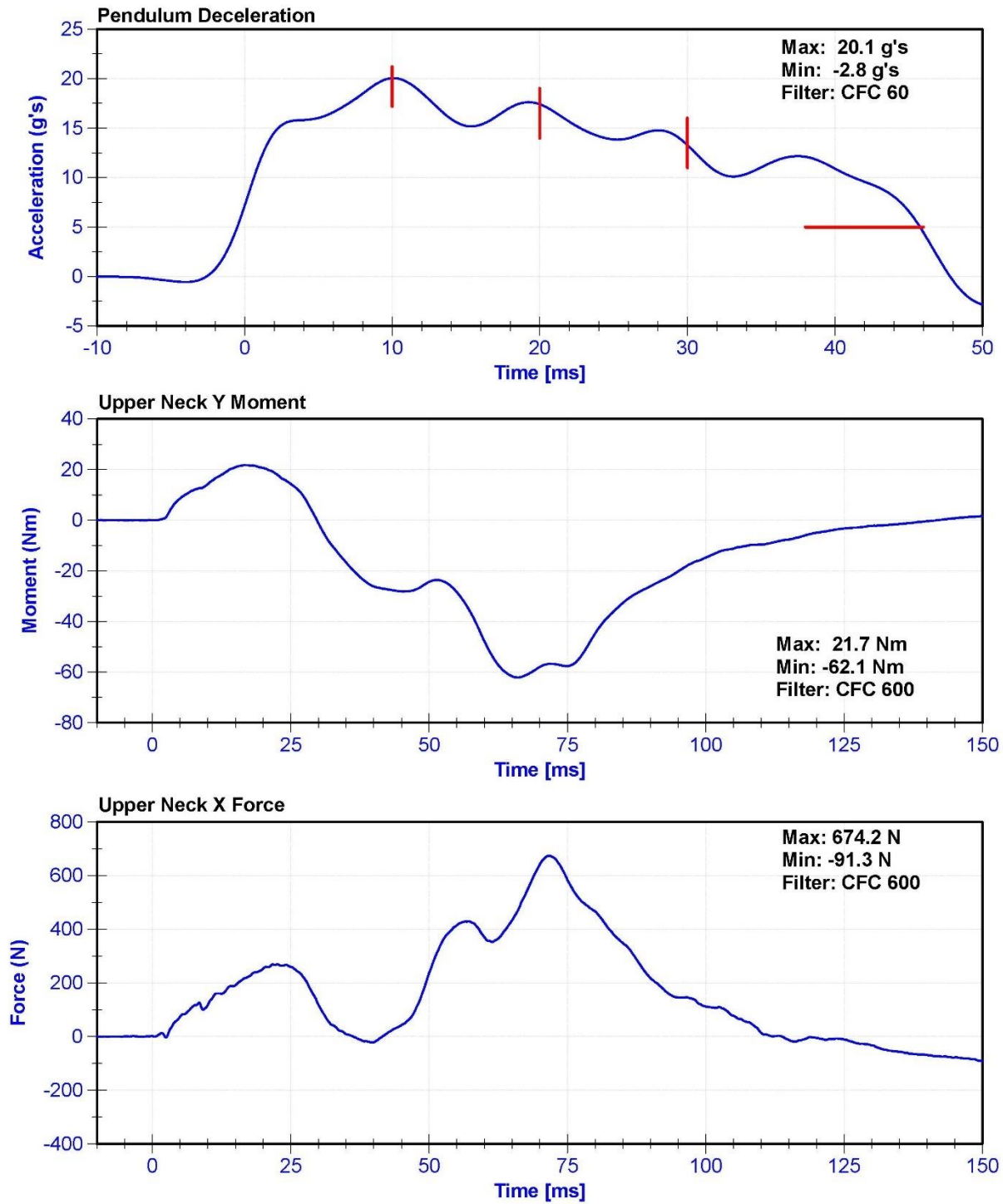
| Test Parameter                        | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---------------------------------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature                           | 20.6                  | 22.2                  | °C   | 21.5   | Pass      |
| Humidity                              | 10                    | 70                    | %    | 45.1   | Pass      |
| Velocity                              | 5.94                  | 6.19                  | m/s  | 6.055  | Pass      |
| Pendulum Deceleration at 10ms         | 17.2                  | 21.2                  | g's  | 20.05  | Pass      |
| Pendulum Deceleration at 20ms         | 14                    | 19                    | g's  | 17.4   | Pass      |
| Pendulum Deceleration at 30ms         | 11                    | 16                    | g's  | 13.3   | Pass      |
| Max. Pendulum Deceleration After 30ms | 0                     | 22                    | g's  | 20.1   | Pass      |
| Pendulum Deceleration Time to 5 g's   | 38                    | 46                    | ms   | 45.8   | Pass      |
| Maximum D Plane Rotation              | 81                    | 106                   | deg  | 89.3   | Pass      |
| Time to Maximum Rotation              | 72                    | 82                    | ms   | 77.3   | Pass      |
| Rotation Decay to Zero                | 147                   | 174                   | ms   | 157.1  | Pass      |
| Minimum Moment About OC               | -80                   | -52.9                 | Nm   | -70.79 | Pass      |
| Time to Minimum Moment                | 65                    | 79                    | ms   | 66.8   | Pass      |
| Moment Decay to Zero                  | 120                   | 148                   | ms   | 137.2  | Pass      |

### Transducer Calibrations

| Channel                | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|------------------------|--------------|---------------|------------------|----------------------|
| Pendulum Accelerometer | Endevco      | C16503        | 10/28/2021       | 10/28/2022           |
| Pendulum Potentiometer | ETI          | LABPOT1       | 5/9/2022         | 5/9/2023             |
| Condyle Potentiometer  | ETI          | LABPOT2       | 5/9/2022         | 5/9/2023             |
| Upper Neck Load Cell   | FTSS         | 280-FX        | 9/14/2021        | 9/14/2022            |







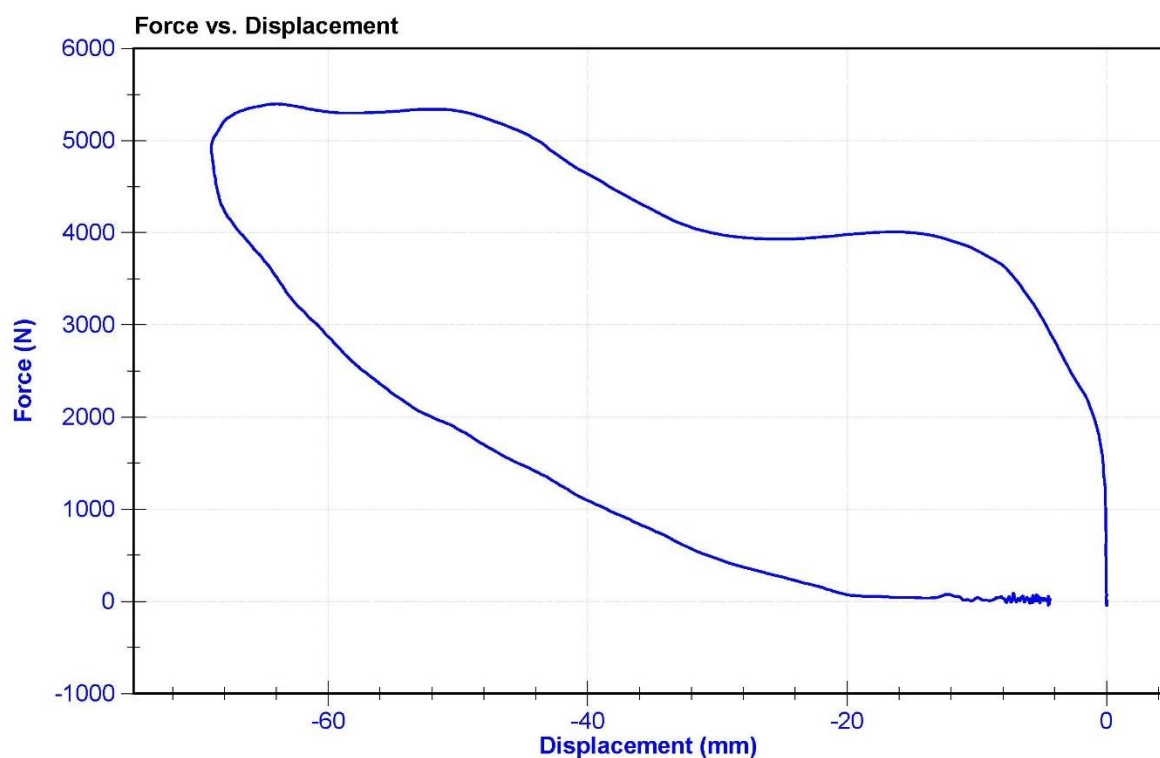
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|-------------------|------------|-----------------------|------------|
| ATD Manufacturer  | Humanetics | Test Technician       | S. Vacanti |
| ATD Serial Number | 142        | Laboratory Supervisor | K. Brogan  |

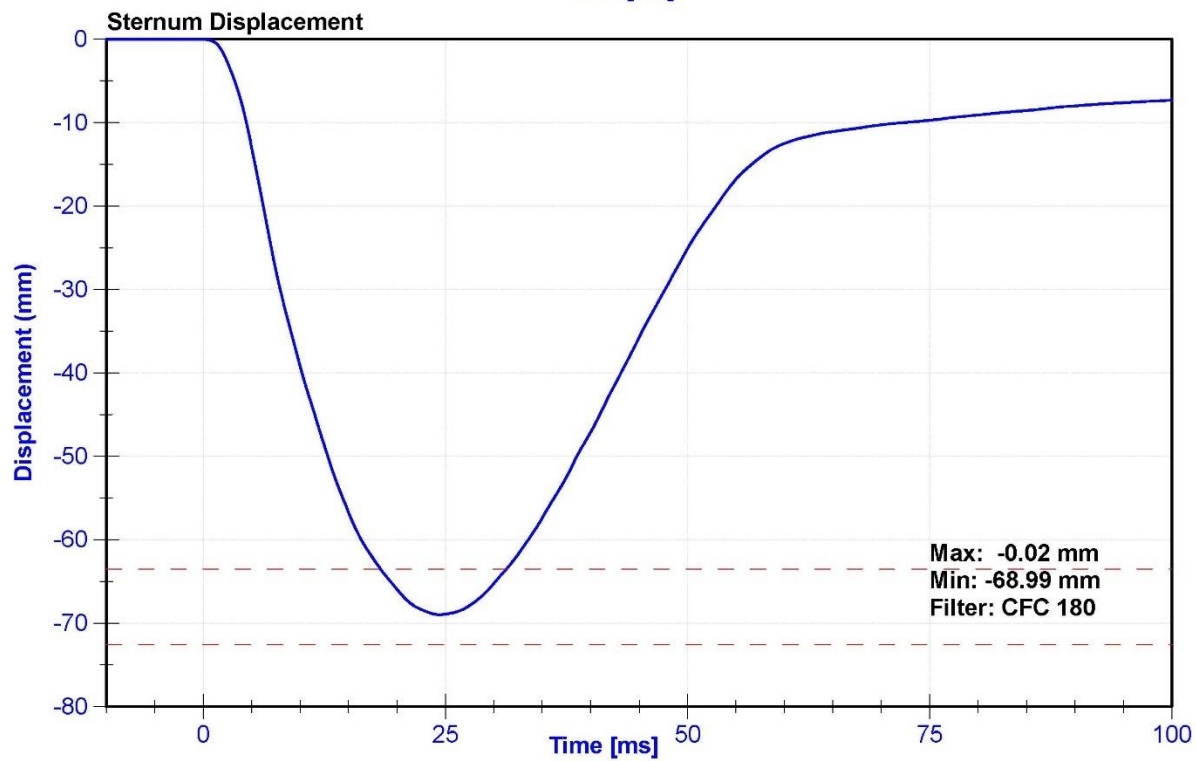
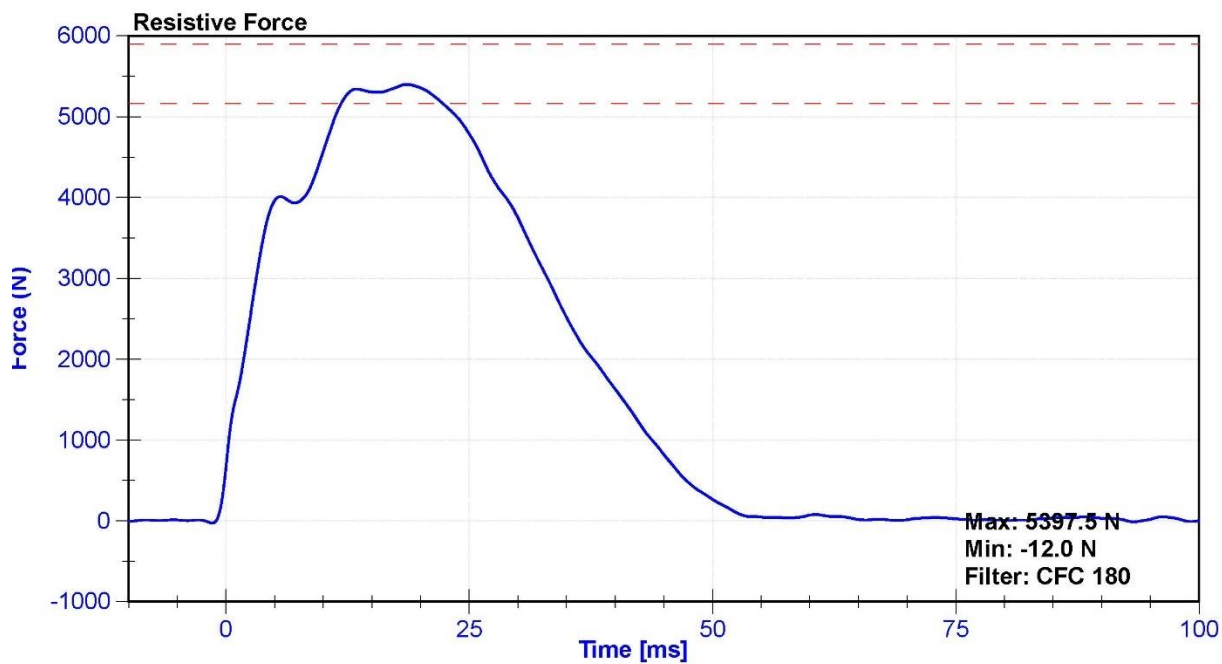
### Results

| Test Parameter     | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|--------------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature        | 20.6                  | 22.2                  | °C   | 21.4   | Pass      |
| Humidity           | 10                    | 70                    | %    | 45.5   | Pass      |
| Velocity           | 6.59                  | 6.83                  | m/s  | 6.689  | Pass      |
| Chest Displacement | -72.6                 | -63.5                 | mm   | -68.99 | Pass      |
| Resistive Force    | 5160                  | 5894                  | N    | 5397.5 | Pass      |
| Hysteresis         | 65                    | 85                    | %    | 73.2   | Pass      |

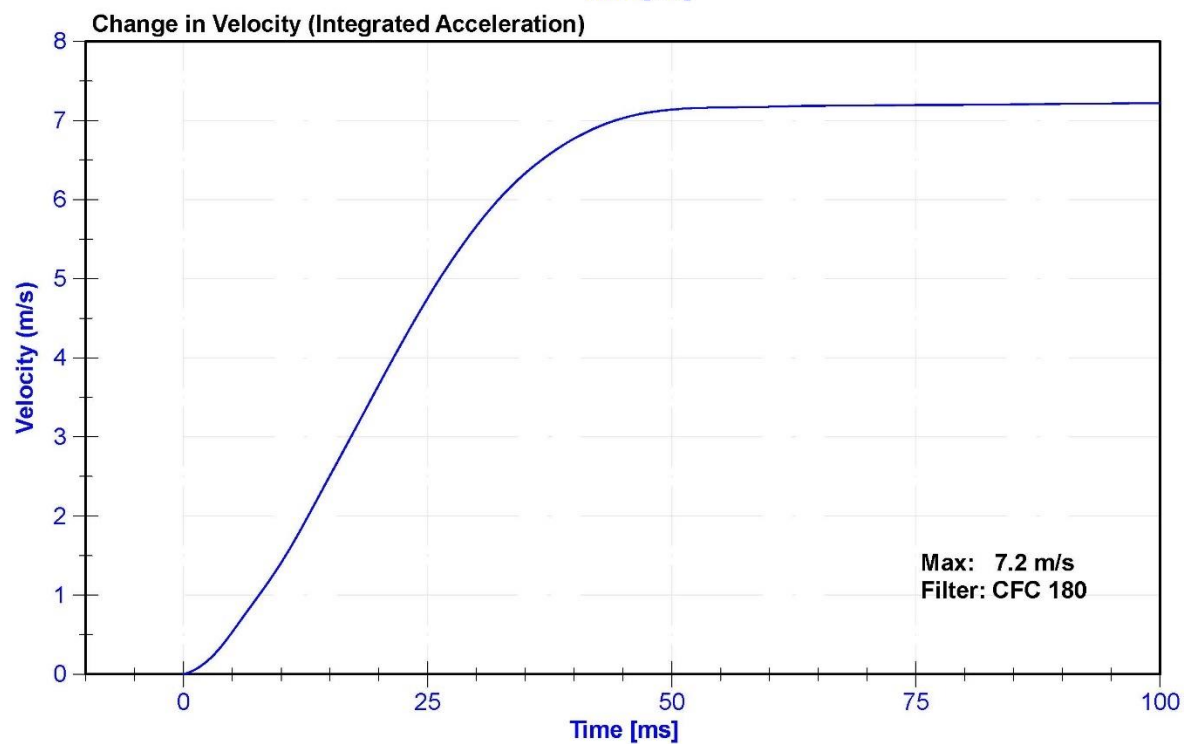
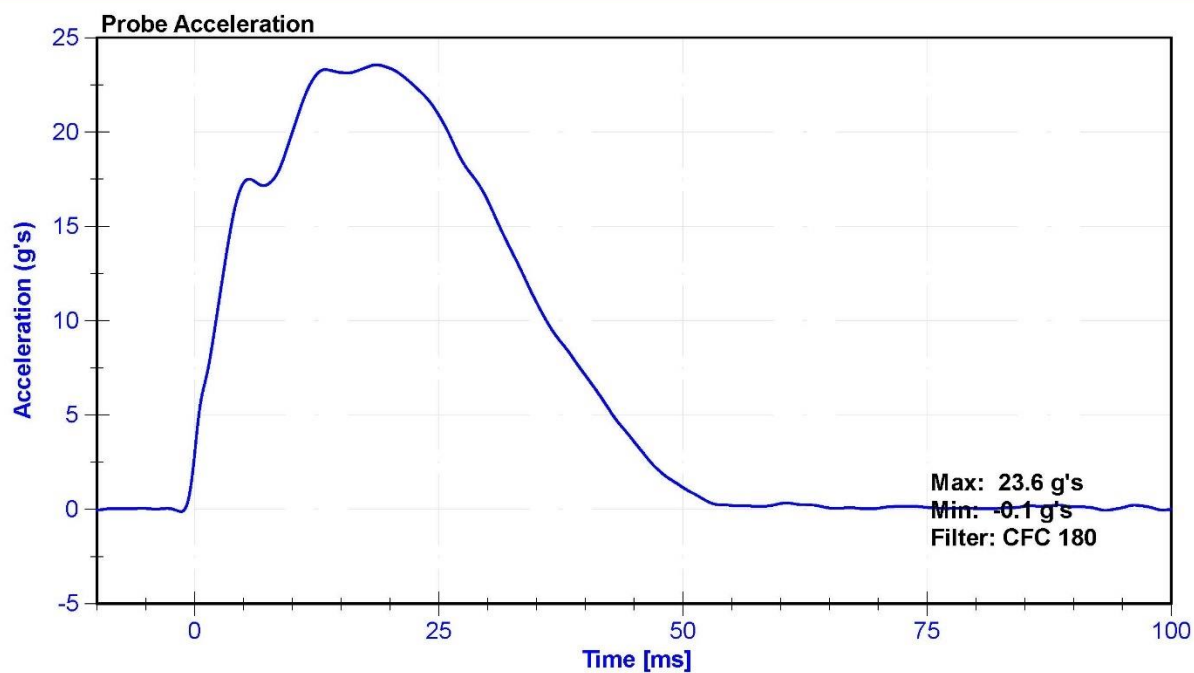
### Transducer Calibrations

| Channel                | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|------------------------|--------------|---------------|------------------|----------------------|
| Pendulum Accelerometer | Endevco      | T25885        | 10/25/2021       | 10/25/2022           |
| Chest Potentiometer    | JDK          | 0075          | 5/10/2022        | 11/8/2022            |





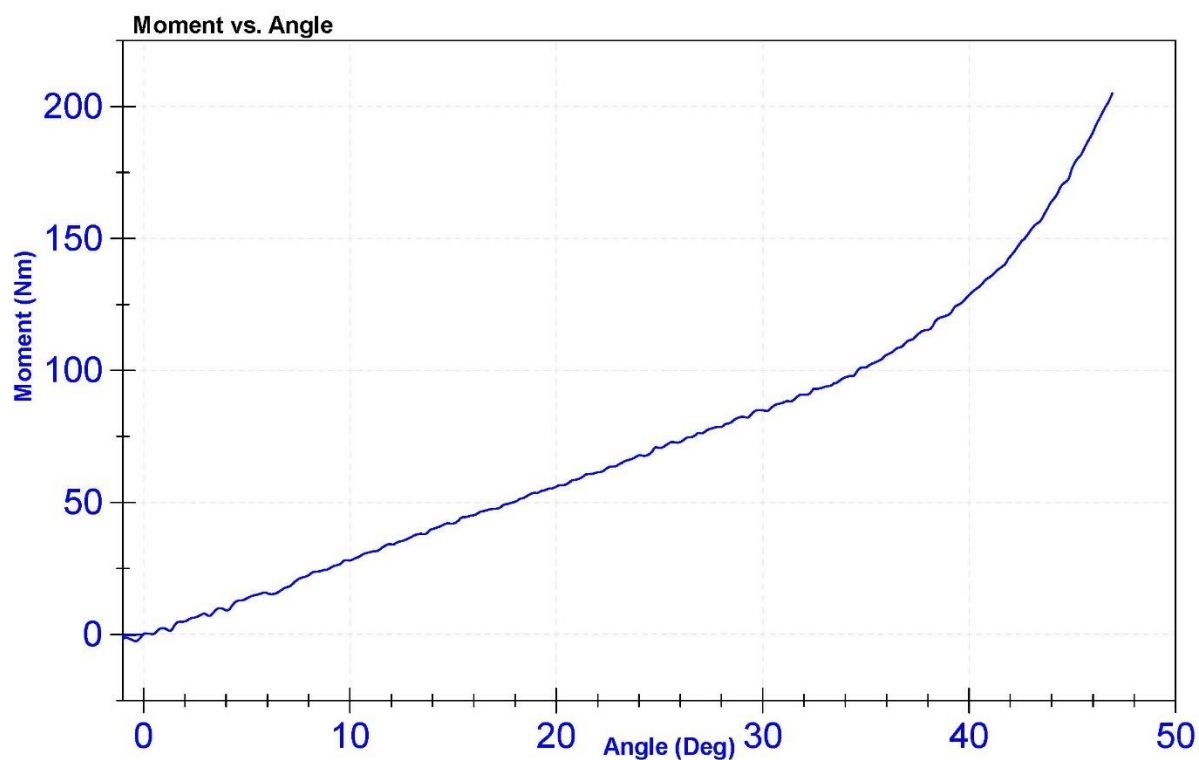




|                   |            |                       |            |
|-------------------|------------|-----------------------|------------|
| ATD Manufacturer  | Humanetics | Test Technician       | S. Vacanti |
| ATD Serial Number | 142        | Laboratory Supervisor | K. Brogan  |

| Test Parameter       | Results               |                       | Unit  | Result | Pass/Fail |
|----------------------|-----------------------|-----------------------|-------|--------|-----------|
|                      | Minimum Specification | Maximum Specification |       |        |           |
| Temperature          | 18.9                  | 25.6                  | °C    | 21.6   | Pass      |
| Humidity             | 10                    | 70                    | %     | 46.9   | Pass      |
| Average Velocity     | 5                     | 10                    | deg/s | 7.4    | Pass      |
| Angle at 203Nm       | 40                    | 50                    | deg   | 46.8   | Pass      |
| Moment at 30 degrees | 0                     | 94.9                  | Nm    | 84.9   | Pass      |

| Transducer Calibrations |                   |               |                  |                      |
|-------------------------|-------------------|---------------|------------------|----------------------|
| Channel                 | Manufacturer      | Serial Number | Calibration Date | Calibration Due Date |
| Potentiometer           | ETI SP22          | DS-0008       | 9/27/2021        | 9/27/2022            |
| Load Cell               | Key Trans 2301-02 | LC-115 My     | 2021-08-13       | 2022-08-13           |



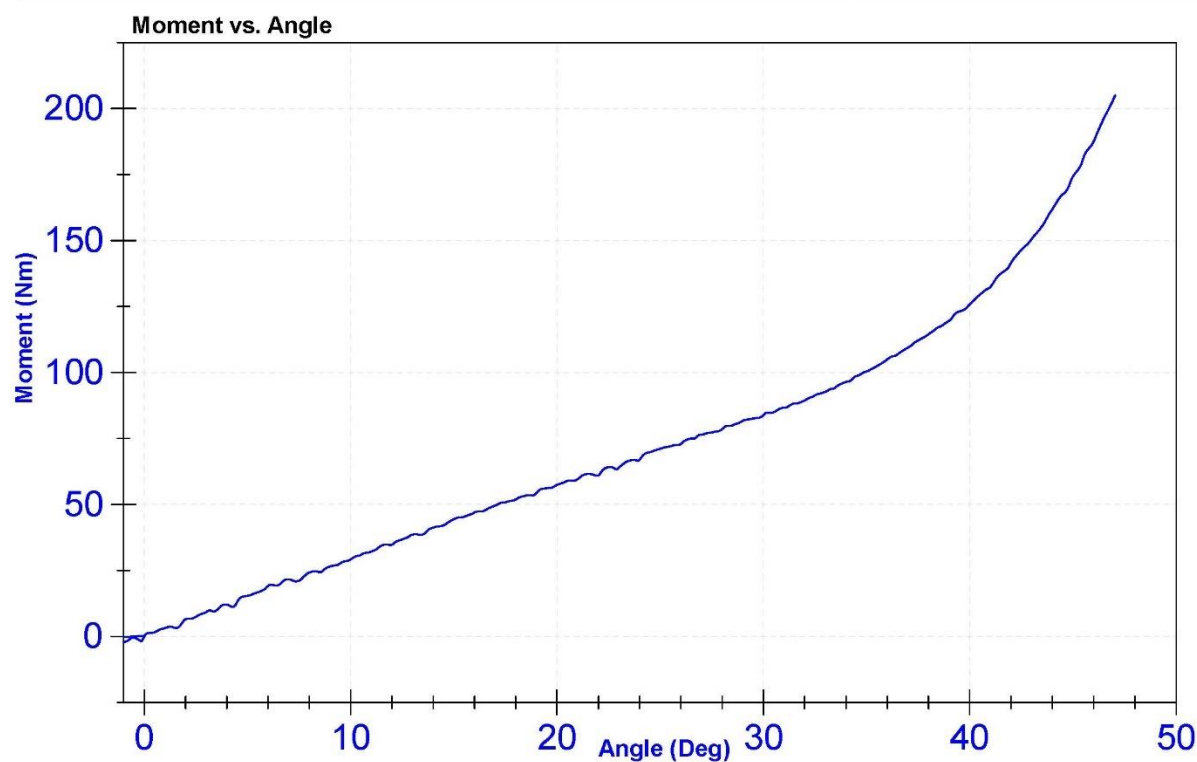
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|-------------------|------------|-----------------------|------------|
| ATD Manufacturer  | Humanetics | Test Technician       | S. Vacanti |
| ATD Serial Number | 142        | Laboratory Supervisor | K. Brogan  |

### Results

| Test Parameter       | Minimum Specification | Maximum Specification | Unit  | Result | Pass/Fail |
|----------------------|-----------------------|-----------------------|-------|--------|-----------|
| Temperature          | 18.9                  | 25.6                  | °C    | 21.6   | Pass      |
| Humidity             | 10                    | 70                    | %     | 46.9   | Pass      |
| Average Velocity     | 5                     | 10                    | deg/s | 7.4    | Pass      |
| Angle at 203Nm       | 40                    | 50                    | deg   | 46.9   | Pass      |
| Moment at 30 degrees | 0                     | 94.9                  | Nm    | 83.8   | Pass      |

### Transducer Calibrations

| Channel       | Manufacturer      | Serial Number | Calibration Date | Calibration Due Date |
|---------------|-------------------|---------------|------------------|----------------------|
| Potentiometer | ETI SP22          | DS-0008       | 9/27/2021        | 9/27/2022            |
| Load Cell     | Key Trans 2301-02 | LC-115 My     | 2021-08-13       | 2022-08-13           |





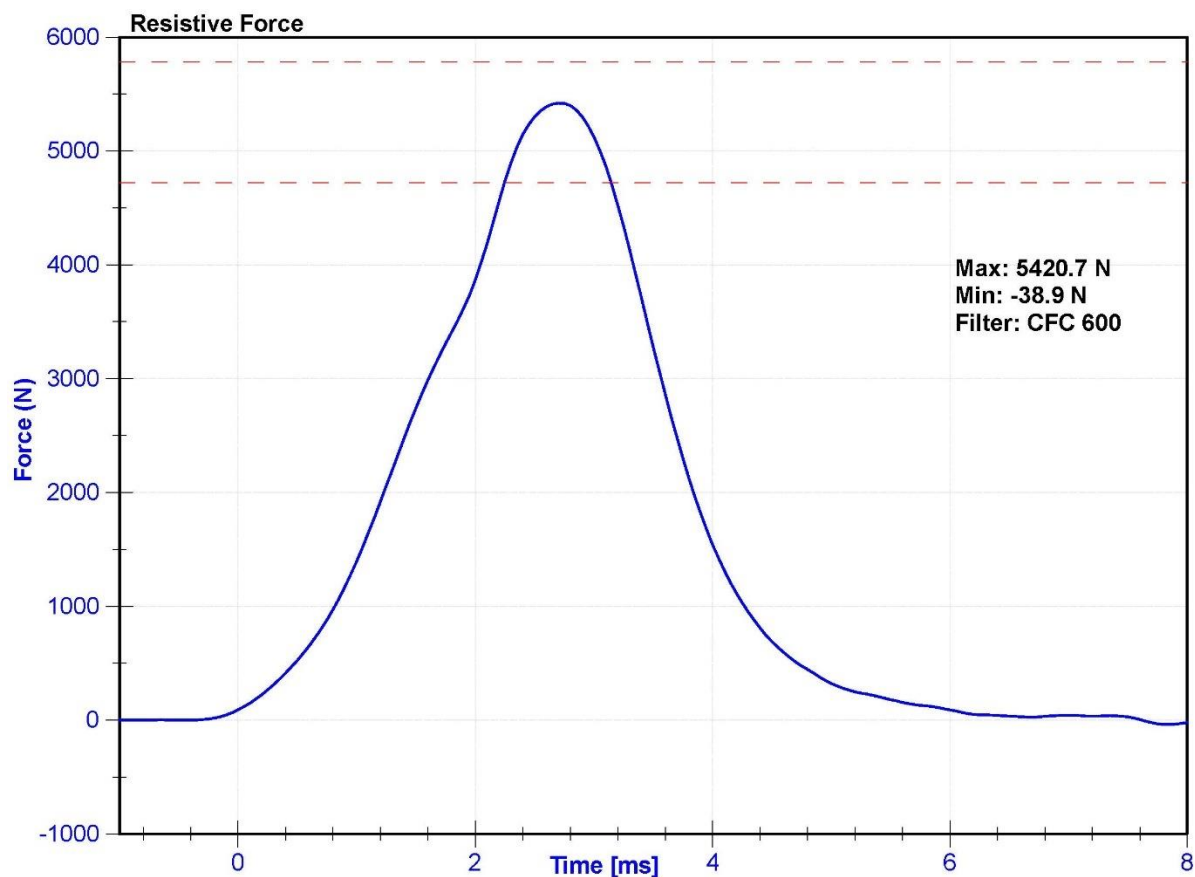
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|-------------------|------------|-----------------------|------------|
| ATD Manufacturer  | Humanetics | Test Technician       | S. Vacanti |
| ATD Serial Number | 142        | Laboratory Supervisor | K. Brogan  |

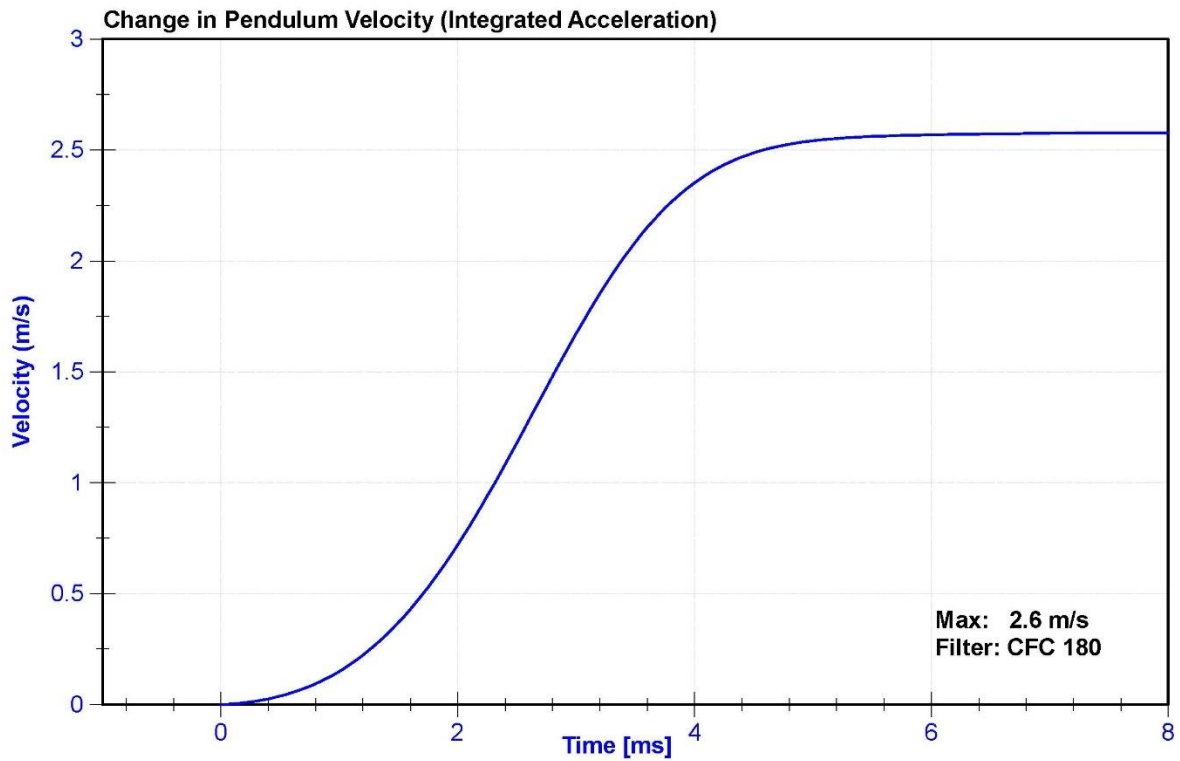
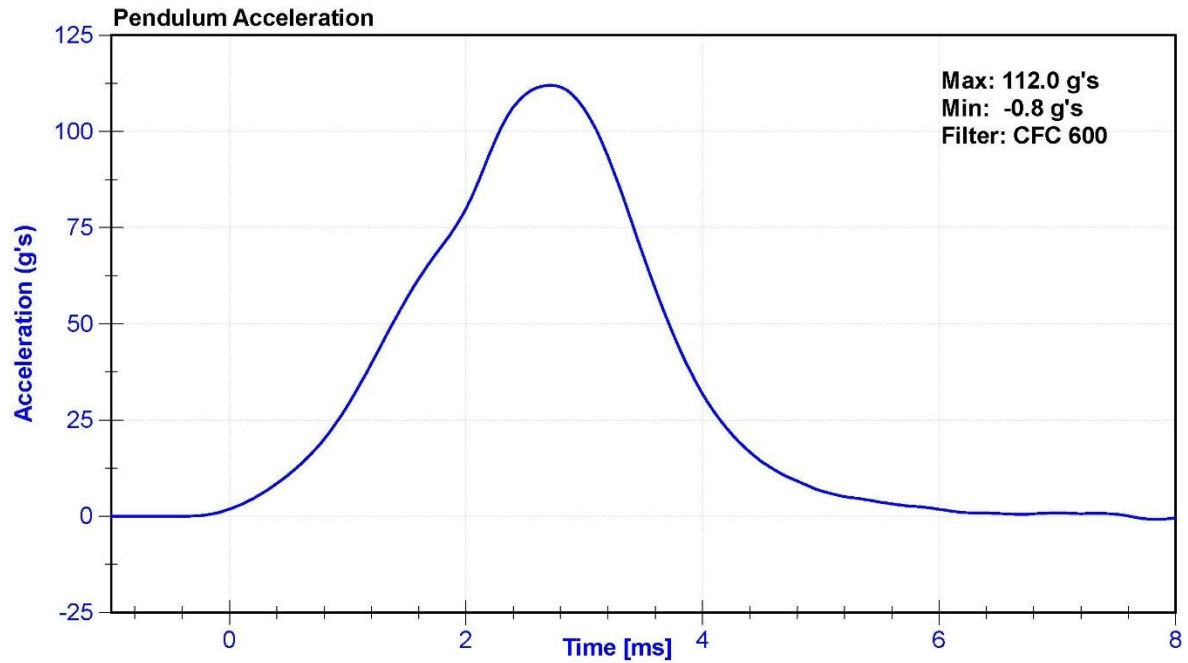
#### Results

| Test Parameter          | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|-------------------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature             | 18.9                  | 25.6                  | °C   | 21.2   | Pass      |
| Humidity                | 10                    | 70                    | %    | 46     | Pass      |
| Velocity                | 2.07                  | 2.13                  | m/s  | 2.109  | Pass      |
| Maximum Resistive Force | 4720                  | 5780                  | N    | 5420.7 | Pass      |

#### Transducer Calibrations

| Channel                | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|------------------------|--------------|---------------|------------------|----------------------|
| Pendulum Accelerometer | Endevco      | T25885        | 10/25/2021       | 10/25/2022           |





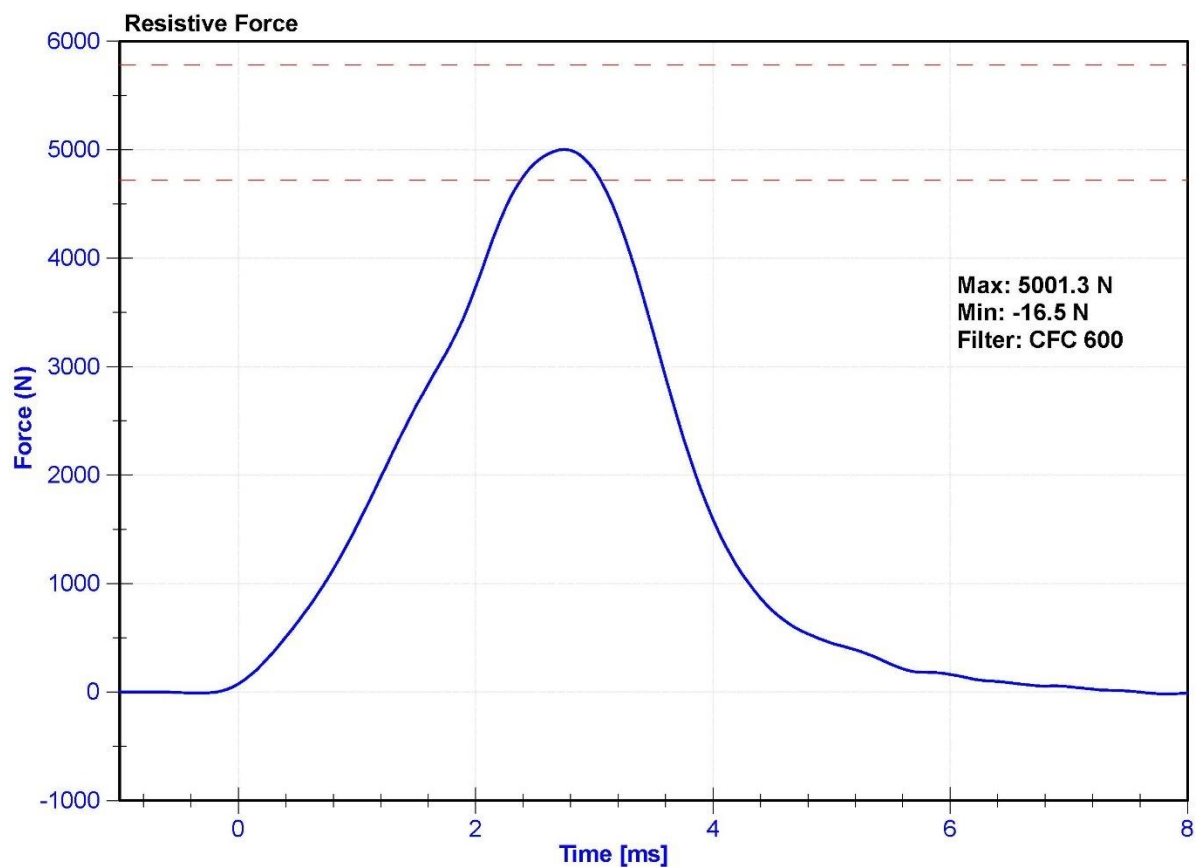
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|-------------------|------------|-----------------------|-----------|
| ATD Manufacturer  | Humanetics | Test Technician       | D. Sakona |
| ATD Serial Number | 142        | Laboratory Supervisor | K. Brogan |

#### Results

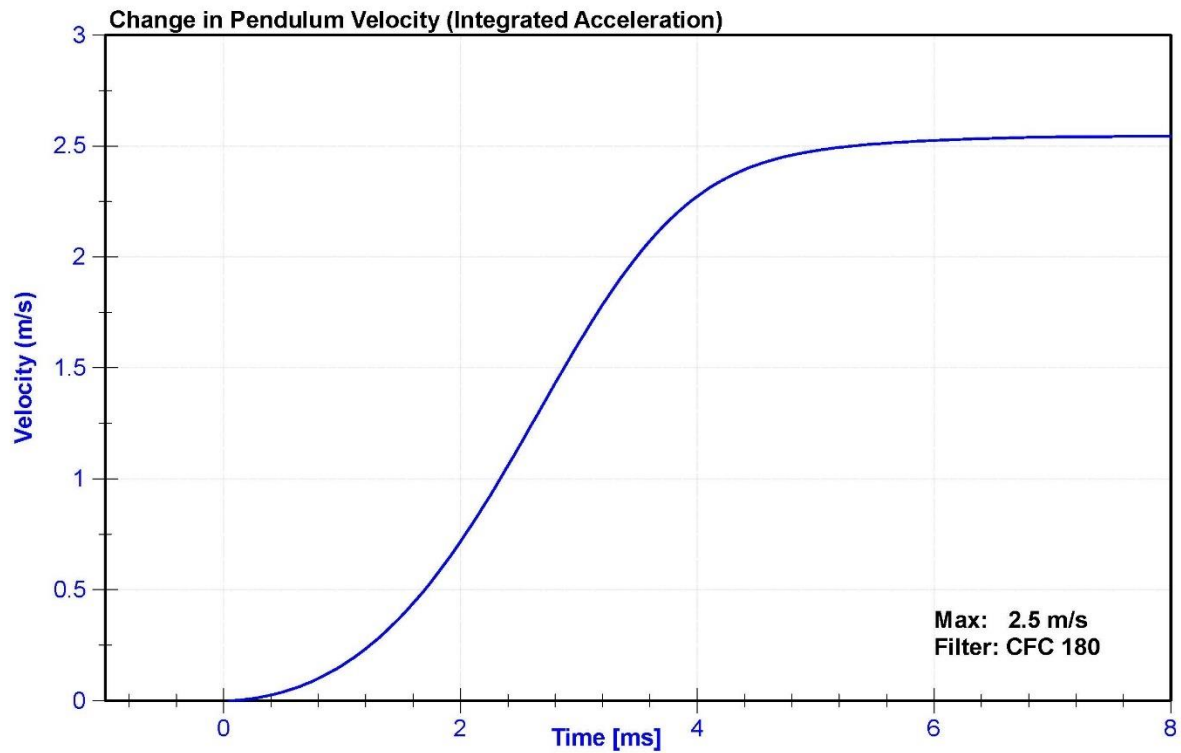
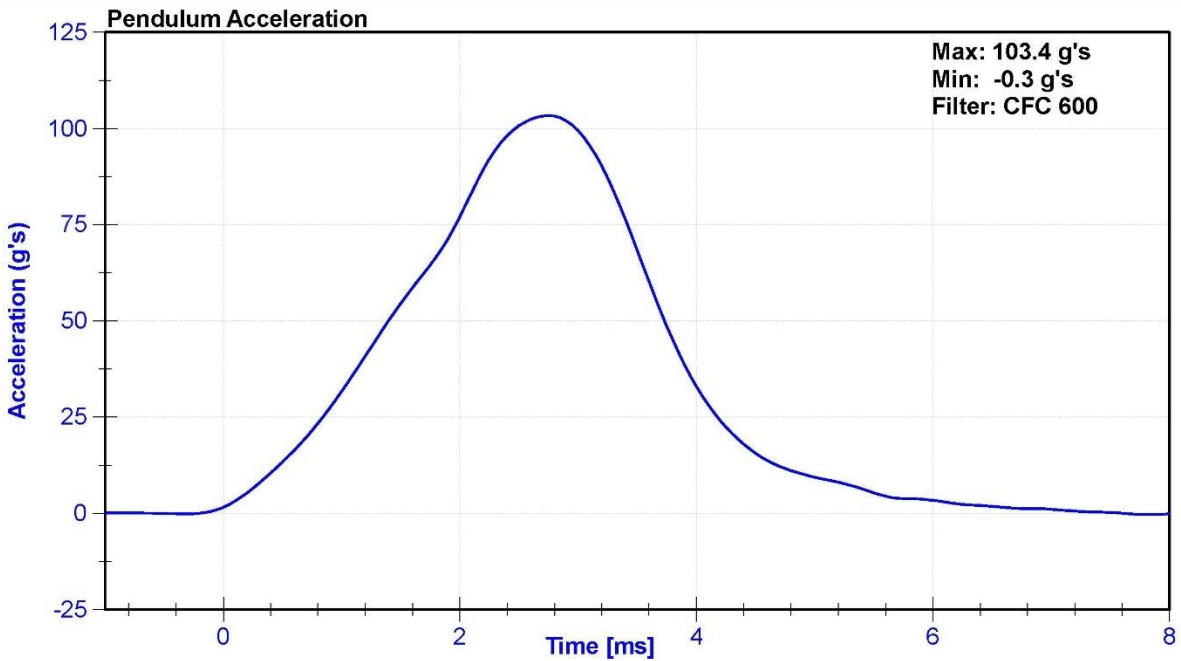
| Test Parameter          | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|-------------------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature             | 18.9                  | 25.6                  | °C   | 21.2   | Pass      |
| Humidity                | 10                    | 70                    | %    | 46     | Pass      |
| Velocity                | 2.07                  | 2.13                  | m/s  | 2.110  | Pass      |
| Maximum Resistive Force | 4720                  | 5780                  | N    | 5001.3 | Pass      |

#### Transducer Calibrations

| Channel                | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|------------------------|--------------|---------------|------------------|----------------------|
| Pendulum Accelerometer | Endevco      | T25885        | 10/25/2021       | 10/25/2022           |







**.CALIBRATION TEST RESULTS**

**POST-TEST**

**HYBRID III 5<sup>TH</sup> PERCENTILE FEMALE - PASSENGER ATD**

**SERIAL NO: 137**

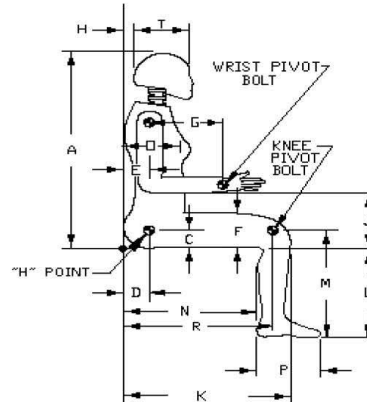
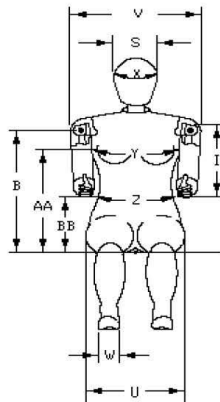


# External Measurements - Hybrid 3 - 5th Female

Technician: K. Brogan

Date: 05/27/2022

Dummy Serial Number: 137



| Symbol | Description                              | Specification (mm) |     | Result (mm) | Pass/Fail |
|--------|------------------------------------------|--------------------|-----|-------------|-----------|
| A      | Sitting Height                           | 775                | 800 | 790         | Pass      |
| B      | Shoulder Pivot Height                    | 432                | 457 | 445         | Pass      |
| C      | H-Point Height                           | 81                 | 86  | 84          | Pass      |
| D      | H-Point from Backline                    | 145                | 150 | 147         | Pass      |
| E      | Shoulder Pivot from Backline             | 69                 | 84  | 76          | Pass      |
| F      | Thigh Clearance                          | 119                | 135 | 125         | Pass      |
| G      | Back of Elbow to Wrist Pivot             | 244                | 259 | 250         | Pass      |
| H      | Head Back to Backline                    | 43                 | 48  | 45          | Pass      |
| I      | Shoulder to Elbow Length                 | 277                | 297 | 290         | Pass      |
| J      | Elbow Rest Height                        | 183                | 203 | 195         | Pass      |
| K      | Buttock to Knee Length                   | 521                | 546 | 535         | Pass      |
| L      | Popliteal Height                         | 356                | 376 | 365         | Pass      |
| M      | Knee Pivot Height                        | 394                | 419 | 410         | Pass      |
| N      | Buttock Popliteal Length                 | 414                | 439 | 425         | Pass      |
| O      | Chest Depth without Jacket               | 175                | 191 | 182         | Pass      |
| P      | Foot Length (right)                      | 219                | 234 | 228         | Pass      |
| R      | Buttock To Knee Pivot Length             | 457                | 483 | 466         | Pass      |
| S      | Head Breadth                             | 137                | 147 | 141         | Pass      |
| T      | Head Depth                               | 178                | 188 | 180         | Pass      |
| U      | Hip Breadth                              | 300                | 315 | 310         | Pass      |
| V      | Shoulder Breadth                         | 351                | 366 | 359         | Pass      |
| W      | Foot Breadth                             | 79                 | 94  | 85          | Pass      |
| X      | Head Circumference                       | 528                | 549 | 540         | Pass      |
| Y      | Chest Circumference with Jacket          | 851                | 881 | 865         | Pass      |
| Z      | Waist Circumference                      | 460                | 790 | 650         | Pass      |
| AA     | Reference Location (Chest Circumference) | 333                | 358 | 345         | Pass      |
| BB     | Reference Location (Waist Circumference) | 160                | 170 | 165         | Pass      |



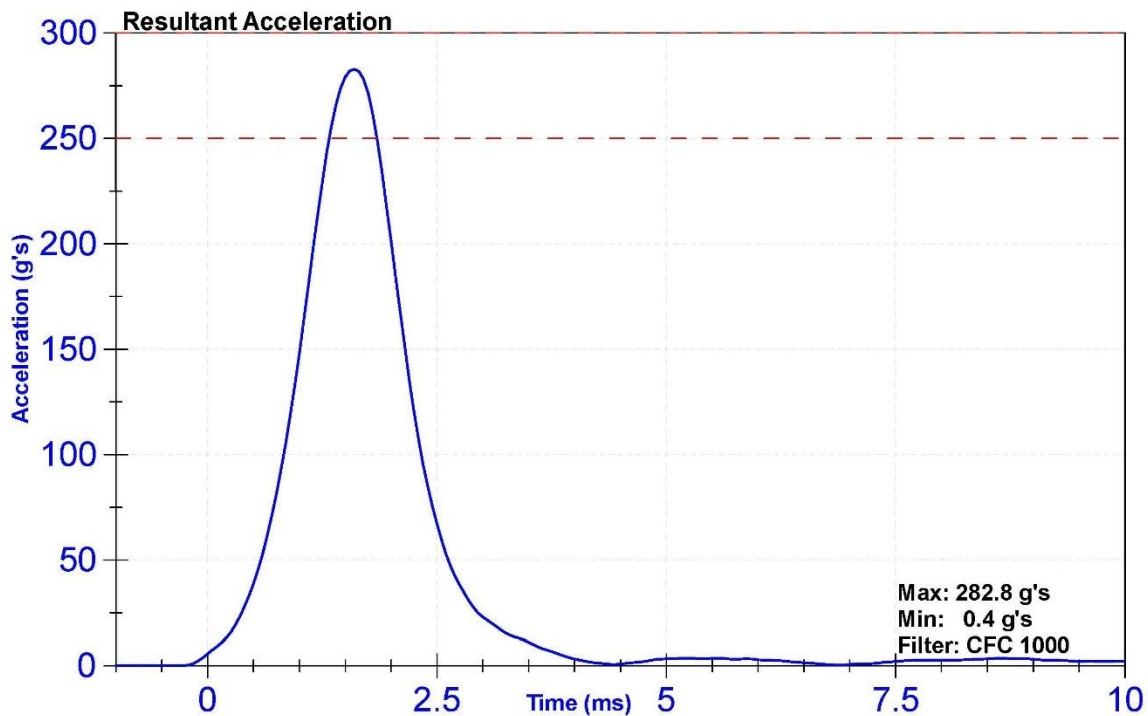
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|-------------------|------------|-----------------------|-------------|
| ATD Manufacturer  | Humanetics | Test Technician       | B. Kirchner |
| ATD Serial Number | 137        | Laboratory Supervisor | K. Brogan   |

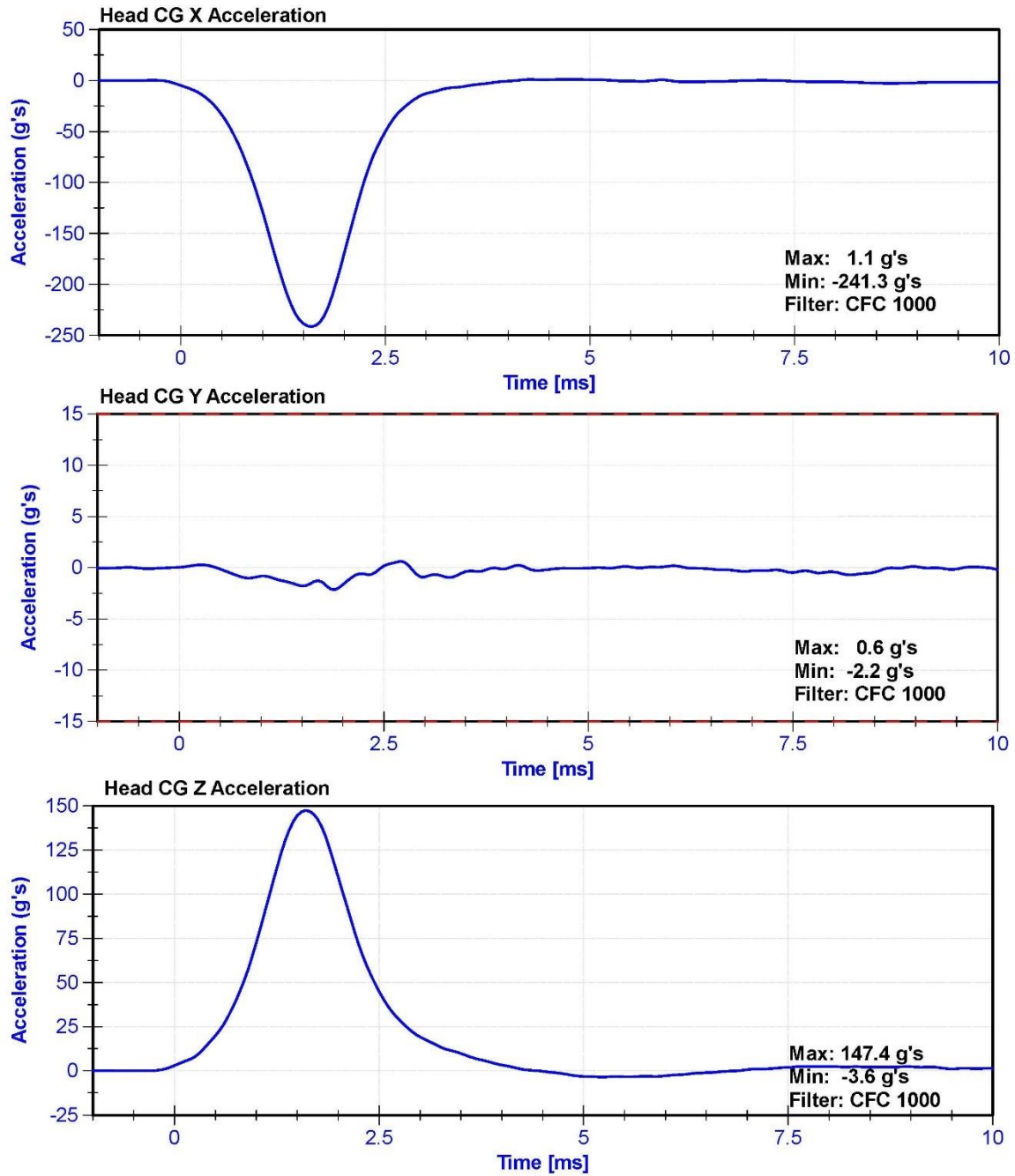
#### Results

| Test Parameter         | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|------------------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature            | 18.9                  | 25.6                  | °C   | 21.0   | Pass      |
| Humidity               | 10                    | 70                    | %    | 50.3   | Pass      |
| Resultant Acceleration | 250                   | 300                   | g's  | 282.8  | Pass      |
| Oscillation            | 0                     | 10                    | %    | 1.2    | Pass      |
| Lateral Acceleration   | -15                   | 15                    | g's  | -2.2   | Pass      |

#### Transducer Calibrations

| Channel         | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|-----------------|--------------|---------------|------------------|----------------------|
| X Accelerometer | Endevco      | P79417        | 2/1/2022         | 7/31/2022            |
| Y Accelerometer | Endevco      | P83335        | 2/1/2022         | 7/31/2022            |
| Z Accelerometer | Endevco      | P64149        | 2/1/2022         | 7/31/2022            |





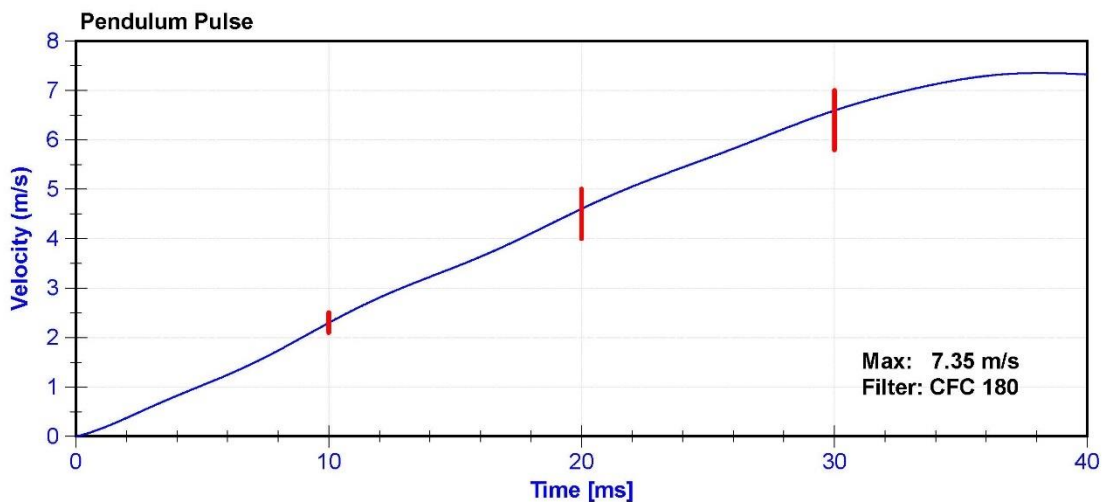
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|-------------------|------------|-----------------------|-------------|
| ATD Manufacturer  | Humanetics | Test Technician       | B. Kirchner |
| ATD Serial Number | 137        | Laboratory Supervisor | K. Brogan   |

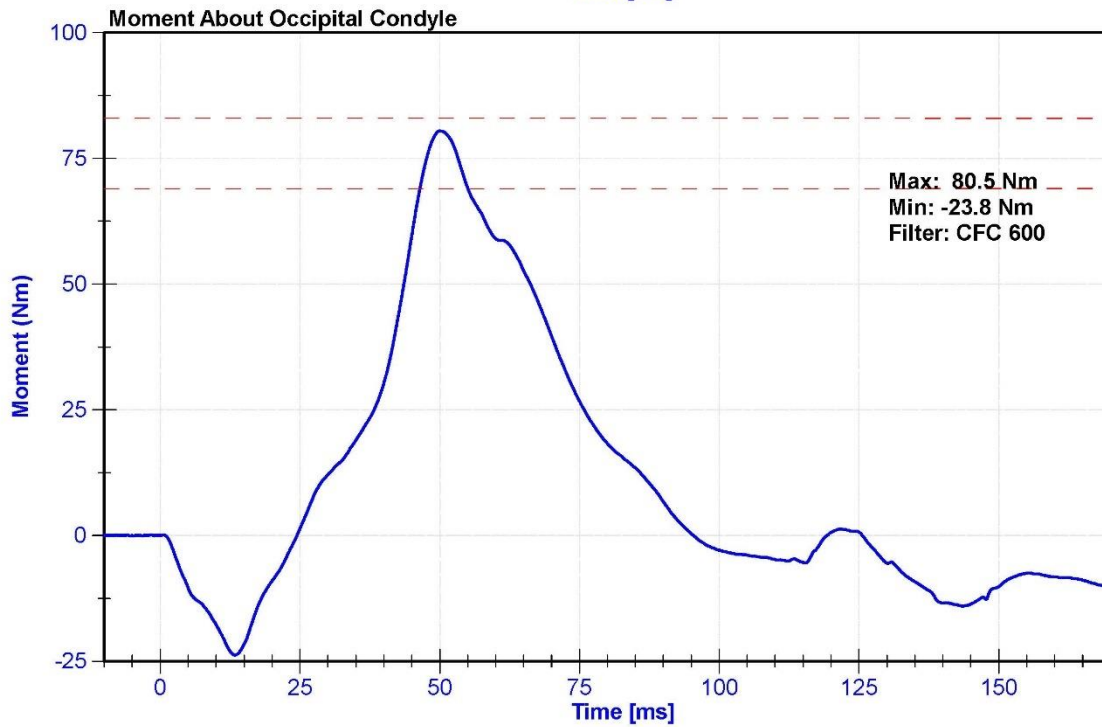
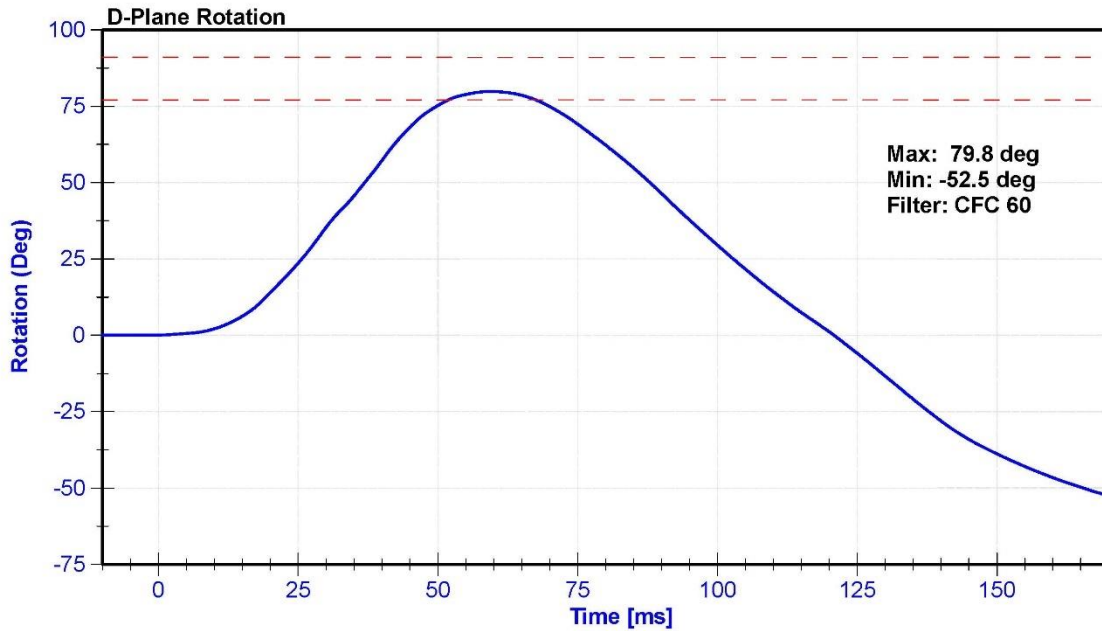
### Results

| Test Parameter                      | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|-------------------------------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature                         | 20.6                  | 22.2                  | °C   | 21.0   | Pass      |
| Humidity                            | 10                    | 70                    | %    | 50.3   | Pass      |
| Velocity                            | 6.89                  | 7.13                  | m/s  | 7.068  | Pass      |
| Pendulum Impulse at 10ms            | 2.1                   | 2.5                   | m/s  | 2.30   | Pass      |
| Pendulum Impulse at 20ms            | 4.0                   | 5.0                   | m/s  | 4.61   | Pass      |
| Pendulum Impulse at 30ms            | 5.8                   | 7.0                   | m/s  | 6.59   | Pass      |
| Max D Plane Rotation                | 77                    | 91                    | deg  | 79.8   | Pass      |
| Max Moment During Rotation Interval | 69                    | 83                    | Nm   | 80.5   | Pass      |
| Moment Decay to 10.0 Nm             | 80                    | 100                   | ms   | 87.8   | Pass      |

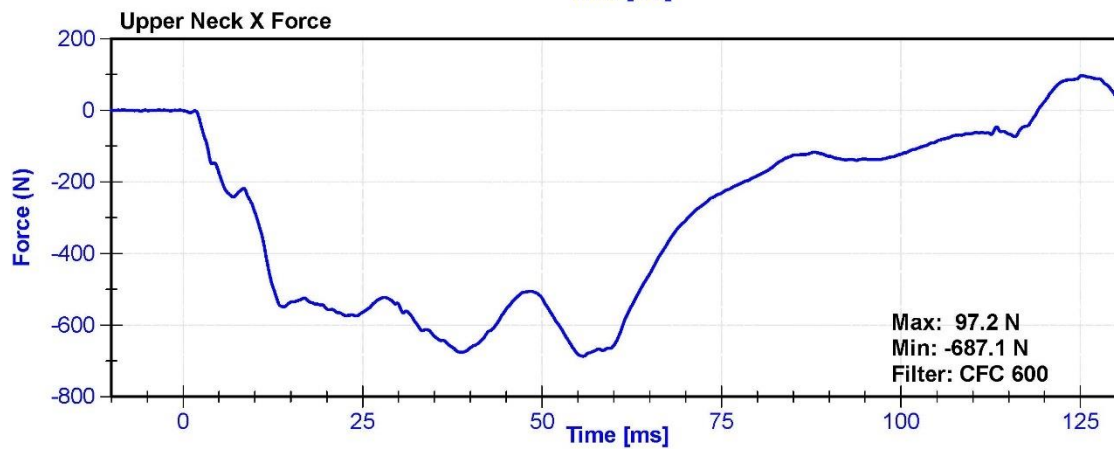
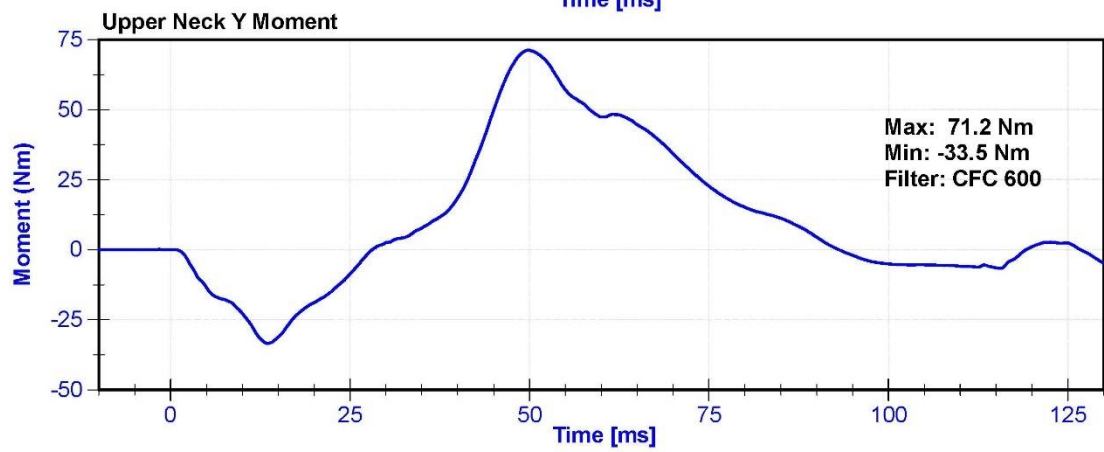
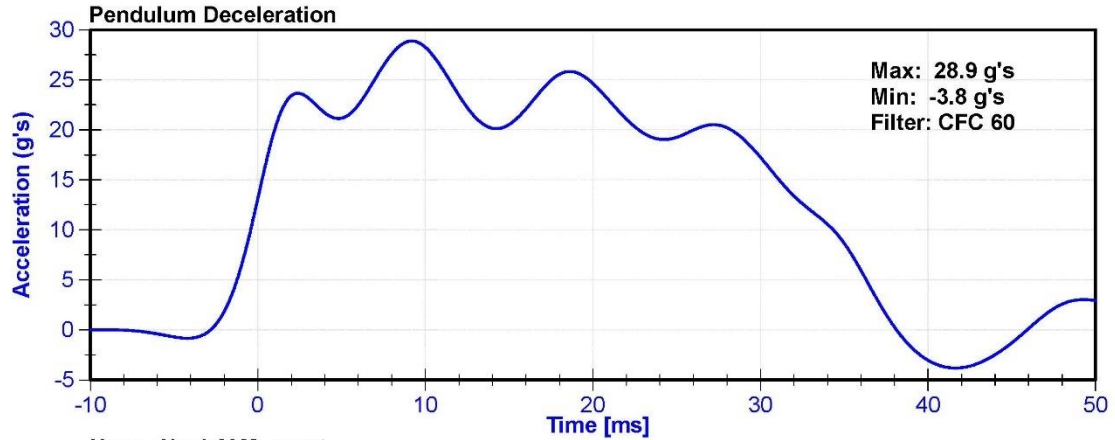
### Transducer Calibrations

| Channel                | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|------------------------|--------------|---------------|------------------|----------------------|
| Pendulum Accelerometer | Endevco      | 7231C-750     | 1/31/2022        | 7/30/2022            |
| Pendulum Potentiometer | ETI          | LABPOT1       | 5/9/2022         | 5/9/2023             |
| Condyle Potentiometer  | ETI          | LABPOT2       | 5/9/2022         | 5/9/2023             |
| Upper Neck Load Cell   | Denton       | 2184-FX       | 6/24/2021        | 6/24/2022            |









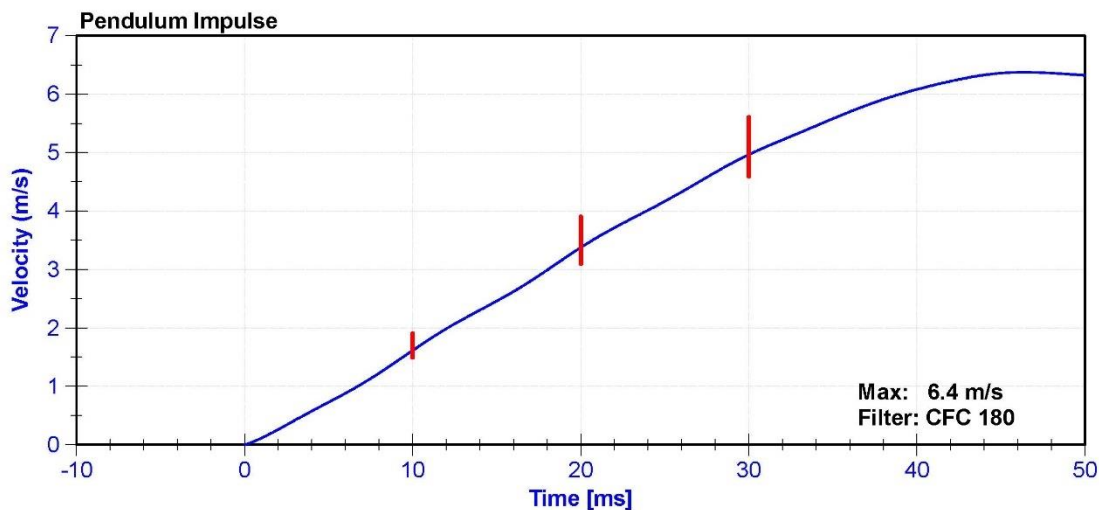
|                   |            |                       |             |
|-------------------|------------|-----------------------|-------------|
| ATD Manufacturer  | Humanetics | Test Technician       | B. Kirchner |
| ATD Serial Number | 137        | Laboratory Supervisor | K. Brogan   |

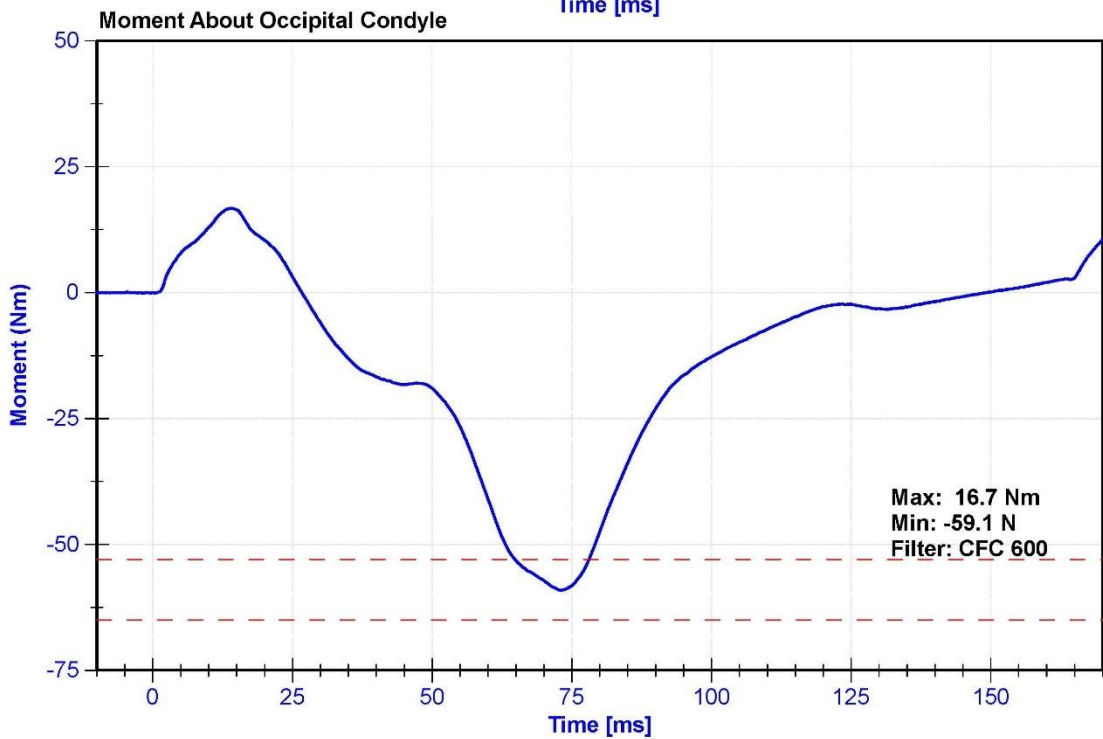
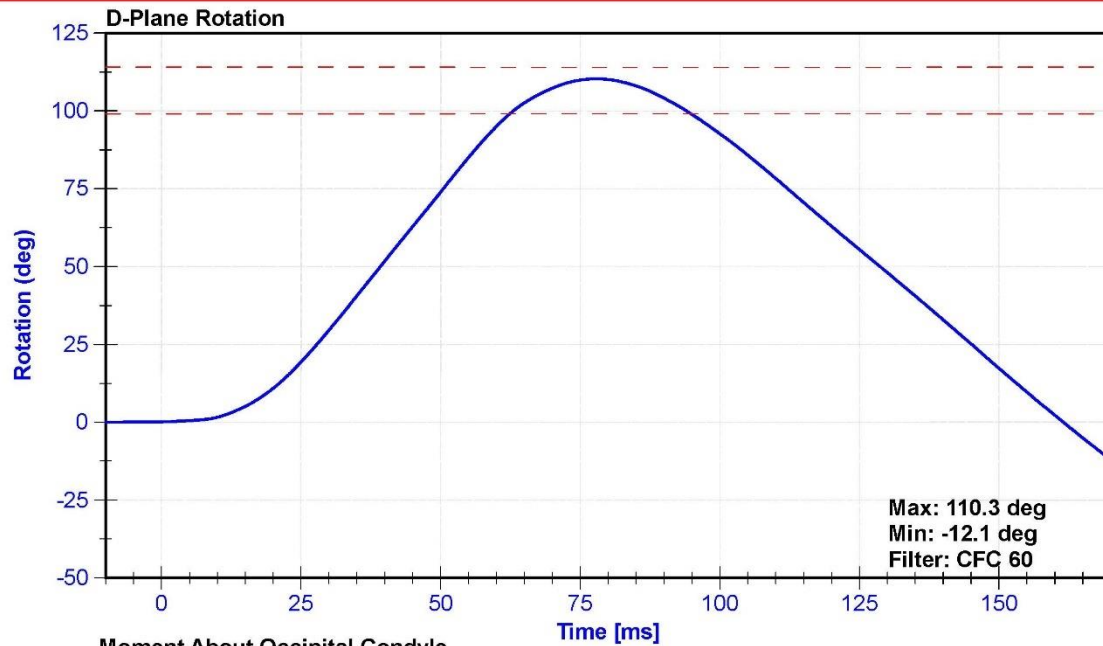
### Results

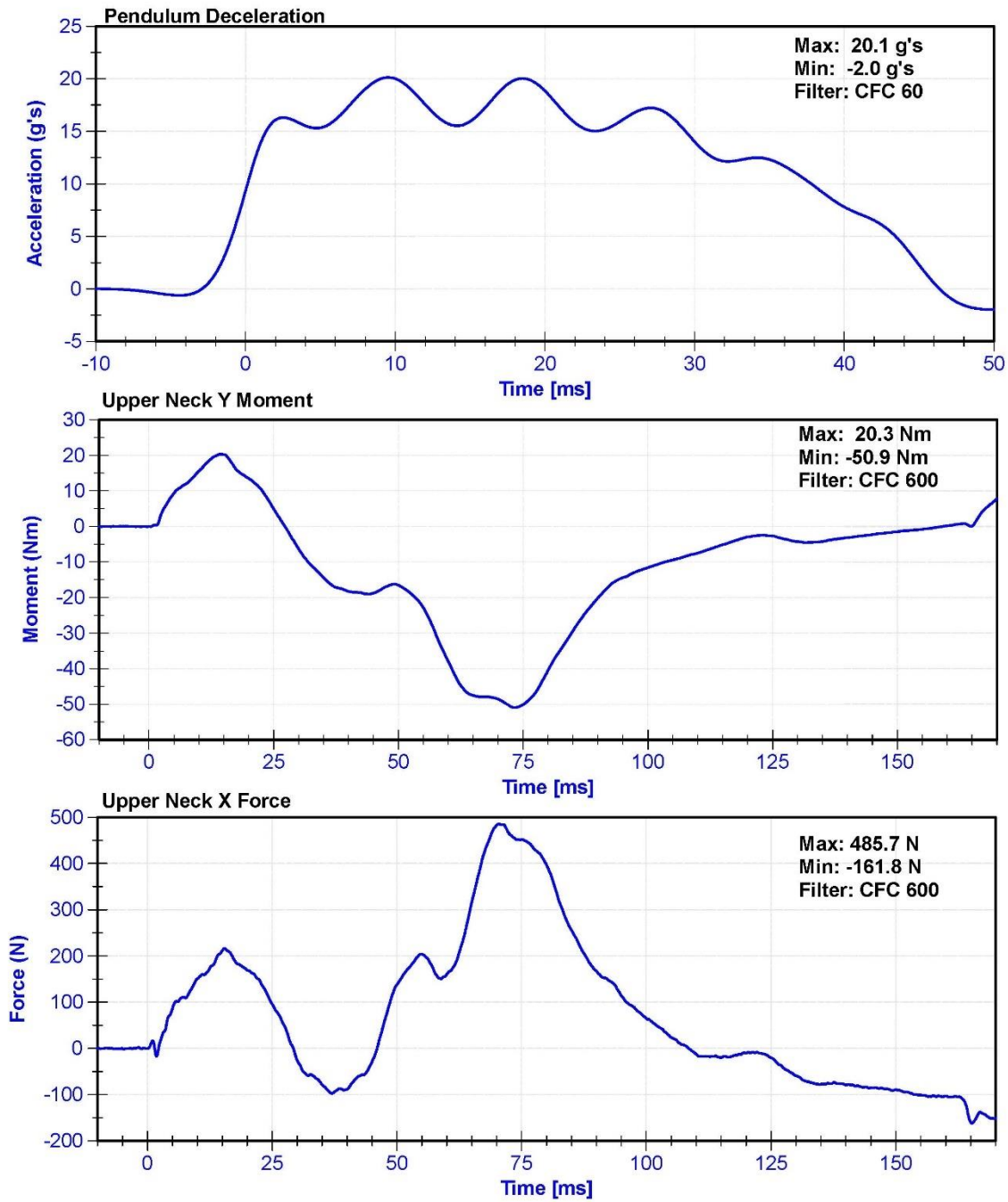
| Test Parameter                  | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---------------------------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature                     | 20.6                  | 22.2                  | °C   | 21.0   | Pass      |
| Humidity                        | 10                    | 70                    | %    | 50.3   | Pass      |
| Velocity                        | 5.95                  | 6.19                  | m/s  | 6.185  | Pass      |
| Pendulum Impulse at 10ms        | 1.5                   | 1.9                   | m/s  | 1.62   | Pass      |
| Pendulum Impulse at 20ms        | 3.1                   | 3.9                   | m/s  | 3.38   | Pass      |
| Pendulum Impulse at 30ms        | 4.6                   | 5.6                   | m/s  | 4.97   | Pass      |
| D Plane Rotation                | 99                    | 114                   | deg  | 110.3  | Pass      |
| Moment During Rotation Interval | -65                   | -53                   | Nm   | -59.1  | Pass      |
| Moment Decay to -10Nm           | 94                    | 114                   | ms   | 104.8  | Pass      |

### Transducer Calibrations

| Channel                | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|------------------------|--------------|---------------|------------------|----------------------|
| Pendulum Accelerometer | Endevco      | C16650        | 1/31/2022        | 7/30/2022            |
| Pendulum Potentiometer | ETI          | LABPOT1       | 5/9/2022         | 5/9/2023             |
| Condyle Potentiometer  | ETI          | LABPOT2       | 5/9/2022         | 5/9/2023             |
| Upper Neck Load Cell   | Denton       | 2184-FX       | 6/24/2021        | 6/24/2022            |







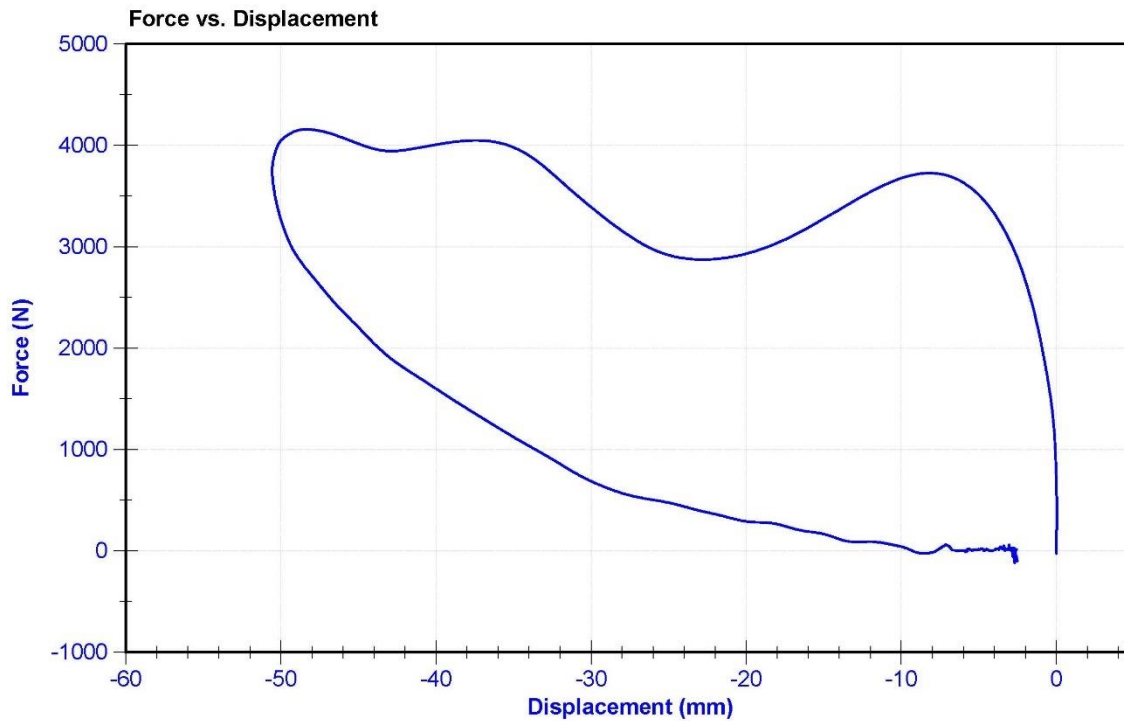


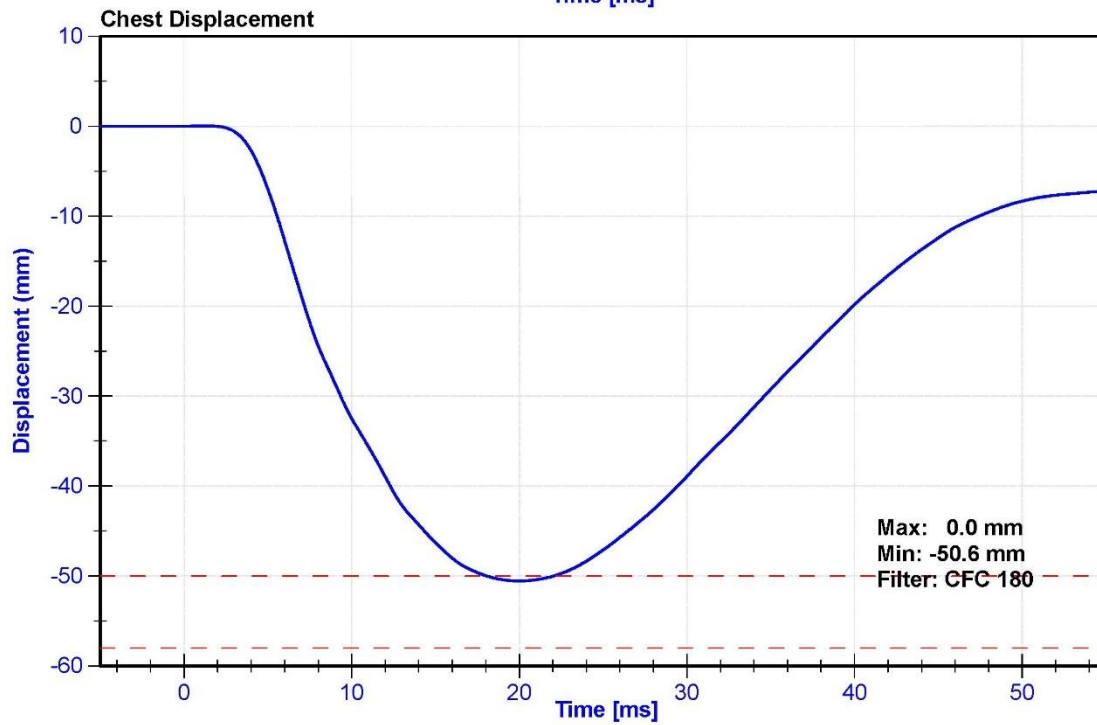
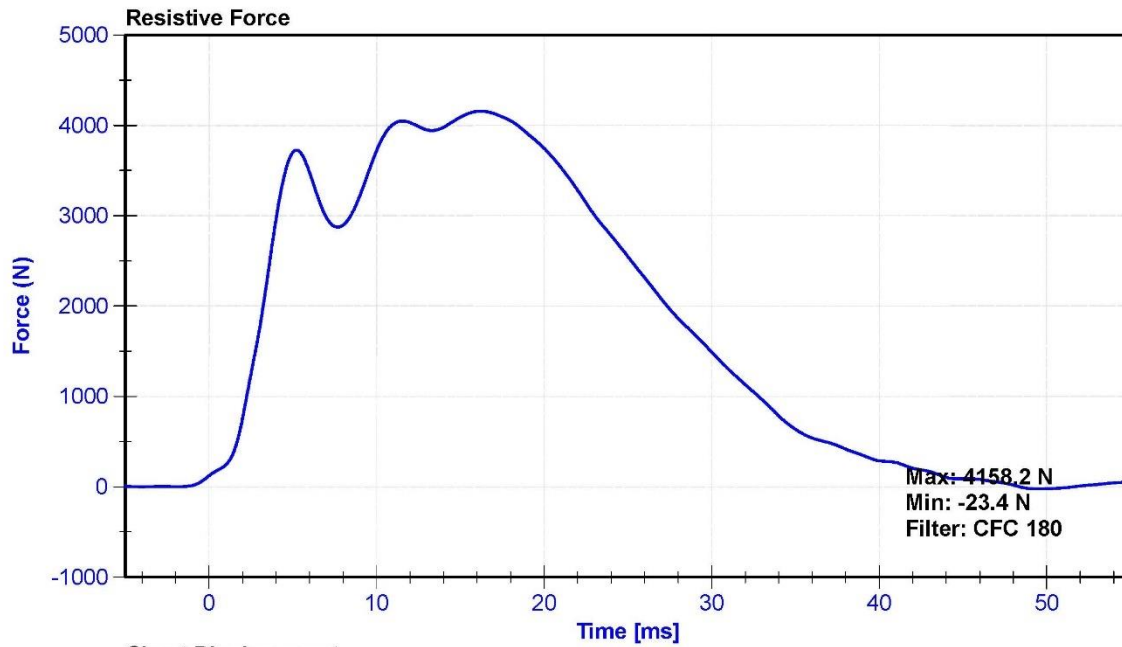
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|-------------------|------------|-----------------------|-------------|
| ATD Manufacturer  | Humanetics | Test Technician       | B. Kirchner |
| ATD Serial Number | 137        | Laboratory Supervisor | K. Brogan   |

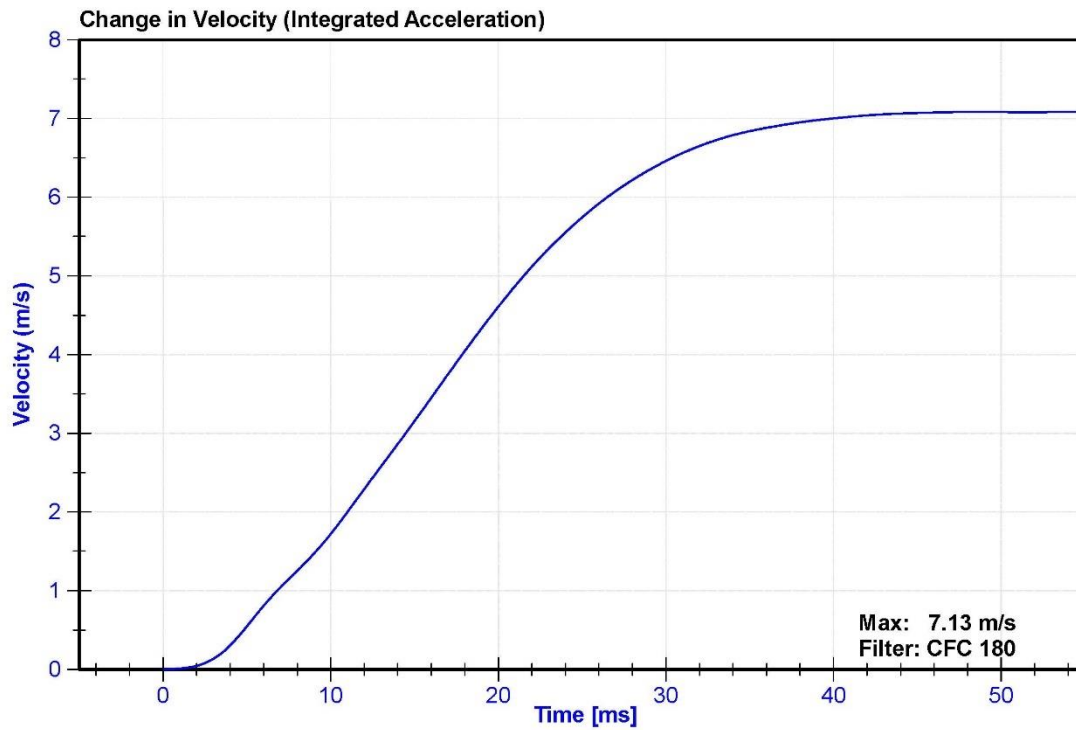
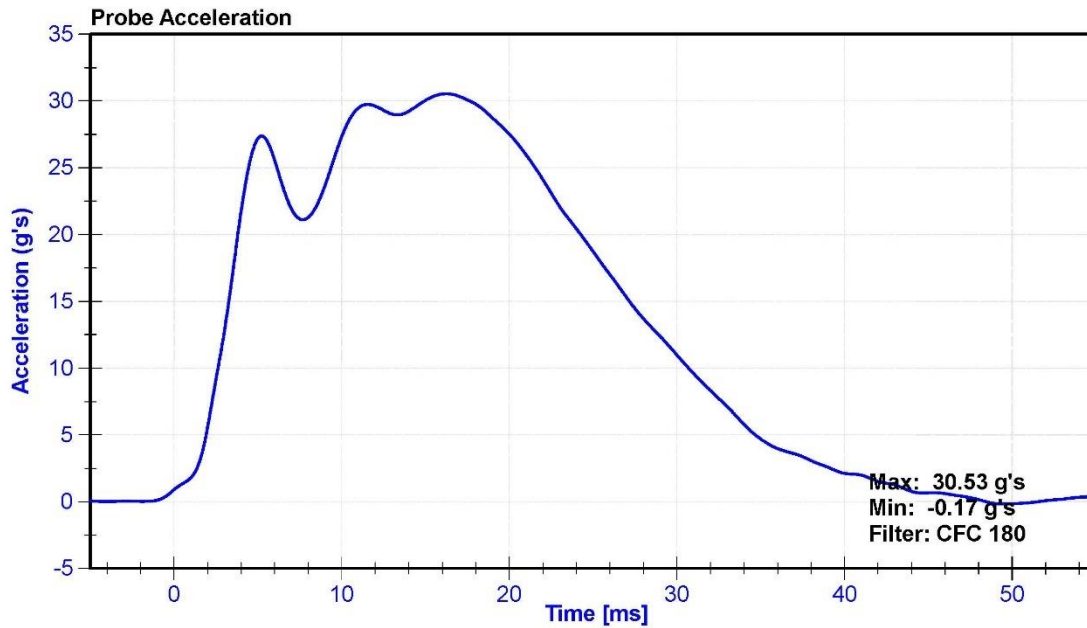
| Test Parameter                       | Results               |                       | Unit | Result | Pass/Fail |
|--------------------------------------|-----------------------|-----------------------|------|--------|-----------|
|                                      | Minimum Specification | Maximum Specification |      |        |           |
| Temperature                          | 20.6                  | 22.2                  | °C   | 21.3   | Pass      |
| Humidity                             | 10                    | 70                    | %    | 58.9   | Pass      |
| Velocity                             | 6.59                  | 6.83                  | m/s  | 6.666  | Pass      |
| Chest Deflection                     | -58                   | -50                   | mm   | -50.6  | Pass      |
| Maximum Resistive Force (50 to 58mm) | 3900                  | 4400                  | N    | 4046.8 | Pass      |
| Maximum Resistive Force (18 to 50mm) | 0                     | 4600                  | N    | 4158.2 | Pass      |
| Hysteresis                           | 69                    | 85                    | %    | 76.0   | Pass      |

#### Transducer Calibrations

| Channel                | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|------------------------|--------------|---------------|------------------|----------------------|
| Pendulum Accelerometer | Endevco      | T25885        | 10/25/2021       | 10/25/2022           |
| Chest Potentiometer    | Servo        | 0720          | 4/18/2022        | 10/17/2022           |







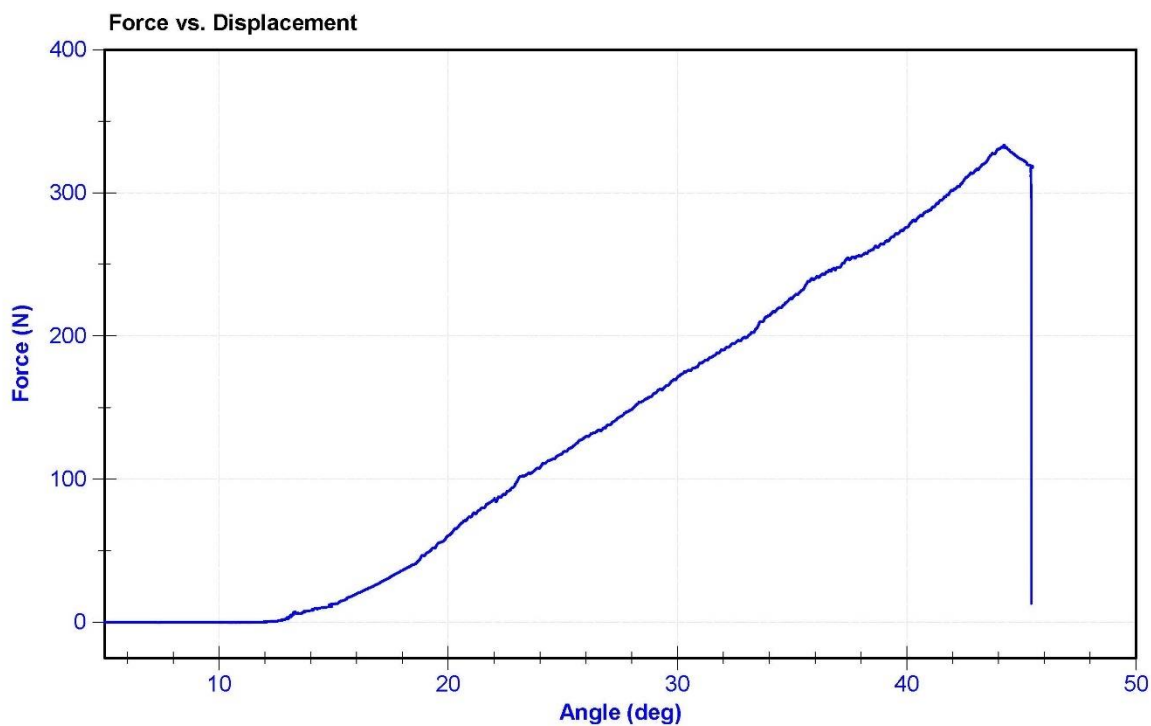
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|-------------------|------------|-----------------------|-------------|
| ATD Manufacturer  | Humanetics | Test Technician       | B. Kirchner |
| ATD Serial Number | 137        | Laboratory Supervisor | K. Brogan   |

### Results

| Test Parameter                   | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|----------------------------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature                      | 18.6                  | 25.6                  | °C   | 21.5   | Pass      |
| Humidity                         | 10                    | 70                    | %    | 59.6   | Pass      |
| Initial Angle                    | 0                     | 20                    | deg  | 10.9   | Pass      |
| Force at 45 Degrees              | 320                   | 390                   | N    | 333.4  | Pass      |
| Return Angle Relative to Initial | 0                     | 8                     | deg  | 6.1    | Pass      |

### Transducer Calibrations

| Channel       | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---------------|--------------|---------------|------------------|----------------------|
| Potentiometer | Rieker       | DS-1905226    | 2021-11-01       | 2022-11-01           |
| Load Cell     | Interface    | 1134516       | 2021-08-27       | 2022-08-27           |





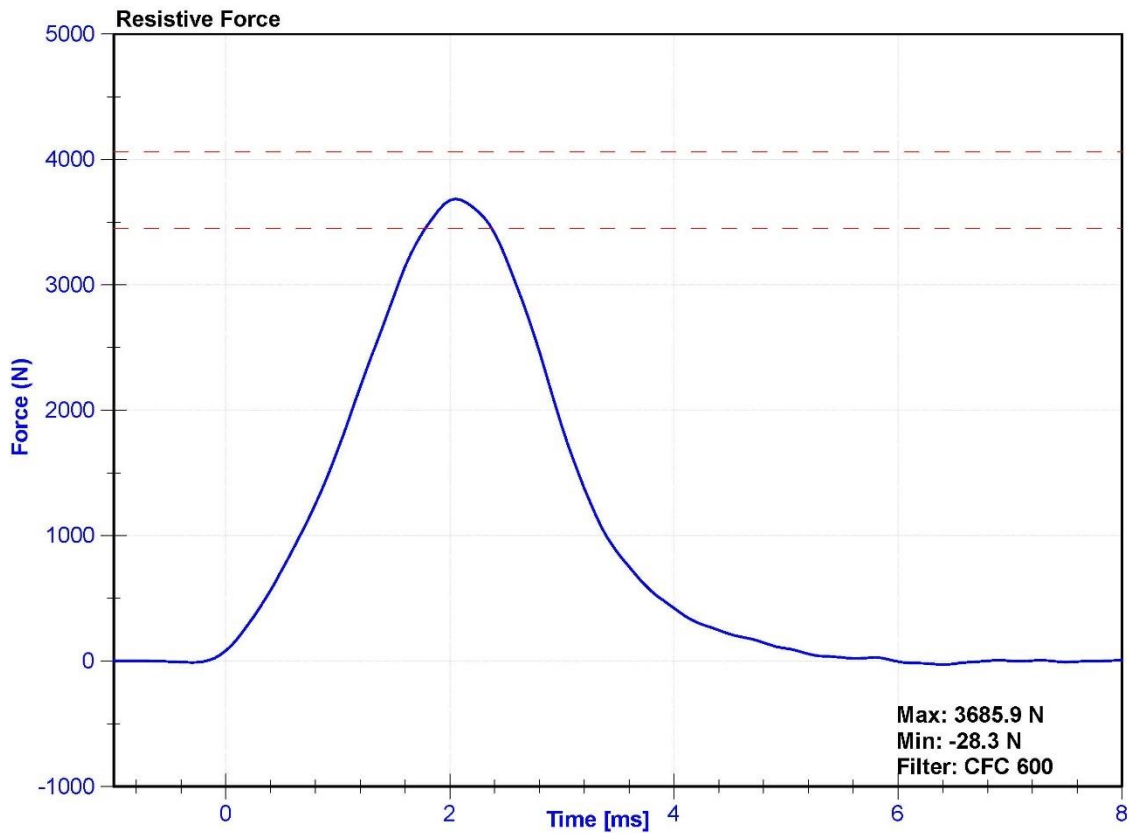
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|-------------------|------------|-----------------------|-------------|
| ATD Manufacturer  | Humanetics | Test Technician       | B. Kirchner |
| ATD Serial Number | 137        | Laboratory Supervisor | K. Brogan   |

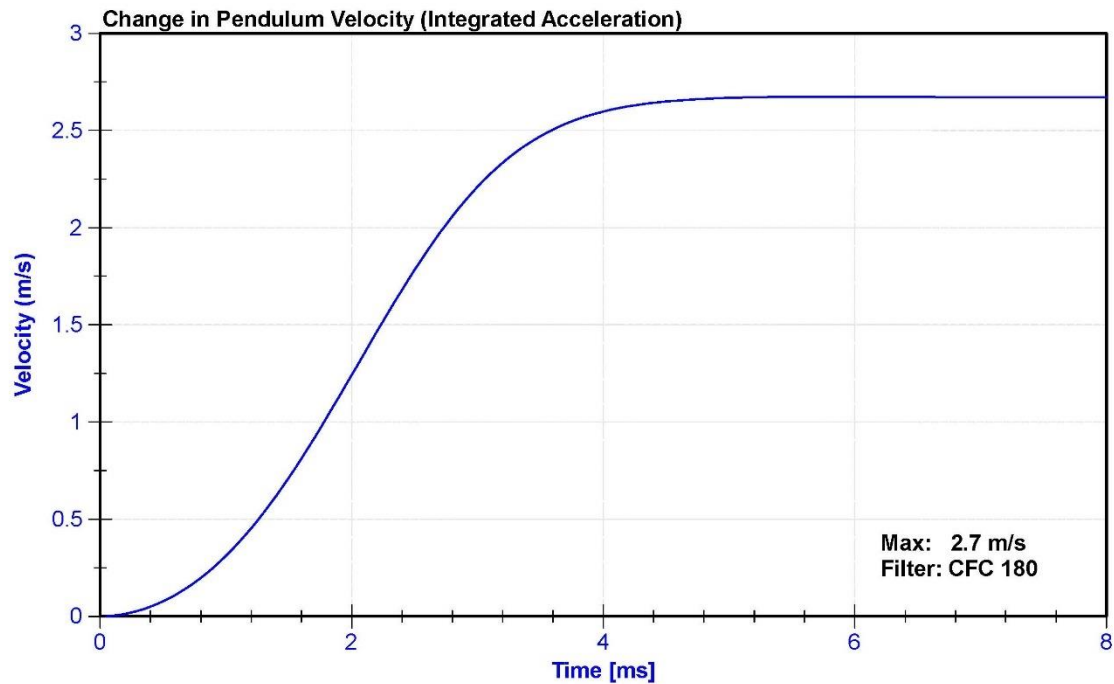
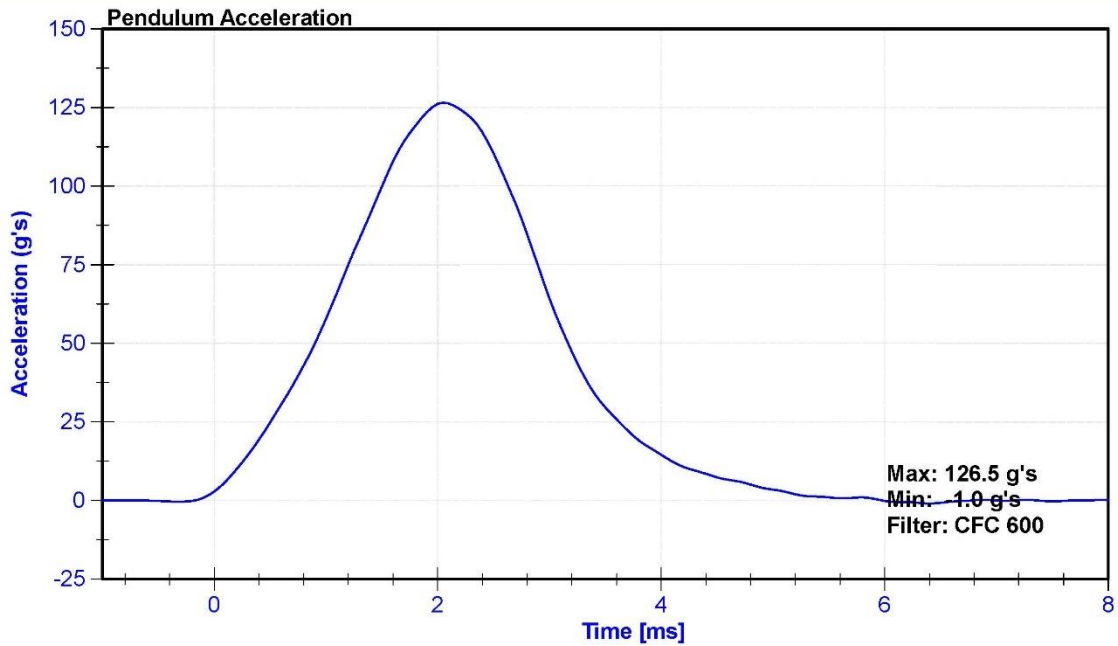
**Results**

| Test Parameter  | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|-----------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature     | 18.9                  | 25.6                  | °C   | 21.0   | Pass      |
| Humidity        | 10                    | 70                    | %    | 50.3   | Pass      |
| Velocity        | 2.07                  | 2.13                  | m/s  | 2.110  | Pass      |
| Resistive Force | 3450                  | 4060                  | N    | 3685.9 | Pass      |

**Transducer Calibrations**

| Channel                | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|------------------------|--------------|---------------|------------------|----------------------|
| Pendulum Accelerometer | Endevco      | T25885        | 10/25/2021       | 10/25/2022           |





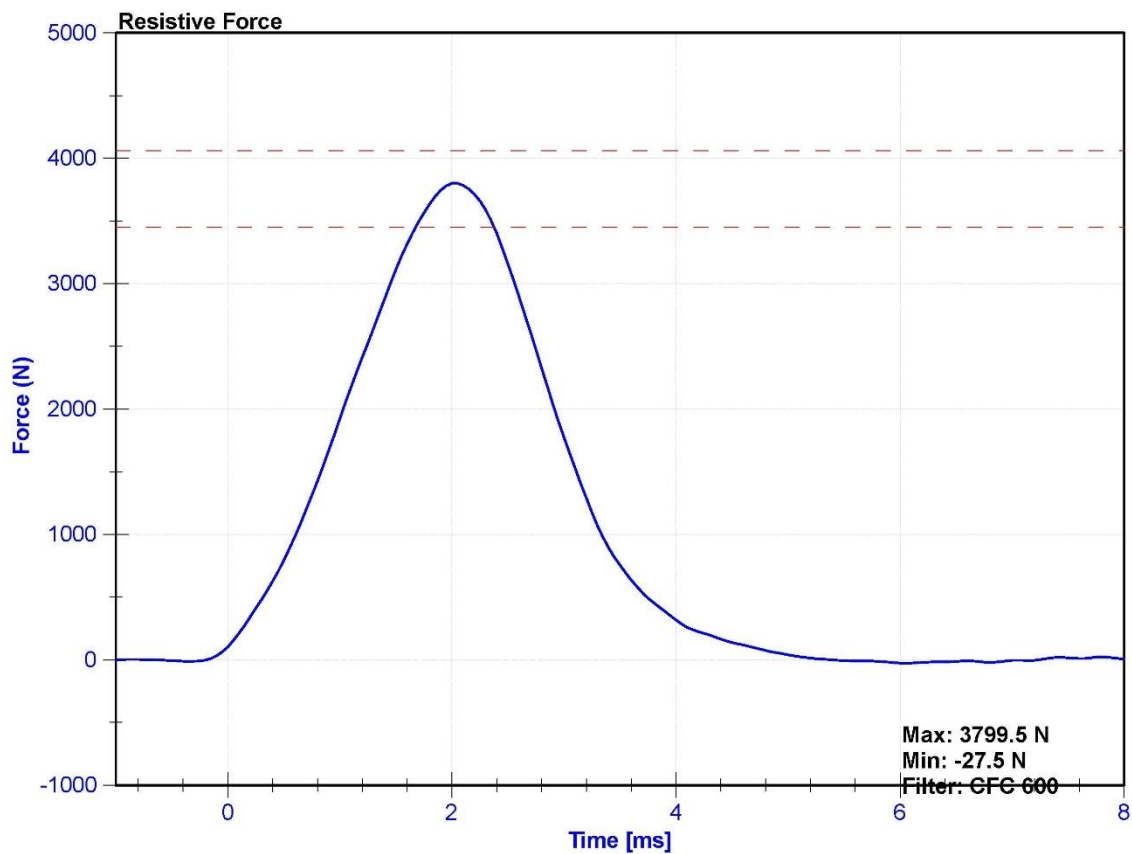
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|-------------------|------------|-----------------------|-------------|
| ATD Manufacturer  | Humanetics | Test Technician       | B. Kirchner |
| ATD Serial Number | 137        | Laboratory Supervisor | K. Brogan   |

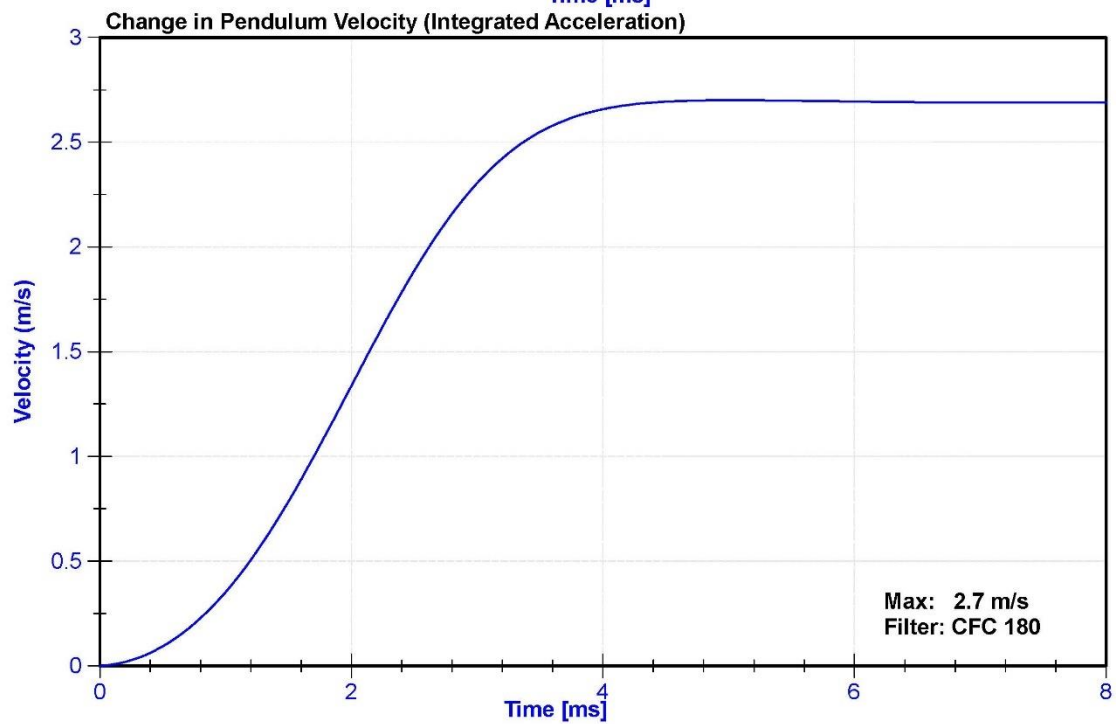
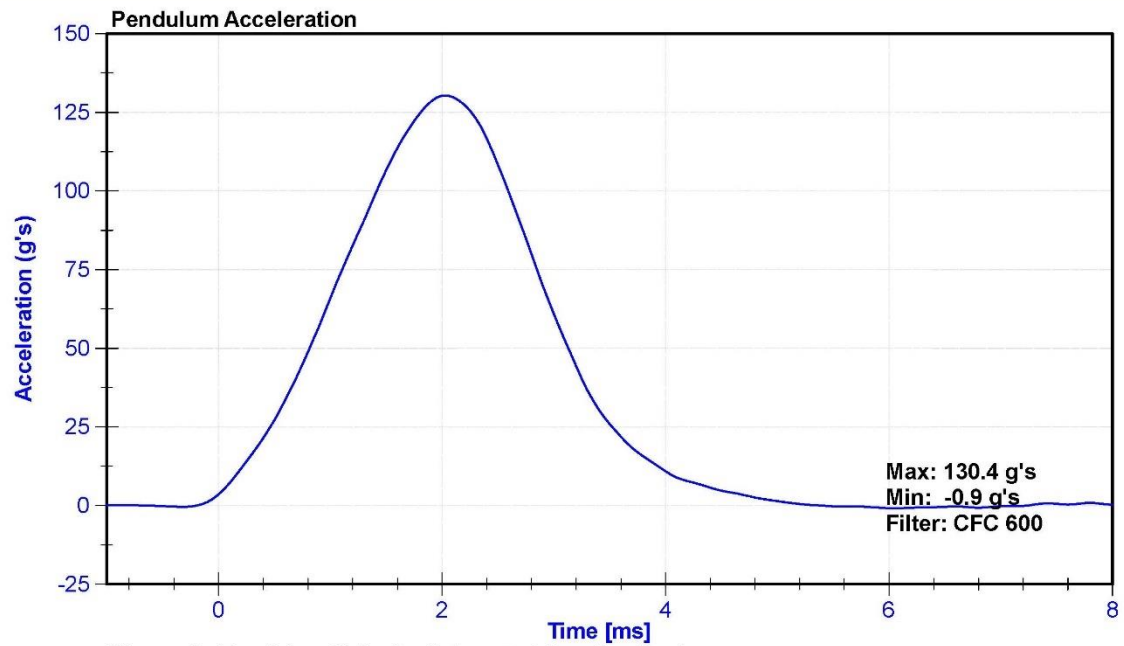
#### Results

| Test Parameter  | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|-----------------|-----------------------|-----------------------|------|--------|-----------|
| Temperature     | 18.9                  | 25.6                  | °C   | 21.0   | Pass      |
| Humidity        | 10                    | 70                    | %    | 50.3   | Pass      |
| Velocity        | 2.07                  | 2.13                  | m/s  | 2.111  | Pass      |
| Resistive Force | 3450                  | 4060                  | N    | 3799.5 | Pass      |

#### Transducer Calibrations

| Channel                | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|------------------------|--------------|---------------|------------------|----------------------|
| Pendulum Accelerometer | Endevco      | T25885        | 10/25/2021       | 10/25/2022           |







## **APPENDIX D**

### **DUMMY CALIBRATION AND PERFORMANCE VERIFICATION DATA**

**Table 1 – Driver Dummy Instrumentation**

| Instrumentation             |           | Axis/Location           | Hybrid III 50 <sup>th</sup> S/N: 142 |              |                  |
|-----------------------------|-----------|-------------------------|--------------------------------------|--------------|------------------|
|                             |           |                         | Serial Number                        | Manufacturer | Calibration Date |
| Head Accelerometers         | Primary   | X                       | P51681                               | Endevco      | 5/10/2022        |
|                             |           | Y                       | P64151                               | Endevco      | 5/10/2022        |
|                             |           | Z                       | P52114                               | Endevco      | 5/10/2022        |
|                             | Redundant | X                       | P58833                               | Endevco      | 5/10/2022        |
|                             |           | Y                       | P58905                               | Endevco      | 5/10/2022        |
|                             |           | Z                       | P63996                               | Endevco      | 5/10/2022        |
| Head Angular Rate Sensors   |           | X                       | 7589                                 | DTS ARS      | 8/9/2021         |
|                             |           | Y                       | 7370                                 | DTS ARS      | 8/9/2021         |
|                             |           | Z                       | 13095                                | DTS ARS      | 8/9/2021         |
| Upper Neck Load Cell        |           | FX, Fy, Fz<br>MX,MY, MZ | 280-FX                               | FTSS         | 9/14/2021        |
| Chest Accelerometers        | Primary   | X                       | P51991                               | Endevco      | 5/10/2022        |
|                             |           | Y                       | P80337                               | Endevco      | 5/10/2022        |
|                             |           | Z                       | P49185                               | Endevco      | 5/10/2022        |
|                             | Redundant | X                       | P68059                               | Endevco      | 5/10/2022        |
|                             |           | Y                       | P51713                               | Endevco      | 5/10/2022        |
|                             |           | Z                       | P78824                               | Endevco      | 5/10/2022        |
| Chest Potentiometer         |           | X                       | 0075                                 | JDK          | 5/10/2022        |
| Pelvis Accelerometer        |           | X                       | P58800                               | Endevco      | 5/10/2022        |
|                             |           | Y                       | P52157                               | Endevco      | 5/10/2022        |
|                             |           | Z                       | P83317                               | Endevco      | 5/10/2022        |
| Femur Load Cells - Left     | Primary   | Z                       | DT0998-FZ1                           | Denton       | 6/30/2021        |
|                             | Redundant | Z                       | DT0998-FZ2                           | Denton       | 6/30/2021        |
| Femur Load Cells - Right    | Primary   | Z                       | 117-FZ1                              | Denton       | 9/14/2021        |
|                             | Redundant | Z                       | 117-FZ2                              | Denton       | 9/14/2021        |
| Tibia Load Cells - Left     | Upper     | MX, MY, FZ              | 371-FZ                               | Denton       | 7/30/2021        |
|                             | Lower     | MX, MY, FZ              | 673-FZ                               | Denton       | 7/30/2021        |
| Tibia Load Cells – Right    | Upper     | MX, MY, FZ              | 361-FZ                               | Denton       | 7/30/2021        |
|                             | Lower     | MX, MY, FZ              | 362-FZ                               | Denton       | 7/30/2021        |
| Foot Accelerometers - Left  | Rear      | X                       | P82756                               | Endevco      | 5/10/2022        |
|                             | Front     | Z                       | P51872                               | Endevco      | 5/10/2022        |
| Foot Accelerometers - Right | Rear      | X                       | P49195                               | Endevco      | 5/10/2022        |
|                             | Front     | Z                       | P58779                               | Endevco      | 5/10/2022        |
| Seat belt Load Cells        | Lap       |                         | 174                                  | GFE          | 2/25/2022        |
|                             | Shoulder  |                         | 292                                  | GFE          | 2/25/2022        |

**Table 2 – Front Passenger Dummy Instrumentation**

| Instrumentation             |           | Axis/Location           | Hybrid III 5 <sup>th</sup> S/N: 137 |              |                  |           |
|-----------------------------|-----------|-------------------------|-------------------------------------|--------------|------------------|-----------|
|                             |           |                         | Serial Number                       | Manufacturer | Calibration Date |           |
| Head Accelerometers         | Primary   | X                       | P79417                              | Endevco      | 2/1/2022         |           |
|                             |           | Y                       | P83335                              | Endevco      | 2/1/2022         |           |
|                             |           | Z                       | P64149                              | Endevco      | 2/1/2022         |           |
|                             | Redundant | X                       | P52008                              | Endevco      | 2/1/2022         |           |
|                             |           | Y                       | P52045                              | Endevco      | 2/1/2022         |           |
|                             |           | Z                       | P74774                              | Endevco      | 2/1/2022         |           |
| Head Angular Rate Sensors   |           | X                       | 4718                                | DTS ARS      | 8/9/2021         |           |
|                             |           | Y                       | 7603                                | DTS ARS      | 8/9/2021         |           |
|                             |           | Z                       | 7521                                | DTS ARS      | 8/9/2021         |           |
| Upper Neck Load Cell        |           | FX, Fy, Fz<br>MX,MY, MZ | 2184-FX                             | Denton       | 6/24/2021        |           |
| Chest Accelerometers        | Primary   | X                       | T21142                              | Endevco      | 2/1/2022         |           |
|                             |           | Y                       | P83346                              | Endevco      | 2/1/2022         |           |
|                             |           | Z                       | P49190                              | Endevco      | 2/1/2022         |           |
|                             | Redundant | X                       | P58794                              | Endevco      | 2/1/2022         |           |
|                             |           | Y                       | P69791                              | Endevco      | 2/14/2022        |           |
|                             |           | Z                       | T11253                              | Endevco      | 2/1/2022         |           |
| Chest Potentiometer         |           | X                       | 0720                                | Servo        | 4/18/2022        |           |
| Pelvis Accelerometer        |           | X                       | P58735                              | Endevco      | 1/31/2022        |           |
|                             |           | Y                       | P77587                              | Endevco      | 1/31/2022        |           |
|                             |           | Z                       | P51285                              | Endevco      | 1/31/2022        |           |
|                             |           | Femur Load Cells - Left |                                     | Primary      | Z                | 119-FZ1   |
| Redundant                   | Z         |                         |                                     | 119-FZ2      | Denton           | 6/30/2021 |
| Femur Load Cells - Right    |           | Primary                 | Z                                   | 109-FZ1      | Denton           | 6/30/2021 |
|                             |           | Redundant               | Z                                   | 109-FZ2      | Denton           | 6/30/2021 |
| Tibia Load Cells - Left     |           | Upper                   | MX, MY, FZ                          | 406-FZ       | Denton           | 7/30/2021 |
|                             |           | Lower                   | MX, MY, FZ                          | 360-FZ       | Denton           | 7/30/2021 |
| Tibia Load Cells – Right    |           | Upper                   | MX, MY, FZ                          | 476-FZ       | Denton           | 7/30/2021 |
|                             |           | Lower                   | MX, MY, FZ                          | 359-FZ       | Denton           | 7/30/2021 |
| Foot Accelerometers - Left  |           | Rear                    | X                                   | P78959       | Endevco          | 1/31/2022 |
|                             |           | Front                   | Z                                   | P83418       | Endevco          | 1/31/2022 |
| Foot Accelerometers - Right |           | Rear                    | X                                   | P83428       | Endevco          | 1/31/2022 |
|                             |           | Front                   | Z                                   | P80265       | Endevco          | 1/31/2022 |
| Seat belt Load Cells        |           | Lap                     |                                     | -            | -                | -         |
|                             |           | Shoulder                |                                     | 295          | GFE              | 2/25/2022 |

**Table 3 – Vehicle Instrumentation**

| Instrumentation                      |        |           | Axis | Serial Number | Manufacturer            | Calibration Date |
|--------------------------------------|--------|-----------|------|---------------|-------------------------|------------------|
| Crossmember/Rear Seat Accelerometers | Left   | Primary   | X    | A315093       | Measurement Specialties | 2/25/2022        |
|                                      |        |           | Z    | A315877       | Measurement Specialties | 2/25/2022        |
|                                      |        | Redundant | X    | A315751       | Measurement Specialties | 2/25/2022        |
|                                      | Right  | Primary   | X    | A300208       | Measurement Specialties | 3/22/2022        |
|                                      |        |           | Z    | A374327       | Measurement Specialties | 3/22/2022        |
|                                      |        | Redundant | X    | A315743       | Measurement Specialties | 3/22/2022        |
| Engine Accelerometers                | Top    |           | X    | A372829       | Measurement Specialties | 3/9/2022         |
|                                      | Bottom |           | X    | A400018       | Measurement Specialties | 3/15/2022        |