**REPORT NUMBER: NCAP-CAL-21-008**

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

**Mitsubishi Motors Corporation**
**2022 Mitsubishi Eclipse Cross**
**Four Door SUV**

**NHTSA No: O20225600**

**PREPARED BY:**
**CALSPAN CORPORATION**
**P.O. BOX 400**
**BUFFALO, NEW YORK 14225**

**August 24, 2021**

**FINAL REPORT**

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

This final test report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, in response to Contract Number 693JJ919D000005.



Prepared by: Matthew Pronko Date: August 24, 2021
Matthew Pronko, Test Engineer

Approved by: Vanessa Hansen Date: August 24, 2021
Vanessa Hansen, Engineering Manager

**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

| | | |
|---|---|---|
| **1. *Report No.***<br>NCAP-CAL-21-008 | ***2. Government Accession No.*** | ***3. Recipient's Catalog No.*** |
| ***4. Title and Subtitle***<br>Final Report of New Car Assessment Program<br>Frontal Impact Testing of a<br>2022 Mitsubishi Eclipse Cross SUV<br>NHTSA No.: O20225600 | | ***5. Report Date***<br>August 24, 2021<br>***6. Performing Organization Code***<br>CAL |
| ***7. Author(s)***<br>Matthew Pronko, Test Engineer<br>Vanessa Hansen, Operations Manager | | ***8. Performing Organization Report No.***<br>CAL-DOT-2021-008 |
| ***9. Performing Organization Name and Address***<br>Calspan Corporation<br>Transportation Test Operations<br>P.O. Box 400<br>Buffalo, New York 14225 | | ***10. Work Unit No.***<br>***11. Contract or Grant No.***<br>693JJ919D000005 |
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| ***15. Supplementary Notes*** | | |

***16. Abstract***

A 56.30 km/h (35 mph), NCAP frontal rigid barrier impact test was conducted on a 2022 Mitsubishi Eclipse Cross 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 13, 2021.

The impact velocity of the vehicle was 56.29 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 621 mm at the vehicles centerline. The test vehicle's occupant performance data is as follows:

| Measurement Description | Units | Driver ATD (Serial No. 142) | | Passenger ATD (Serial No. 288) | |
|---|---|---|---|---|---|
| | | Threshold | Result | Threshold | Result |
| Head Injury Criteria ($HIC_{15}$) | | 700 | 244.763 | 700 | 215.107 |
| Maximum Chest Compression | mm | 63 | -25.516 | 52 | -18.186 |
| Nij | | 1 | 0.387 | 1 | 0.397 |
| Neck Tension | N | 4,170 | 1887.304 | 2,620 | 810.954 |
| Neck Compression | N | 4,000 | -146.840 | 2,520 | -242.499 |
| Left Femur Force | N | 10,008 | -818.670 | 6,805 | -1473.228 |
| Right Femur Force | N | 10,008 | -1442.077 | 6,805 | -882.150 |


| | |
|---|---|
| ***17. Key Words***<br>56.3 km/h (35 mph) Full Frontal Rigid Barrier Impact Test<br>New Car Assessment Program (NCAP) | ***18. Distribution Statement***<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 |

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**Form DOT F1700.7** (8-69)

## TABLE OF CONTENTS

## 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 Mitsubishi Eclipse Cross SUV at a velocity of 56.29 km/h. The test was performed at Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on May 13, 2021. 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$^{th}$ percentile male anthropomorphic test device (ATD), was placed in the driver seating position and one Part 572O 5$^{th}$ 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 and passenger's lap belts to measure dummy pelvic section loading. The driver (position 1) ATD (Serial No. 142) and the right-front passenger (position 2) ATD (Serial No. 288) 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 100 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 621 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 air bag.

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.

The occupant data is summarized below.

| ATD Position | $HIC_{15}$ | Nij | Neck Tension (N) | Neck Comp. (N) | 3ms Chest Clip (Gs) | Chest Disp. (mm) | Left Femur (N) | Right Femur (N) |
|---|---|---|---|---|---|---|---|---|
| Driver ($50^{th}$) | 244.763 | 0.387 | 1887.304 | -146.840 | 38.767 | -25.516 | -818.670 | -1442.077 |
| Passenger ($5^{th}$) | 215.107 | 0.397 | 810.954 | -242.499 | 43.473 | -18.186 | -1473.228 | -882.150 |

**GENERAL COMMENTS:**

1. P1 (Driver) serial number - 142
2. P2 (Passenger) serial number – 288
3. No seatbelt load cells were used for driver or passenger shoulder belts.

**Data Anomalies:**

- None

## 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. 1**
**GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2022 Mitsubishi Eclipse Cross SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: O20225600
Test Date: 5/13/2021

## TEST VEHICLE INFORMATION AND OPTIONS

| | |
|---|---|
| NHTSA No. | O20225600 |
| Model Year | 2022 |
| Make | Mitsubishi |
| Model | Eclipse Cross |
| Body Style | SUV |
| VIN | JA4ATUAA7NZ002125 |
| Body Color | Silver |
| Odometer Reading (km /mi) | 7 mi |
| Engine Displacement (L) | 1.5 |
| Type / No. Cylinders | I4 |
| Engine Placement | Transverse |
| Transmission Type | Automatic |
| Transmission Speeds | CVT |
| Overdrive | Yes |
| Final Drive | All Wheel Drive |
| Roof Rack | No |
| Sunroof / T-Top | No |
| Running Boards | No |
| Tilt Steering Wheel | Yes |
| Power Seats | No |
| Anti-Lock Brakes (ABS) | Yes |
| Automatic Door Locks (ADLs) | No |

| | |
|---|---|
| Traction Control System (TCS) | Yes |
| Power Steering | Yes |
| Power Window Auto-Reverse | No |
| Driver Frontal Airbag | Yes |
| Driver Curtain Airbag | Yes |
| Driver Head/Torso Airbag | No |
| Driver Torso Airbag | No |
| Driver Torso/Pelvis Airbag | Yes |
| Driver Pelvis Airbag | No |
| Driver Knee Airbag | Yes |
| Front Pass. Frontal Airbag | Yes |
| Front Pass. Curtain Airbag | Yes |
| Front Pass. Head/Torso Airbag | No |
| Front Pass. Torso Airbag | No |
| Front Pass. Torso/Pelvis Airbag | Yes |
| Front Pass. Pelvis Airbag | No |
| Front Pass. Knee Airbag | No |
| Driver Pretensioner | Yes |
| Driver Load Limiter | Yes |
| Front Pass. Pretensioner | Yes |
| Front Pass. Load Limiter | Yes |
| Other – | - |

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

## DATA FROM CERTIFICATION LABEL

| | |
|---|---|
| Manufactured By | Mitsubishi Motors Corporation |
| Date of Manufacture | JAN 2021 |

| | |
|---|---|
| GVWR (kg) | 2100 |
| GAWR Front (kg) | 1200 |
| GAWR Rear (kg) | 1160 |

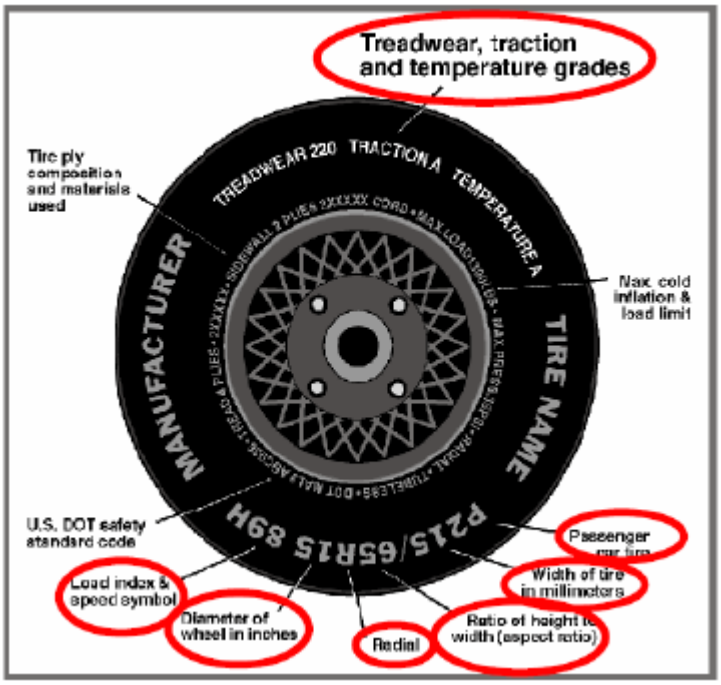
## VEHICLE SEATING AND WEIGHT CAPACITY DATA

| Measured Parameter | Front | Rear | Third | Total |
|---|---|---|---|---|
| Type of Seats | Bucket | Bench | N/A | |
| Number of Occupants | 2 | 3 | N/A | 5 |
| Capacity Wt. (VCW) (kg) | | | | 375 |
| Cargo Wt. (RCLW) (kg) | | | | 34.8 |

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

| | | | |
|---|---|---|---|
| Test Vehicle: | 2022 Mitsubishi Eclipse Cross SUV | NHTSA No.: | O20225600 |
| Test Program: | NCAP Frontal Barrier Impact Test | Test Date: | 5/13/2021 |

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) | 260 | 260 |
| Recommended Tire Size | P215/70R16 | P215/70R16 |
| Tire Size on Vehicle | P215/70R16 | P215/70R16 |
| Tire Manufacturer | Falken | Falken |
| Tire Model | Sincera SN250 | Sincera SN250 |
| Treadwear | 320 | 320 |
| Traction | B | B |
| Temperature Grades | A | A |
| Tire Plies Sidewall | 2 Polyester | 2 Polyester |
| Tire Plies Body | 2 Polyester, 2 Steel, 1 Polyamide | 2 Polyester, 2 Steel, 1 Polyamide |
| Load Index / Speed Symbol | 99H | 99H |
| Tire Material | Rubber | Rubber |
| DOT Safety Code Left | EUYV3MHR0820 | EUYV3MHR0820 |
| DOT Safety Code Right | EUYV3MHR0820 | EUYV3MHR0820 |

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

Test Vehicle: 2022 Mitsubishi Eclipse Cross SUV NHTSA No.: O20225600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/13/2021

### TEST VEHICLE WEIGHTS

| | Units | As Delivered Weights (UVW) | | | As Tested Weights (ATW) | | |
|---|---|---|---|---|---|---|---|
| | | Front Axle | Rear Axle | Total | Front Axle | Rear Axle | Total |
| Left | kg | 452 | 342 | | 492 | 394 | |
| Right | kg | 440 | 318 | | 465 | 369 | |
| Ratio | % | 57.5 | 42.5 | | 55.6 | 44.4 | |
| Totals | kg | 892 | 660 | 1552 | 957 | 763 | 1720 |

### TARGET TEST WEIGHT CALCULATION

| Measured Parameter | Units | Value | |
|---|---|---|---|
| Total Delivered Weight (UVW) | kg | 1552 | (A) |
| Weight of 1 P572E ATD & 1 P572O ATD | kg | 142 | (B) |
| Rated Cargo / Luggage Weight (RCLW) | kg | 34.8 | (C) |
| Calculated Vehicle Target Weight (TVTW) | kg | 1728.8 | (A+B+C) |

### TEST VEHICLE ATTITUDES AND CG

| Condition | Units | LF | RF | LR | RR | CG (aft of front axle) |
|---|---|---|---|---|---|---|
| As Delivered | mm | 864 | 867 | 868 | 875 | 1134 |
| As Tested | mm | 844 | 857 | 843 | 849 | 1183 |
| Post-Test | mm | 817 | 840 | 837 | 855 | |

### GENERAL TEST VEHICLE DATA

| Measurement Description | Units | Value |
|---|---|---|
| Total Vehicle Wheel Base | mm | 2667 |
| Total Vehicle Length at Left Side | mm | 4487 |
| Total Vehicle Length at Centerline | mm | 4546 |
| Total Vehicle Length at Right Side | mm | 4487 |
| Weight of Ballast in Cargo Area | kg | 0 |
| Weight of Vehicle Components Removed | kg | 43 |
| Amount of Stoddard Solvent in Fuel Tank | L | 55.6 |

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

Trunk Carpeting, Spare Tire, Jack, Rear Door Panels, Rear Tail Lights, Rear Seat Cushion

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

Test Vehicle: 2022 Mitsubishi Eclipse Cross SUV NHTSA No.: O20225600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/13/2021

**TARGET VEHICLE STRUCTURAL MEASUREMENT**

| No. | Description | Pre-Test |
|---|---|---|
| 1 | Total Length | 4546 |
| 2 | Total Width | 1807 |
| 3* | Bumper Top Height | 579 |
| 4* | Bumper Bottom Height | 487 |
| 5* | Longitudinal Member Top Height | 666 |
| 6 | Distance Between Longitudinal Members | 986 |
| 7 | Longitudinal Member Width | 41 |
| 8* | Engine Top Height | 831 |
| 9* | Engine Bottom Height | 275 |
| 10 | Engine and Gearbox Width | 457 |
| 11 | Front Bumper-Engine Distance | 724 |
| 12* | Front Shock Absorber Fixing Height | 951 |
| 13* | Bonnet Leading Edge Height | 936 |
| 14 | Front Shock Absorber Fixing Width | 1124 |
| 15 | Front Bumper – Front Axle Distance | 984 |
| 16 | Front Axle – A Pillar Distance | 514 |
| 17 | A-Pillar – B-Pillar Distance | 1111 |
| 18 | B-Pillar – Rear Axle Distance | 1047 |
| 19 | B-Pillar – C-Pillar Distance | 945 |
| 20* | Roof Sill Bottom Height | 1568 |
| 21* | Roof Sill Top Height | 1601 |
| 22* | Floor Sill Bottom Height | 352 |
| 23* | Floor Sill Top Height | 469 |

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

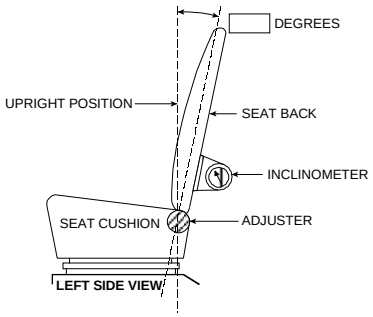
**DATA SHEET NO. 2**
**SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA**

| | | | |
|---|---|---|---|
| Test Vehicle: | 2022 Mitsubishi Eclipse Cross SUV | NHTSA No.: | O20225600 |
| Test Program: | NCAP Frontal Barrier Impact Test | Test Date: | 5/13/2021 |

## 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.

| Seating Position | Degrees |
|---|---|
| Driver Seat Back Angle | 0.6 |
| Passenger Seat Back Angle | 5.3 |



**FRONT SEAT ASSEMBLY**

## SEAT FORE / AFT POSITIONS

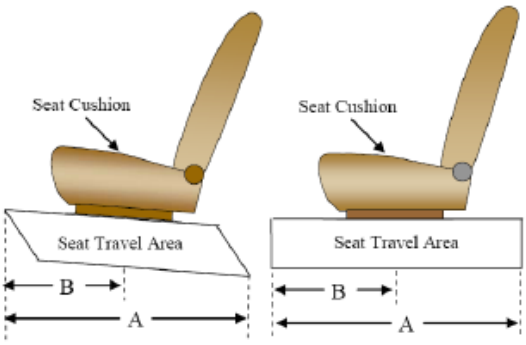
The driver's seat was positioned at the mid-point of fore/aft travel at its lowest position. The passenger's seat was positioned at the most forward position of fore/aft travel. Zero is defined as the forward most position.

| Seating Position | Total Fore / Aft Travel | Placed in Position # |
|---|---|---|
| Driver Seat | 23 (0-22) | 10 |
| Passenger Seat | 23 (0-22) | 0 |

## SEAT BELT UPPER ANCHORAGE

The driver's seat belt anchorage was positioned according to the manufacturer's designated positioning for a 50$^{th}$ percentile adult male ATD. The passenger's seat belt anchorage was positioned according to the manufacturer's designated positioning for a 5$^{th}$ 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

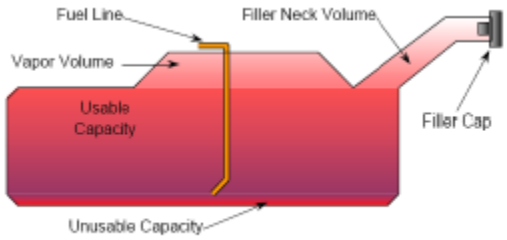
Test Vehicle: 2022 Mitsubishi Eclipse Cross SUV
NHTSA No.: O20225600
Test Program: NCAP Frontal Barrier Impact Test
Test Date: 5/13/2021

### FUEL TANK CAPACITY

| Description | Liters |
|---|---|
| Usable Capacity of "Standard Tank" | 59.8 |
| Usable Capacity of "Optional Tank" | N/A |
| 92%-94% of Usable Capacity | 55 – 56.2 |
| Actual Amount of Solvent Used | 55.6 |
| 1/3 of Usable Capacity | 19.9 |

### FUEL PUMP

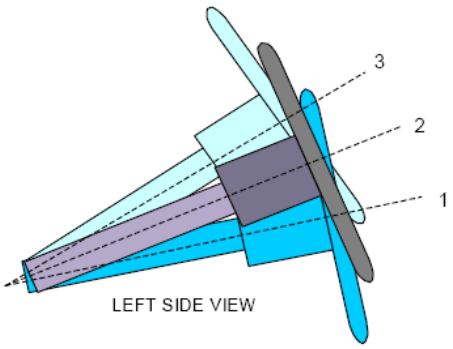
The vehicle is equipped with an electric fuel pump. The fuel filler neck is on the left side of the vehicle. The pump creates positive pressure in the fuel lines, pushing the gasoline to the engine. See form 1 for more information.



*VEHICLE FUEL TANK ASSEMBLY*

### 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*

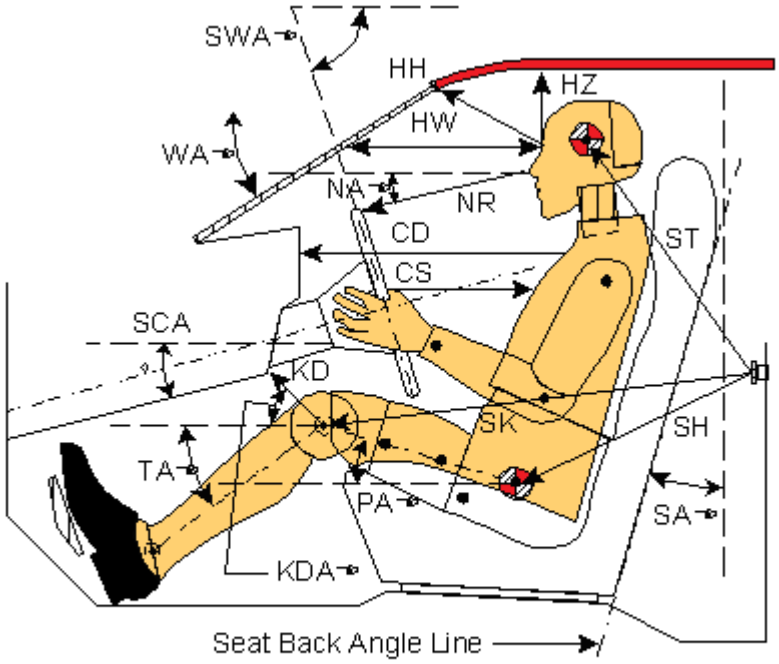
### STEERING COLUMN POSITIONS

| Description | Degrees | Fore / Aft Position (mm) |
|---|---|---|
| Lowermost position No. 1 | 26.4 | |
| Geometric center position No. 2 | 27.8 | |
| Uppermost position No. 3 | 30.5 | |
| Telescoping Steering Wheel Travel | | 38 |
| Test Position | 27.8 | 19 |

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

Test Vehicle: 2022 Mitsubishi Eclipse Cross SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20225600
Test Date: 5/13/2021



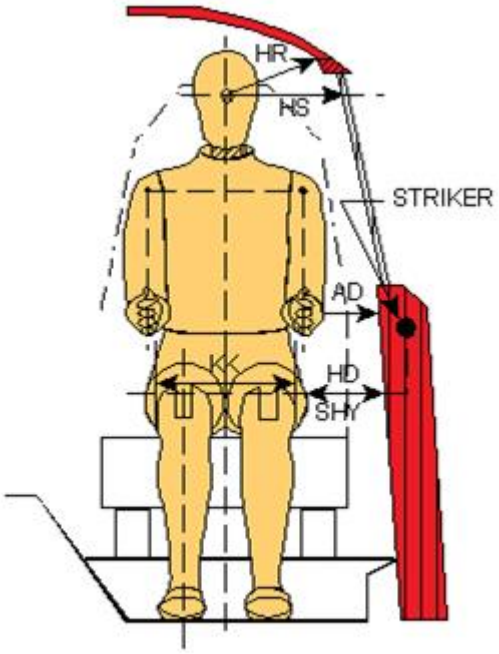

Left Side View

| Code | Measurement Description | Driver (SN: 142) | | Passenger (SN: 288) | |
|---|---|---|---|---|---|
| | | Length (mm) | Angle (°) | Length (mm) | Angle (°) |
| **WA°** | Windshield Angle | | 30.8 | | |
| **SWA°** | Steering Wheel Angle | | 27.3 | | |
| **SCA°** | Steering Column Angle | | 62.7 | | |
| **SA°** | Seat Back Angle (on headrest post) | | 0.6 | | 5.3 |
| **HZ** | Head to Roof (Z) | 238 | 90 | 216 | 90 |
| **HH** | Head to Header | 430 | 20.4 | 355 | 35.2 |
| **HW** | Head to Windshield | 730 | 0.0 | 716 | 0.0 |
| **NR** | Nose to Rim / Dash | 425 | 12.8 | 470 | 28.7 |
| **CD** | Chest to Dash | 548 | | 420 | |
| **CS** | Chest to Steering Hub | 328 | 8.3 | | |
| **RA** | Rim to Abdomen | 190 | 0.5 | | |
| **KDL** | Left Knee to Dash | 180 | 14.1 | 85 | 37.1 |
| **KDR** | Right Knee to Dash | 192 | 1.4 | 89 | 37.1 |
| **PA°** | Pelvic Angle | | 23.6 | | 19.8 |
| **TA°** | Tibia Angle | | 44.1 | | 50.0 |
| **SK** | Striker to Knee | 607 | 7.0 | 738 | 11.7 |
| **ST** | Striker to Head | 465 | 75.8 | 494 | 53.6 |
| **SH** | Striker to H-Point | 314 | 38.2 | 455 | 28.1 |

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

Test Vehicle: 2022 Mitsubishi Eclipse Cross SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20225600
Test Date: 5/13/2021

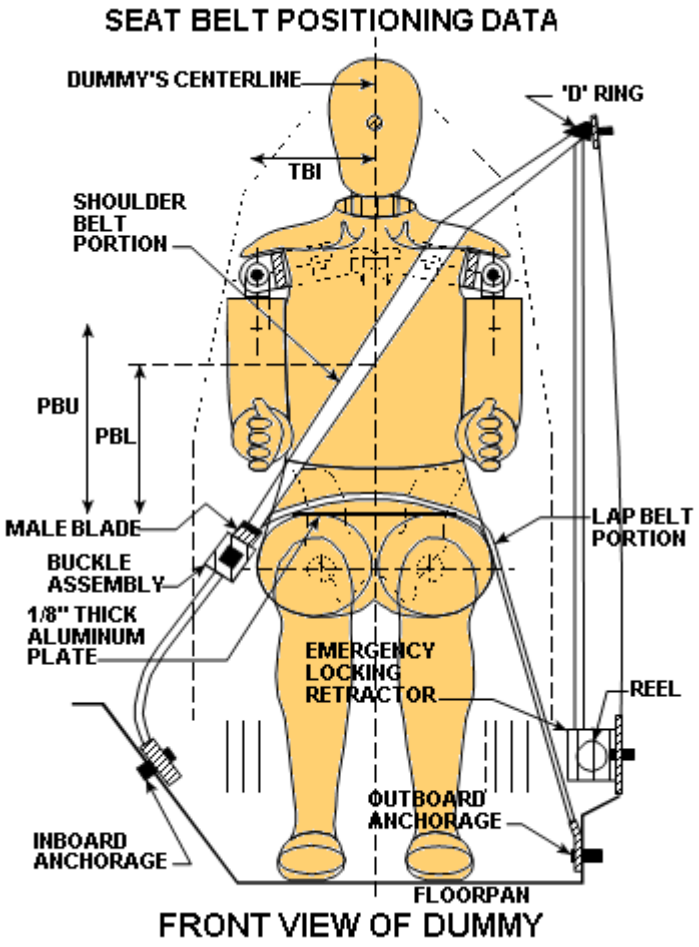



Front View

| Code | Description | Driver (mm) | Passenger (mm) |
|---|---|---|---|
| **AD** | Arm to Door | 106 | 78 |
| **HD** | H-Point to Door | 142 | 171 |
| **HR** | Head to Side Header | 231 | 270 |
| **HS** | Head to Side Window | 349 | 379 |
| **KK** | Knee to Knee | 352 | 212 |
| **SHY** | Striker to H-Point (Y Direction) | 254 | 255 |
| **AA** | Ankle to Ankle | 348 | 167 |

**DATA SHEET NO. 5**
**SEAT BELT POSITIONING DATA**

| | | | |
|---|---|---|---|
| Test Vehicle: | 2022 Mitsubishi Eclipse Cross SUV | NHTSA No.: | O20225600 |
| Test Program: | NCAP Frontal Barrier Impact Test | Test Date: | 5/13/2021 |




**SEAT BELT POSITIONING MEASUREMENTS**

| Measurement Description | Units | Driver | Passenger |
|---|---|---|---|
| **PBU —** Top surface of reference to belt upper edge | mm | 315 | 279 |
| **PBL —** Top surface of reference to belt lower edge | mm | 240 | 192 |

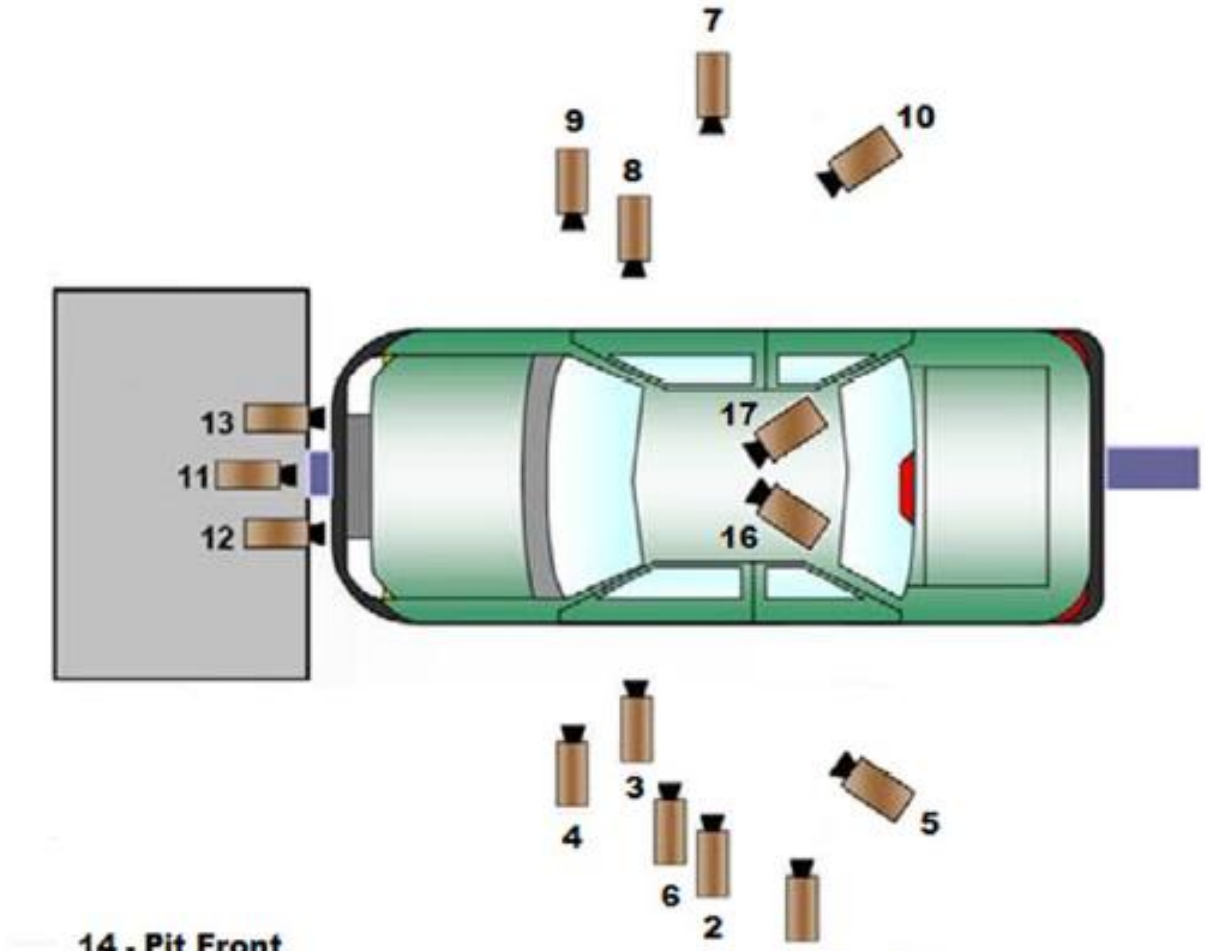
**BELT LENGTH DATA**

| Measurement Description | Units | Driver | Passenger |
|---|---|---|---|
| Shoulder belt length as measured on ATD | mm | 852 | 913 |
| Lap Belt Length as measured on ATD | mm | 685 | 748 |
| Remainder of belt on reel | mm | 963 | 839 |
| Total belt length for continuous webbing systems | mm | 2500 | 2500 |

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

| | | | |
|---|---|---|---|
| Test Vehicle: | 2022 Mitsubishi Eclipse Cross SUV | NHTSA No.: | O20225600 |
| Test Program: | NCAP Frontal Barrier Impact Test | Test Date: | 5/13/2021 |

**CAMERA POSITIONS FOR FRONTAL IMPACTS**



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

Test Vehicle: 2022 Mitsubishi Eclipse Cross SUV NHTSA No.: O20225600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/13/2021

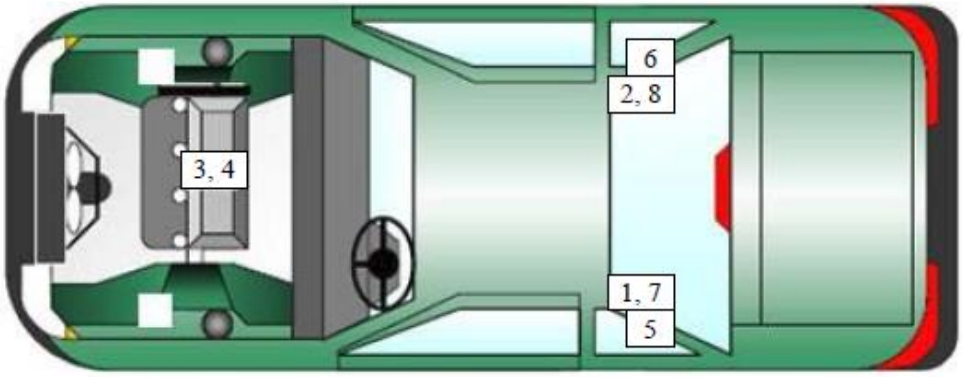
**CAMERA LOCATIONS**

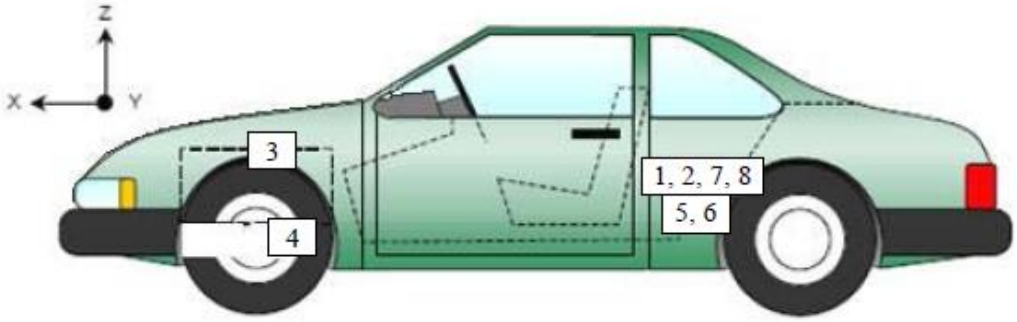
| No. | Camera View | Location (mm) | | | Lens (mm) | Speed (fps) |
|---|---|---|---|---|---|---|
| | | X | Y | Z | | |
| 1 | Real-Time Left Overall | - | - | - | | 60 |
| 2 | Left Overall | -2046 | -7391 | -1385 | 24 | 1000 |
| 3 | Driver Close-Up | -1647 | -7019 | -1752 | 50 | 1000 |
| 4 | Left Front Half | -1051 | -5162 | -1397 | 28 | 1000 |
| 5 | Left Angle | -4168 | -5144 | -2544 | 50 | 1000 |
| 6 | Steering Column | -2241 | -9543 | -2218 | 75 | 1000 |
| 7 | Right Overall | -1760 | 7223 | -1418 | 24 | 1000 |
| 8 | Passenger Close-Up | -1519 | 6988 | -1572 | 50 | 1000 |
| 9 | Right Front Half | -1081 | 5817 | -1328 | 28 | 1000 |
| 10 | Right Angle | -4126 | 4962 | -2788 | 50 | 1000 |
| 11 | Windshield | 1142 | 0 | -3685 | 12.5 | 1000 |
| 12 | Driver Windshield | 750 | 400 | -2335 | 25 | 1000 |
| 13 | Passenger Windshield | 750 | 400 | -2335 | 25 | 1000 |
| 14 | Pit Front | -1527 | 0 | 2540 | 12.5 | 1000 |
| 15 | Pit Rear | -2637 | 0 | 2540 | 12.5 | 1000 |
| 16 | Onboard Driver Airbag (Optional) | | | | 8 | 1000 |
| 17 | Onboard Passenger Airbag (Optional) | | | | 8 | 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 Mitsubishi Eclipse Cross SUV NHTSA No.: O20225600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/13/2021




**VEHICLE ACCELEROMETER PRE-TEST LOCATIONS**

| No. | Accelerometer Location | Measurements (mm) | | |
|---|---|---|---|---|
| | | X | Y | Z |
| 1 | Left Rear Accelerometer – X Direction | 1673 | -365 | 208 |
| 2 | Right Rear Accelerometer – X Direction | 1673 | 359 | 187 |
| 3 | Engine Top X | 3652 | 194 | -167 |
| 4 | Engine Bottom X | 3814 | 219 | 373 |
| 5 | Left Rear Accelerometer – Z Direction | 1673 | -365 | 208 |
| 6 | Right Rear Accelerometer – Z Direction | 1673 | 359 | 187 |
| 7 | Left Rear Accelerometer – X Direction Redundant | 1673 | -375 | 206 |
| 8 | Right Rear Accelerometer – X Direction Redundant | 1673 | 359 | 188 |

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

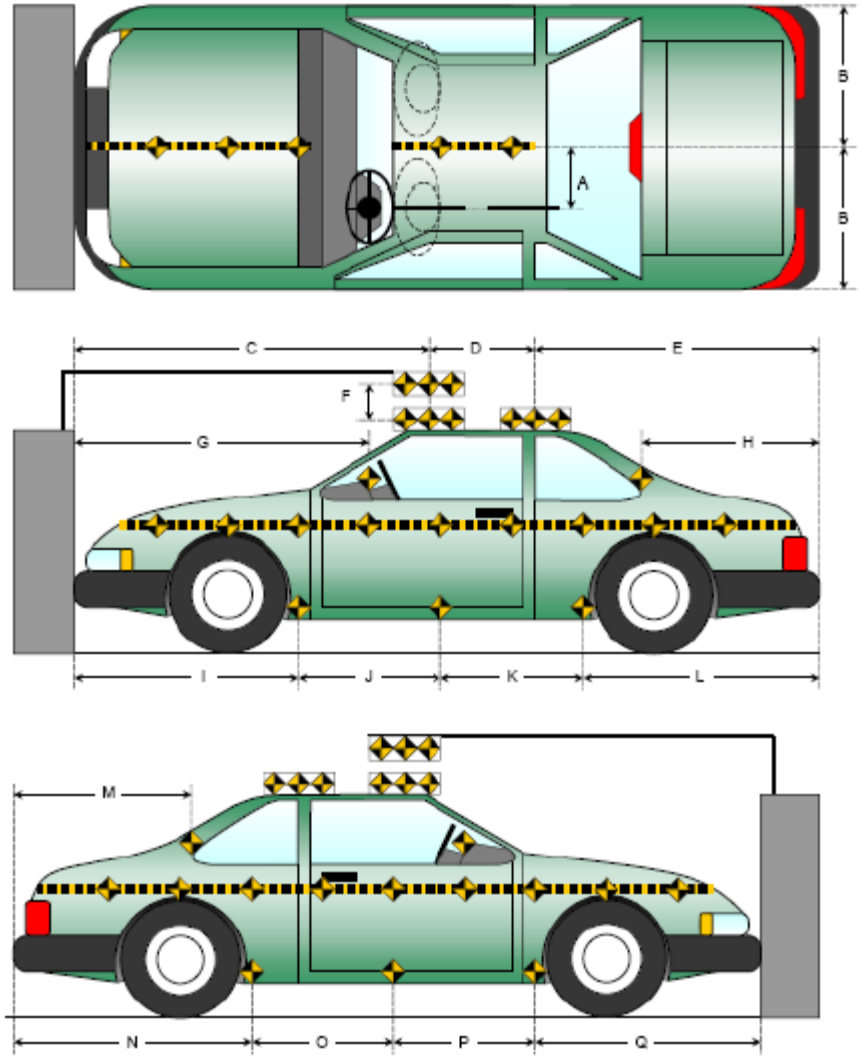
**DATA SHEET NO. 8**
**PHOTOGRAPHIC REFERENCE TARGET LOCATIONS**

Test Vehicle: 2022 Mitsubishi Eclipse Cross SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: O20225600
Test Date: 5/13/2021

| Item | Value |
|---|---|
| A | 364 |
| B | 904 |
| C | 2411 |
| D | 613 |
| E | 1522 |
| F | 190 |
| G | 1795 |
| H | 990 |
| I | 1451 |
| J | 873 |
| K | 874 |
| L | 1348 |
| M | 990 |
| N | 1348 |
| O | 873 |
| P | 874 |
| Q | 1451 |

All units in millimeters



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

| | | | |
|---|---|---|---|
| Test Vehicle: | 2022 Mitsubishi Eclipse Cross SUV | NHTSA No.: | O20225600 |
| Test Program: | NCAP Frontal Barrier Impact Test | Test Date: | 5/13/2021 |

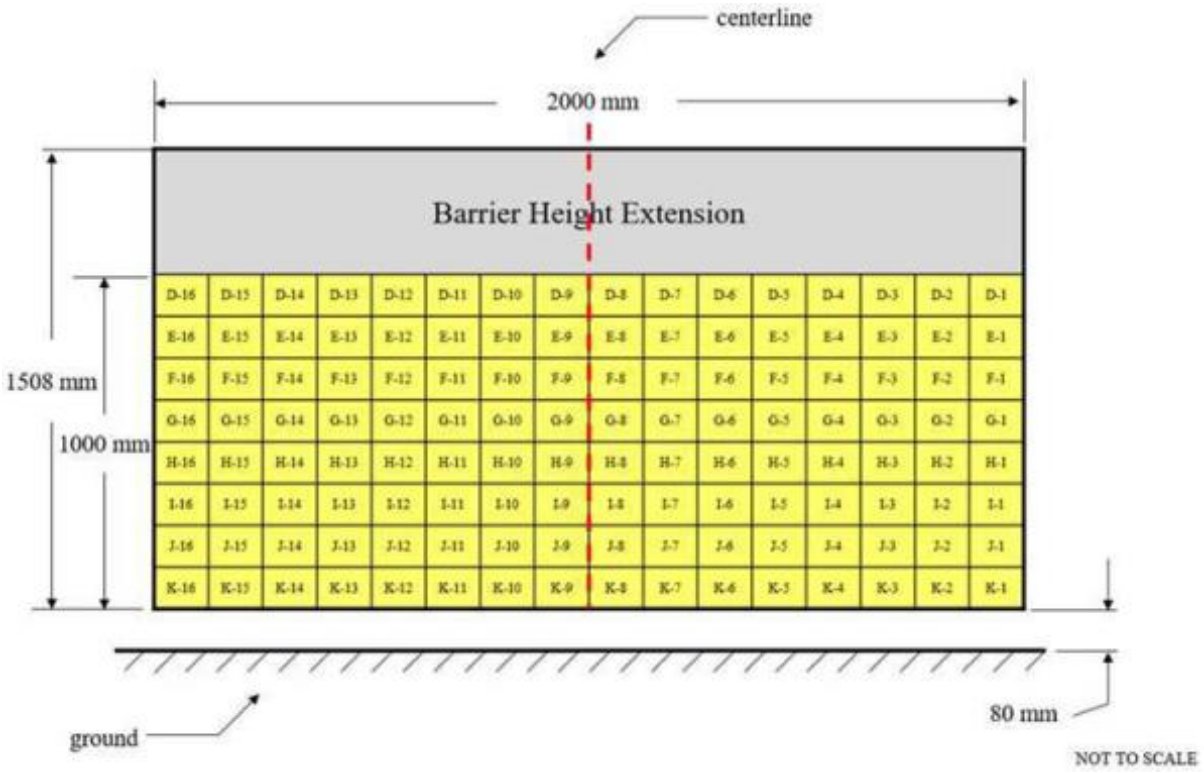



Figure 1 - Load Cell Locations on a 128-Load Cell Barrier with Plywood Height Extension*
Please note above diagram is not actual representation of load cell barrier used.

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

Test Vehicle: 2022 Mitsubishi Eclipse Cross SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: O20225600
Test Date: 5/13/2021

## INSTRUMENTATION

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

## CAMERA COVERAGE

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

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

Test Vehicle: 2022 Mitsubishi Eclipse Cross SUV NHTSA No.: O20225600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/13/2021

## TEST DUMMY INFORMATION AND CONTACT LOCATIONS

| Description | Driver | Passenger |
|---|---|---|
| Dummy Type / Serial No. | P572E 50th Male / 142 | P5720 5th Female / 288 |
| Head Contact | Frontal Airbag & Headrest | Frontal Airbag & Headrest |
| Upper Torso Contact | Frontal Airbag | Frontal Airbag |
| Lower Torso Contact | None | None |
| Left Knee Contact | Knee Airbag | Glove Box |
| Right Knee Contact | Knee Airbag | 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 | |

## POST-TEST STRUCTURAL OBSERVATIONS

| Critical Areas of Performance | Observations and Conclusions |
|---|---|
| Windshield Damage | Minor Cracks throughout |
| Window Damage | None |
| Other | None |

## VEHICLE REBOUND FROM BARRIER

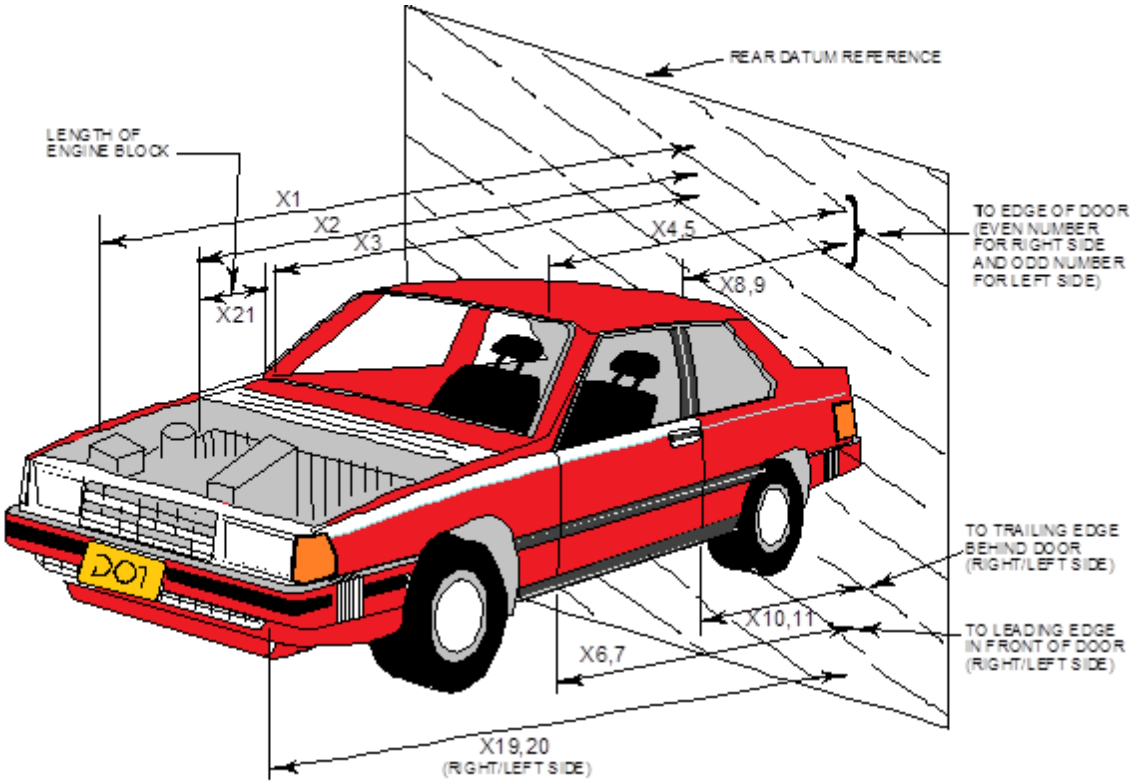
| Measured Parameter | Units | Value |
|---|---|---|
| Left Side | mm | 1004 |
| Center | mm | 989 |
| Right Side | mm | 995 |
| Average | mm | 996 |

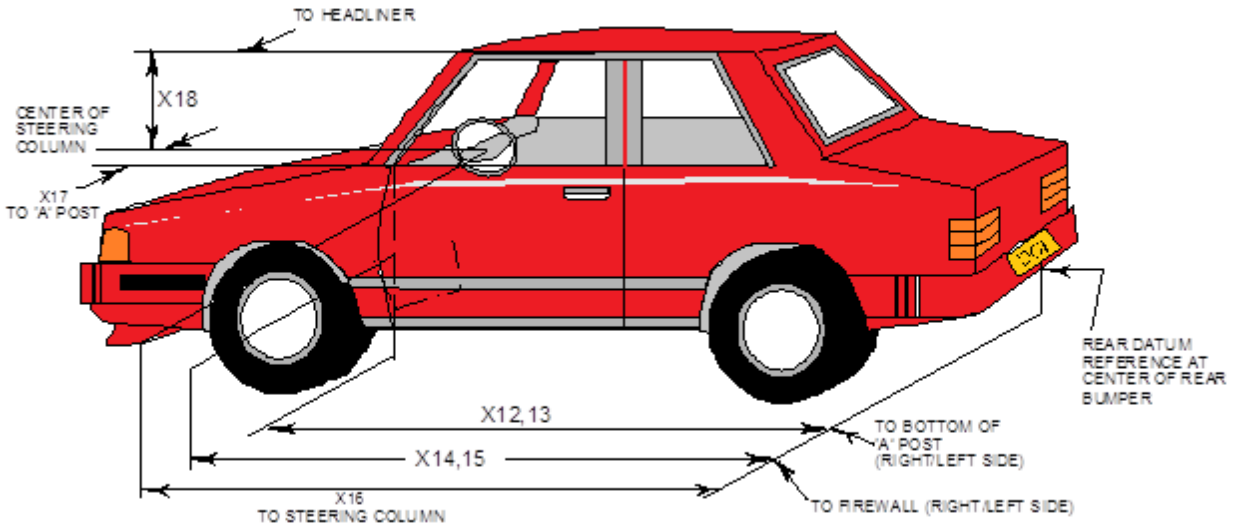
## SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

| 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 | Yes | Yes | 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 Mitsubishi Eclipse Cross SUV | NHTSA No.: | O20225600 |
| Test Program: | NCAP Frontal Barrier Impact Test | Test Date: | 5/13/2021 |



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

Test Vehicle: 2022 Mitsubishi Eclipse Cross SUV NHTSA No.: O20225600
Test Program: NCAP Frontal Barrier Impact Test Test Date: 5/13/2021

| No. | Measurement Description | Pre-Test | Post-Test | Difference |
|---|---|---|---|---|
| 1 | Total Length of Vehicle at Centerline | 4546 | 3925 | -621 |
| 2 | Rear Surface of Vehicle (RSOV) to Front of Engine | 3822 | 3643 | -179 |
| 3 | RSOV to Firewall | 3274 | 3199 | -75 |
| 4 | RSOV to Upper Leading Edge of Right Door | 3048 | 3041 | -7 |
| 5 | RSOV to Upper Leading Edge of Left Door | 3047 | 3046 | -1 |
| 6 | RSOV to Lower Leading Edge of Right Door | 3044 | 3040 | -4 |
| 7 | RSOV to Lower Leading Edge of Left Door | 3044 | 3048 | 4 |
| 8 | RSOV to Upper Trailing Edge of Right Door | 1937 | 1931 | -6 |
| 9 | RSOV to Upper Trailing Edge of Left Door | 1937 | 1935 | -2 |
| 10 | RSOV to Lower Trailing Edge of Right Door | 1994 | 1991 | -3 |
| 11 | RSOV to Lower Trailing Edge of Left Door | 1995 | 1995 | 0 |
| 12 | RSOV to Bottom of “A” Post of Right Side | 3123 | 3120 | -3 |
| 13 | RSOV to Bottom of “A” Post of Left Side | 3122 | 3122 | 0 |
| 14 | RSOV to Firewall, Right Side | 3515 | 3492 | -23 |
| 15 | RSOV to Firewall, Left Side | 3516 | 3489 | -27 |
| 16 | RSOV to Steering Column | 2595 | 2622 | 27 |
| 17 | Center of Steering Column to “A” Post | 314 | 312 | -2 |
| 18 | Center of Steering Column to Headliner | 434 | 467 | 33 |
| 19 | RSOV to Right Side of Front Bumper | 4513 | 3935 | -578 |
| 20 | RSOV to Left Side of Front Bumper | 4512 | 3908 | -604 |
| 21 | Length of Engine Block | 235 | 235 | 0 |
| RD | RSOV to Right Side of Dash Panel | 2898 | 2895 | -3 |
| CD | RSOV to Center of Dash Panel | 2800 | 2795 | -5 |
| LD | RSOV to Left Side of Dash Panel | 2901 | 2901 | 0 |

*UR= Unrecoverable data point
All Dimensions in mm

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

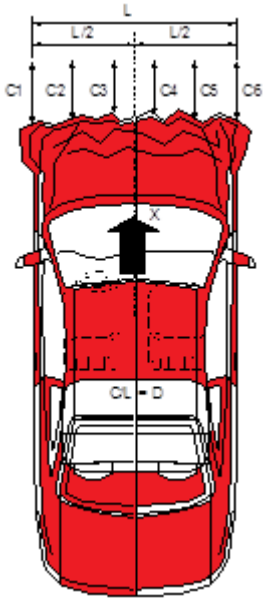
| | | | |
|---|---|---|---|
| Test Vehicle: | 2022 Mitsubishi Eclipse Cross SUV | NHTSA No.: | O20225600 |
| Test Program: | NCAP Frontal Barrier Impact Test | Test Date: | 5/13/2021 |

## VEHICLE INFORMATION

| | | | |
|---|---|---|---|
| VIN: | JA4ATUAA7NZ002125 | Wheelbase (mm): | 2667 |
| Vehicle Size Category: | MPV | Test Weight (kg): | 1720 |

## 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): | 56.29 |
| Velocity Change (km/h): | 62.83 |
| Time of Separation (ms): | 135 |




## CRUSH PROFILE

| | |
|---|---|
| Collision Deformation Classification: | 12FDEW3 |
| Midpoint of Damage: | C3 |
| Damage Region Length (mm): | 1453 |
| Impact Mode: | Frontal |

| No. | Measurement Description | Units | Pre-Test | Post-Test | Difference |
|---|---|---|---|---|---|
| C1 | Crush Zone 1 at Left Side | mm | 4294 | 3992 | 302 |
| C2 | Crush Zone 2 at Left Side | mm | 4514 | 3906 | 608 |
| C3 | Crush Zone 3 at Left Side | mm | 4540 | 3929 | 611 |
| C4 | Crush Zone 4 at Right Side | mm | 4540 | 3935 | 605 |
| C5 | Crush Zone 5 at Right Side | mm | 4513 | 3929 | 584 |
| C6 | Crush Zone 6 at Right Side | mm | 4293 | 4152 | 141 |
| L | C1 to C6 | mm | 1453 | 1493 | -40 |

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

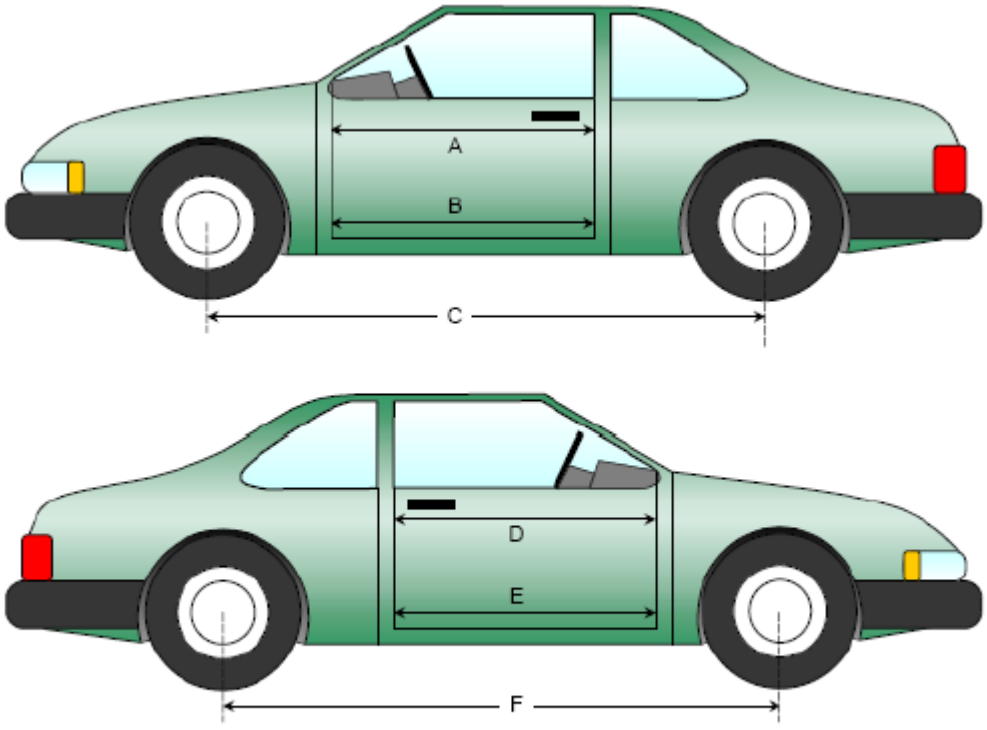
Test Vehicle: 2022 Mitsubishi Eclipse Cross SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: O20225600
Test Date: 5/13/2021

**DOOR OPENING WIDTH**

| Item | Description | Units | Pre-Test | Post-Test | Difference |
|---|---|---|---|---|---|
| A | Left Side Upper | mm | 1022 | 1020 | -2 |
| B | Left Side Lower | mm | 869 | 867 | -2 |
| D | Right Side Upper | mm | 1022 | 1020 | -2 |
| E | Right Side Lower | mm | 870 | 869 | -1 |

**WHEELBASE MEASUREMENTS**

| Item | Description | Units | Pre-Test | Post-Test | Difference |
|---|---|---|---|---|---|
| C | Left Side Wheelbase | mm | 2667 | 2638 | -29 |
| F | Right Side Wheelbase | mm | 2667 | 2640 | -27 |




**Left & Right Side Views**

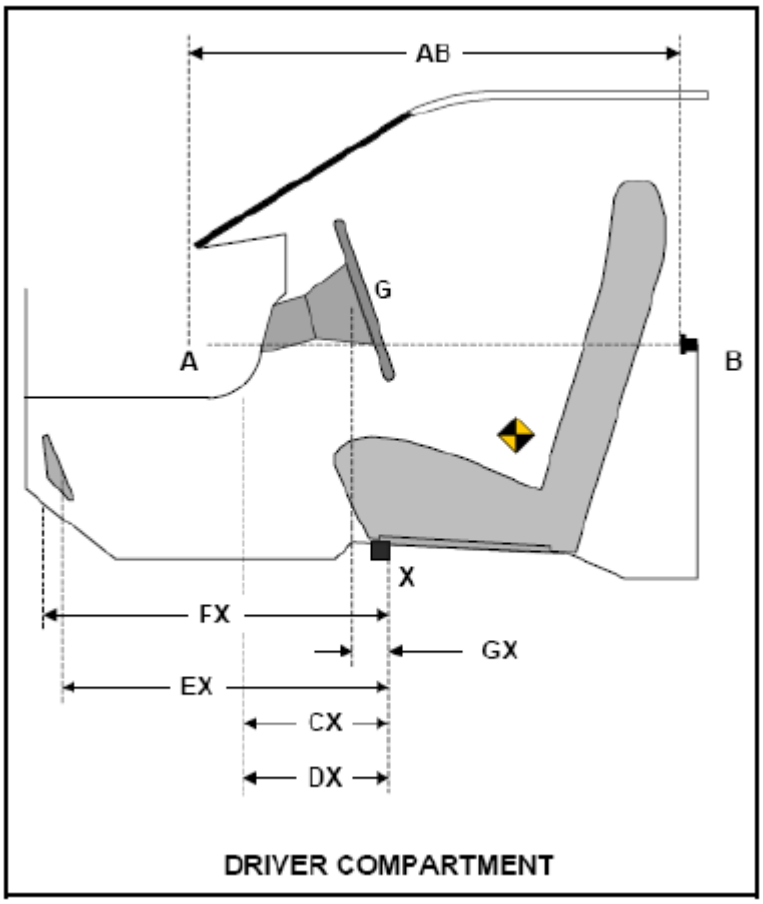
**DATA SHEET NO.14 … (CONTINUED)**
**VEHICLE INTRUSION MEASUREMENTS**

Test Vehicle: 2022 Mitsubishi Eclipse Cross SUV
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: O20225600
Test Date: 5/13/2021

**DRIVER COMPARTMENT INTRUSION**

| Item | Description | Units | Pre-Test | Post-Test | Difference |
|---|---|---|---|---|---|
| AB | Door Opening (Inside Window Jam) | mm | 799 | 799 | 0 |
| CX | Left Knee Bolster to X | mm | 327 | 326 | -1 |
| DX | Right Knee Bolster to X | mm | 333 | 330 | -3 |
| EX | Brake Pedal to X | mm | 525 | 484 | -41 |
| FX | Foot Rest to X | mm | 609 | 596 | -13 |
| GX | Center of Steering Column Wheel Hub to X | mm | 58 | 87 | 29 |

*X = Front of Seat Track (Stationary)*



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

| | | | |
|---|---|---|---|
| Test Vehicle: | 2022 Mitsubishi Eclipse Cross SUV | NHTSA No.: | O20225600 |
| Test Program: | NCAP Frontal Barrier Impact Test | Test Date: | 5/13/2021 |

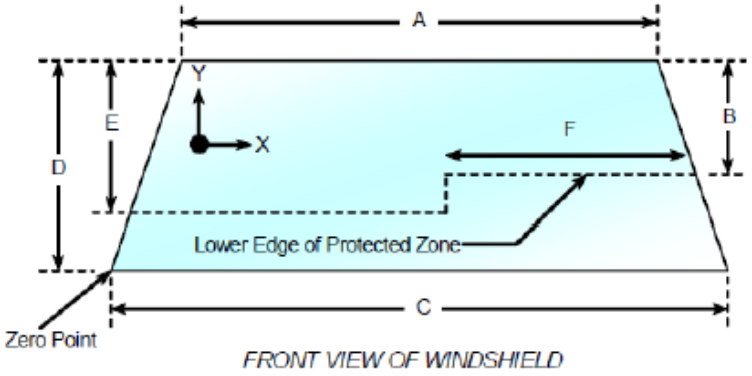
**Windshield Mounting Details:** A 0.8 mm trim surrounds the top and side of windshield while a plastic shroud is on the bottom.

*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 | 2224 | 2224 | 100 |
| Right Side | 2224 | 2224 | 100 |
| Total | 4448 | 4448 | 100 |



*FRONT VIEW OF WINDSHIELD*

| Item | Units | Value |
|---|---|---|
| A | mm | 1245 |
| B | mm | 570 |
| C | mm | 1593 |
| D | mm | 805 |
| E | mm | 568 |
| F | mm | 555 |

**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 Mitsubishi Eclipse Cross SUV | NHTSA No.: | O20225600 |
| Test Program: | NCAP Frontal Barrier Impact Test | Test Date: | 5/13/2021 |

## FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 21 ° C  Test Time: 12:09 PM

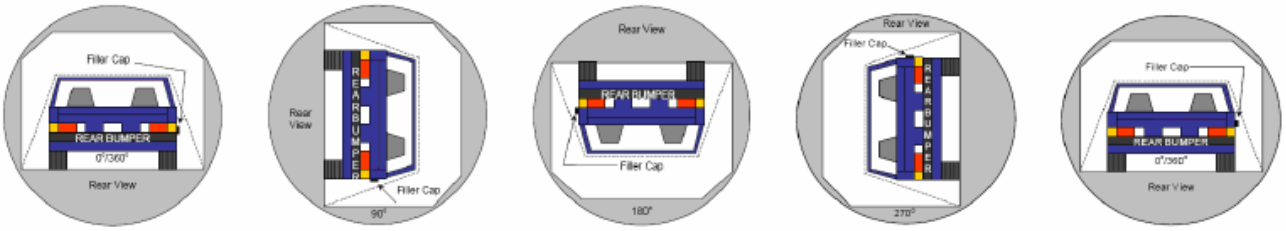
## STODDARD SOLVENT SPILLAGE MEASUREMENTS

| | | |
|---|---|---|
| A. From impact until vehicle motion ceases: (Maximum allowable is 1 oz.) | 0 | oz. |
| B. For the 5-minute period after motion ceases: (Maximum allowable is 5 oz.) | 0 | oz. |
| C. For the following 25 minutes: (Maximum allowable is 1 oz./minute) | 0 | oz. |

D. Spillage: No Spillage Occurred

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

| | | | |
|---|---|---|---|
| Test Vehicle: | 2022 Mitsubishi Eclipse Cross SUV | NHTSA No.: | O20225600 |
| Test Program: | NCAP Frontal Barrier Impact Test | Test Date: | 5/13/2021 |




0° TO 90° 90° TO 180° 180° TO 270° 270° TO 360°

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° | 69 | 300 | 369 |
| 90° to 180° | 65 | 300 | 365 |
| 180° to 270° | 60 | 300 | 360 |
| 270° to 360° | 70 | 300 | 370 |

**FMVSS 301 SPILLAGE TABLE**

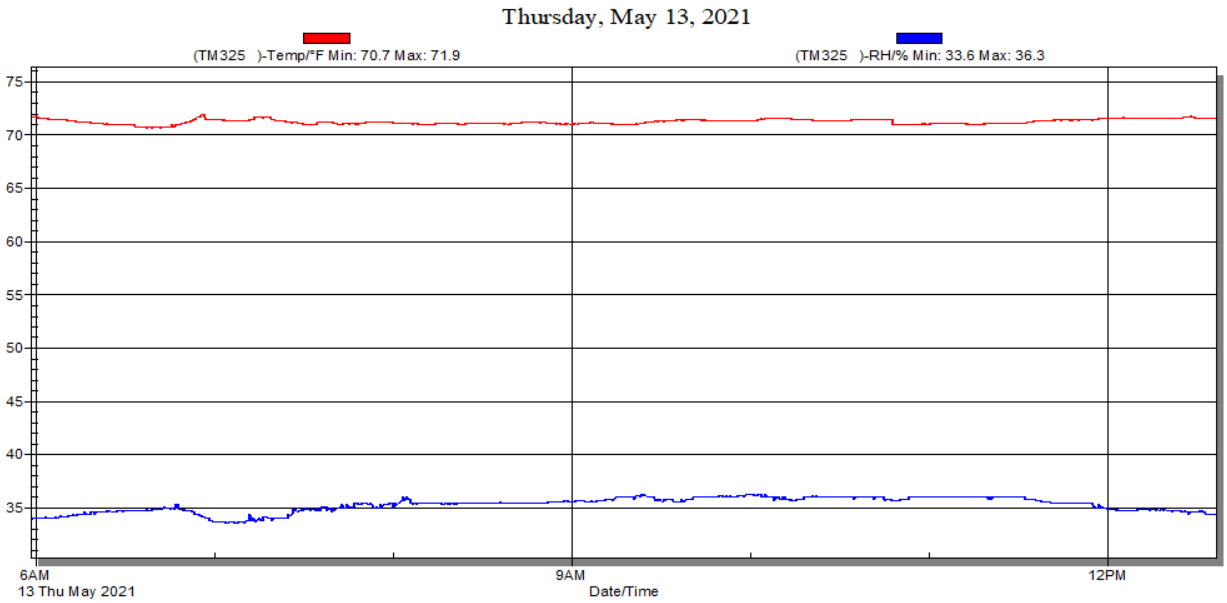
| Test Phase | First 5 Minutes | Sixth Minute | Seventh Minute | Eighth Minute |
|---|---|---|---|---|
| 0° to 90° | 0 | 0 | 0 | |
| 90° to 180° | 0 | 0 | 0 | |
| 180° to 270° | 0 | 0 | 0 | |
| 270° to 360° | 0 | 0 | 0 | |

**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 Mitsubishi Eclipse Cross SUV | NHTSA No.: | O20225600 |
| Test Program: | NCAP Frontal Barrier Impact Test | Test Date: | 5/13/2021 |




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

# APPENDIX A

# PHOTOGRAPHS

## TABLE OF PHOTOGRAPHS

[1]**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.*

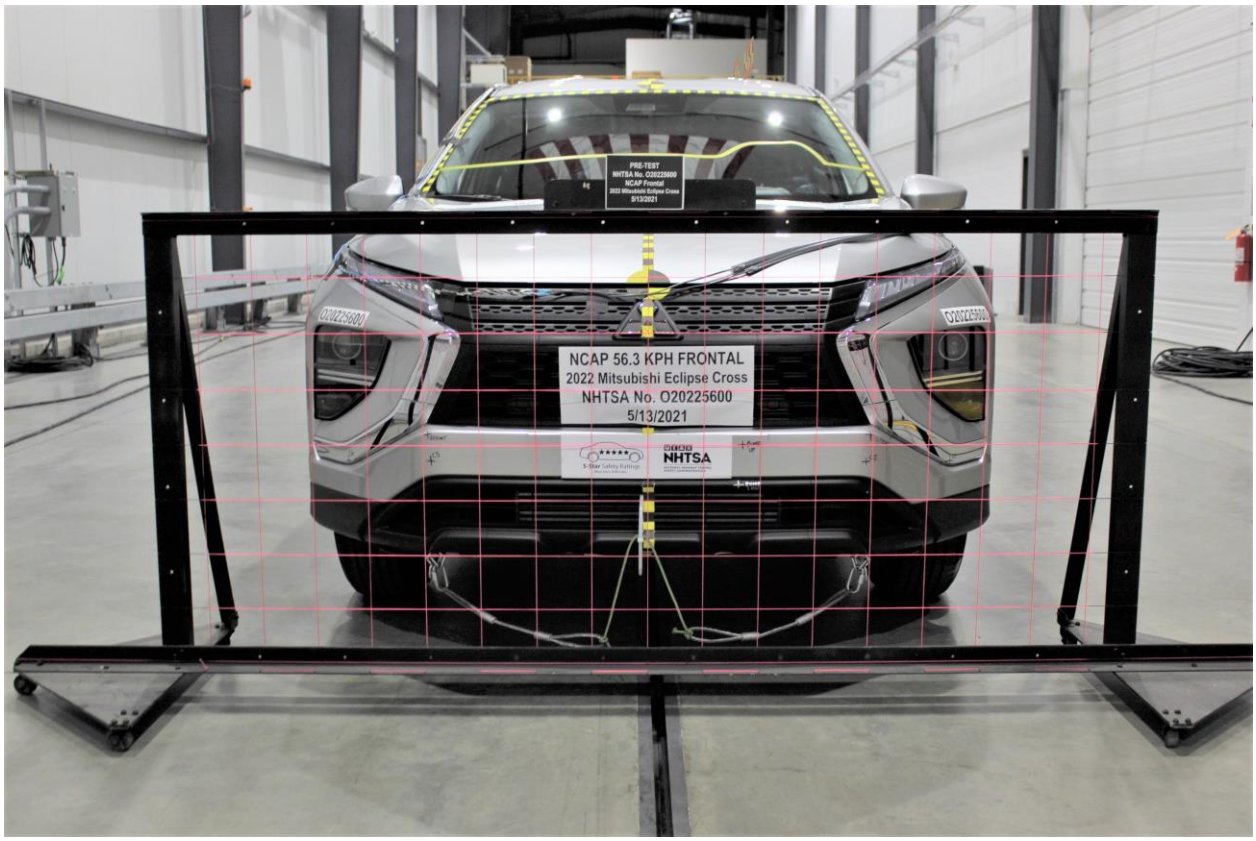



**Figure A-1: Load Cell Location**

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


**Figure A-3: Post-Test Load Cell Wall**

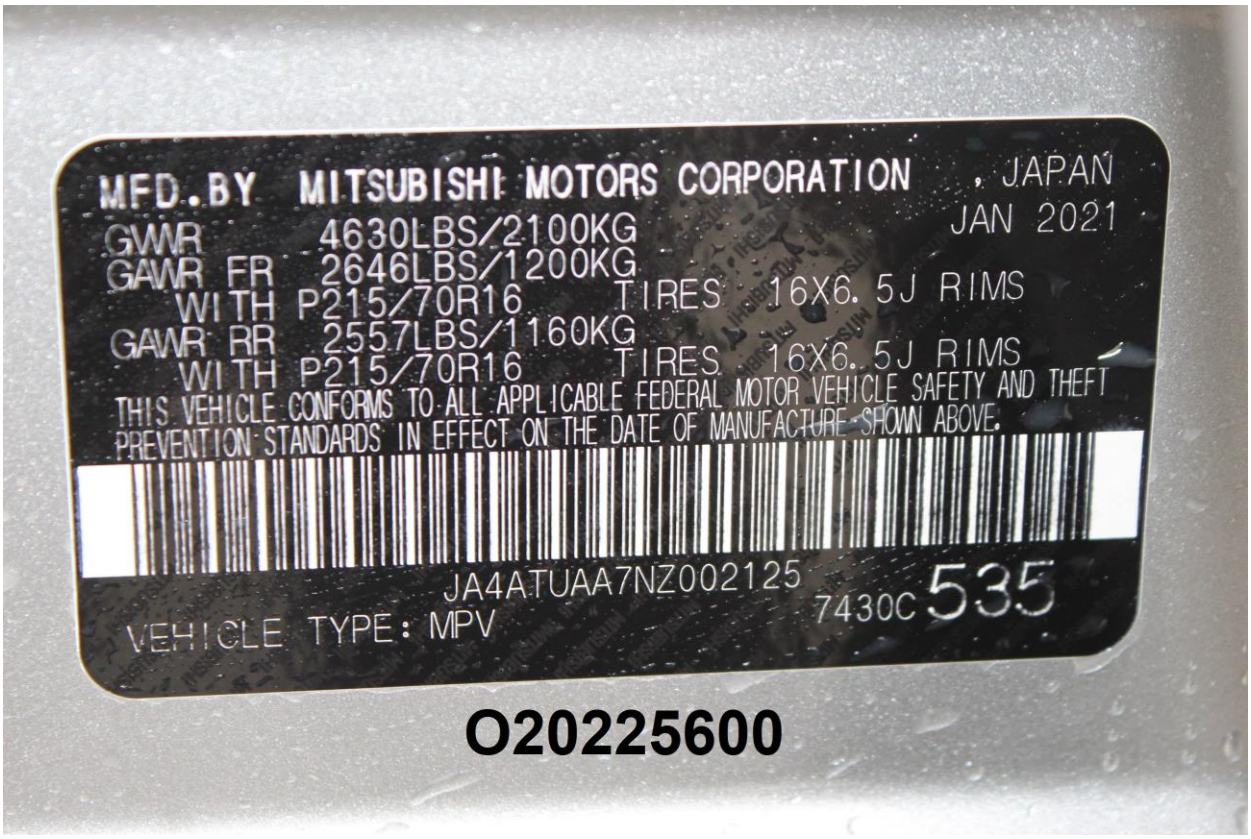



**Figure A-4: Manufacturer's Label**


**Figure A-5: Tire Placard**


**Figure A-6: 2022 Mitsubishi Eclipse Cross Frontal As Delivered**


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


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

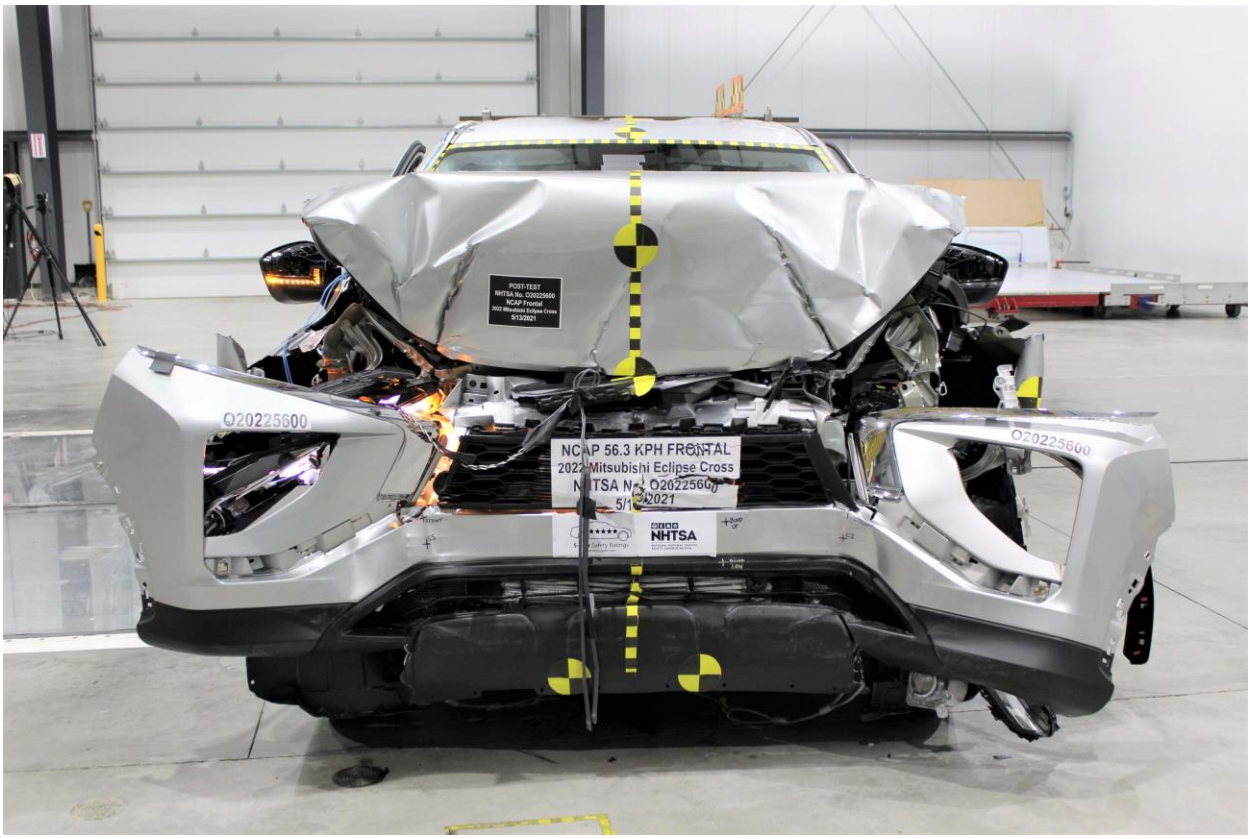



**Figure A-9: Post-Test Front View of Test Vehicle**


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

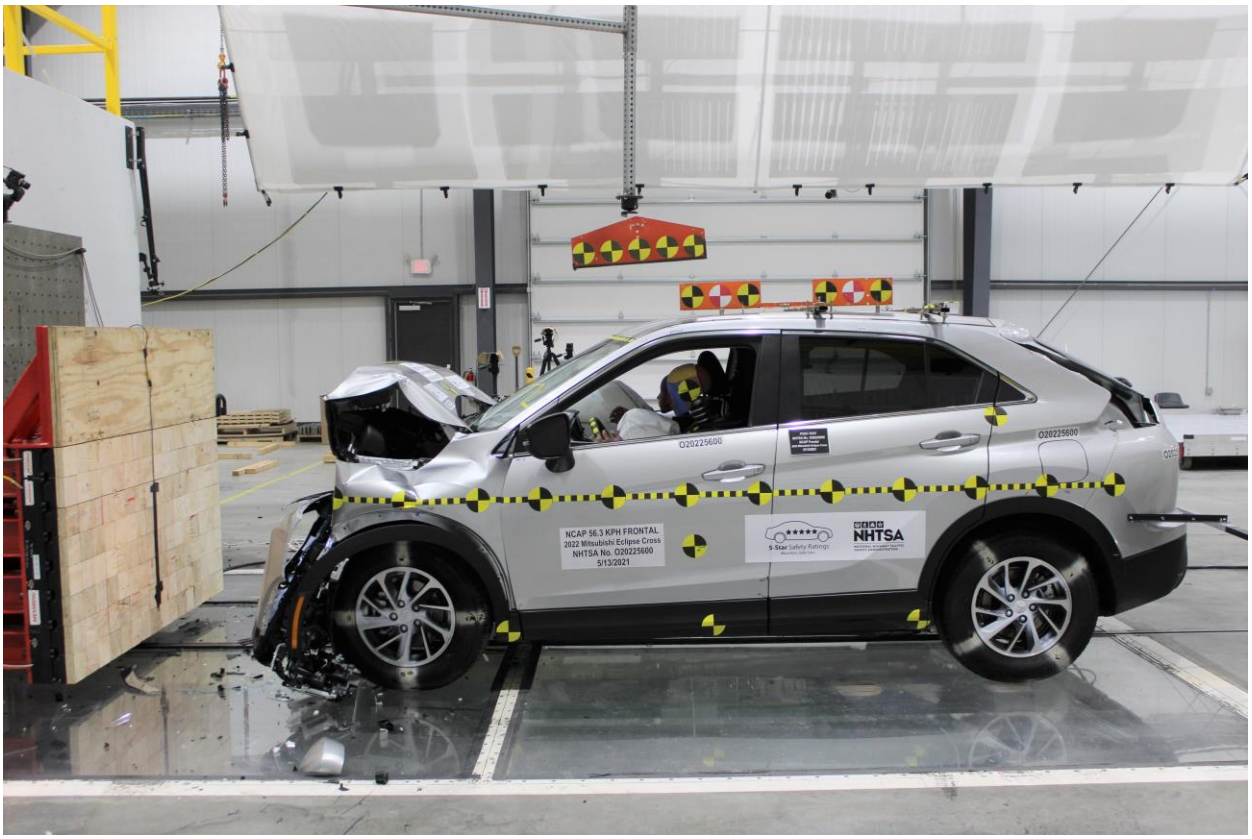



**Figure A-11: Post-Test Left View of Test Vehicle**


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

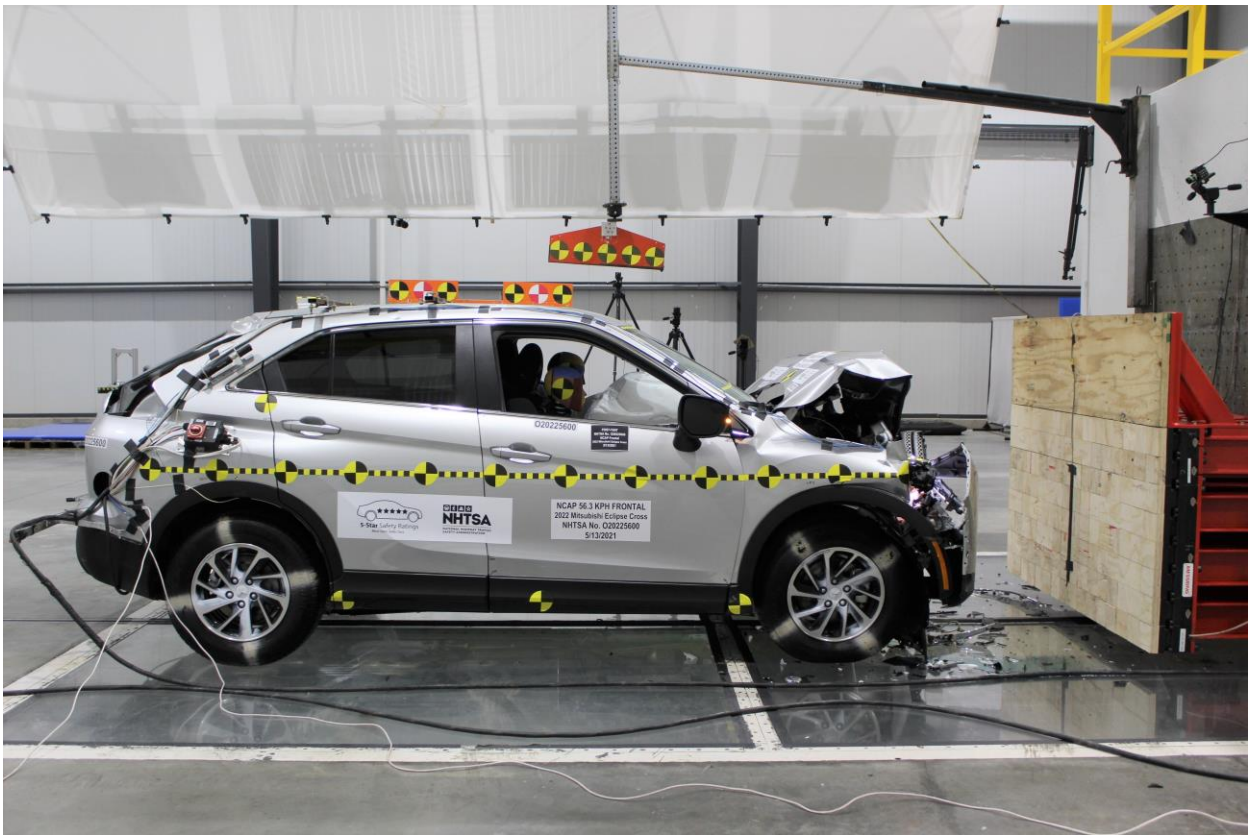



**Figure A-13: Post-Test Right View of Test Vehicle**


**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**

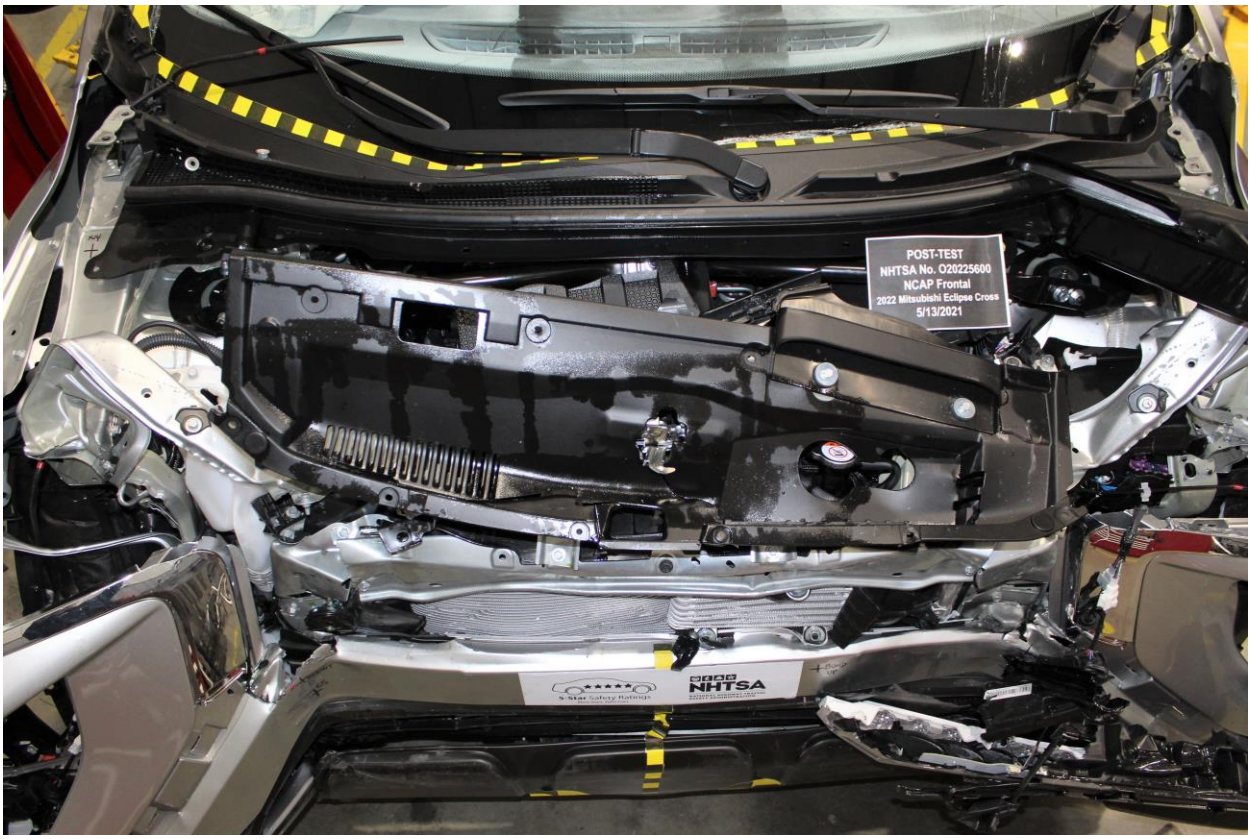



**Figure A-21: Post-Test Engine Compartment View**


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


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

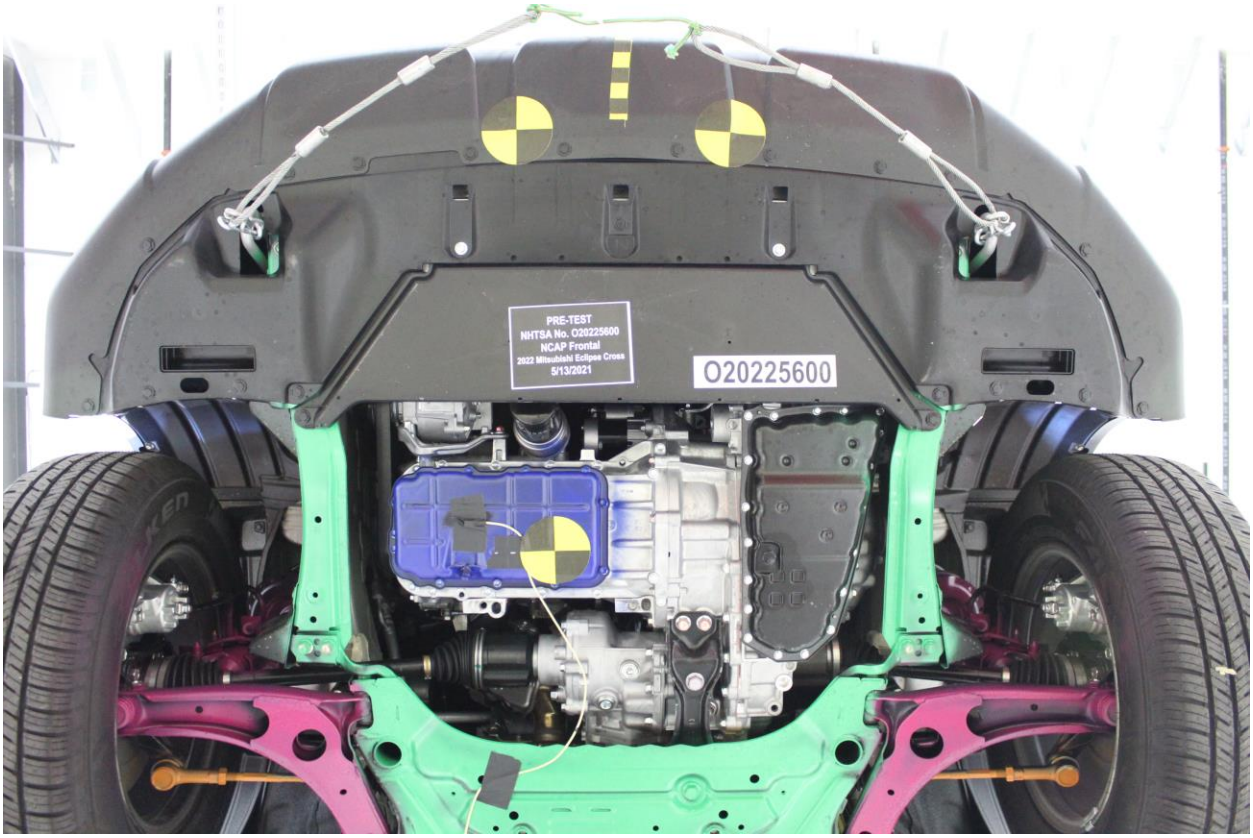



**Figure A-24: Pre-Test Front Underbody View**

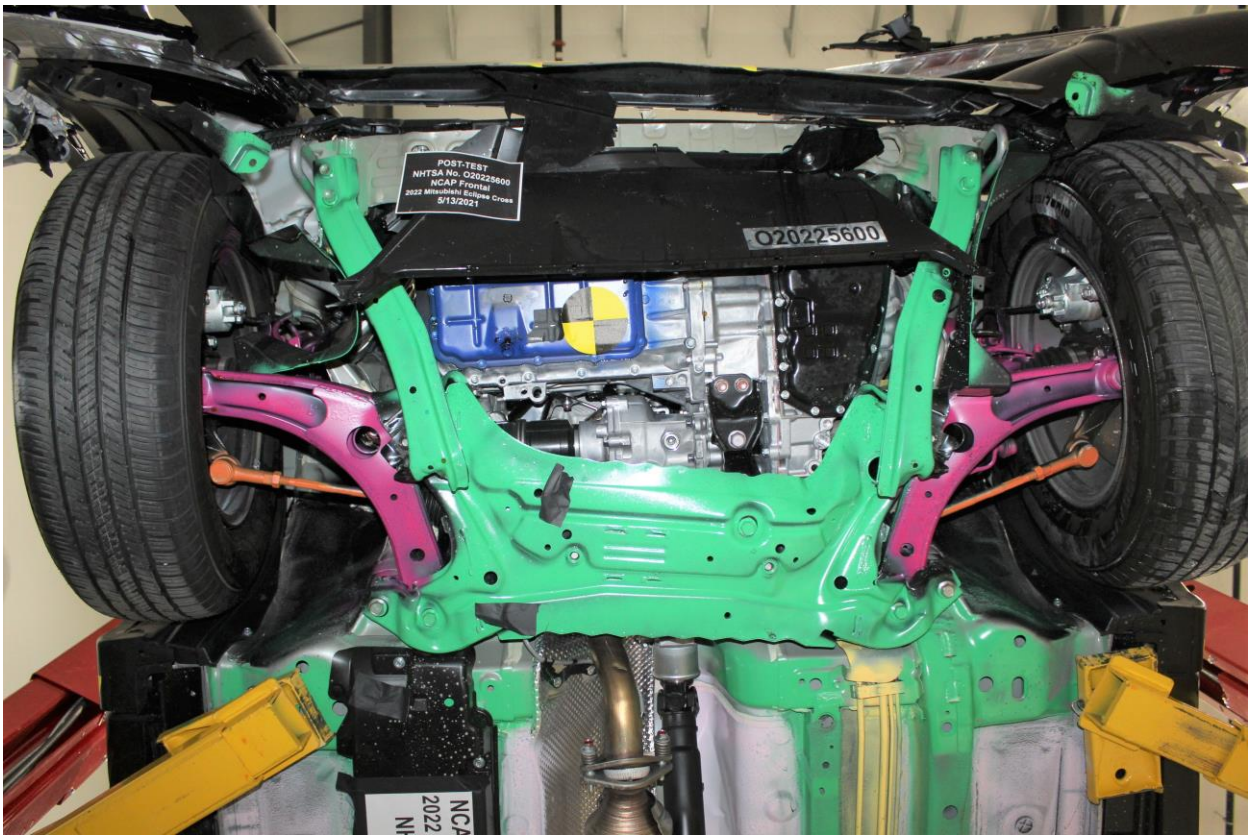



**Figure A-25: Post-Test Front Underbody View**

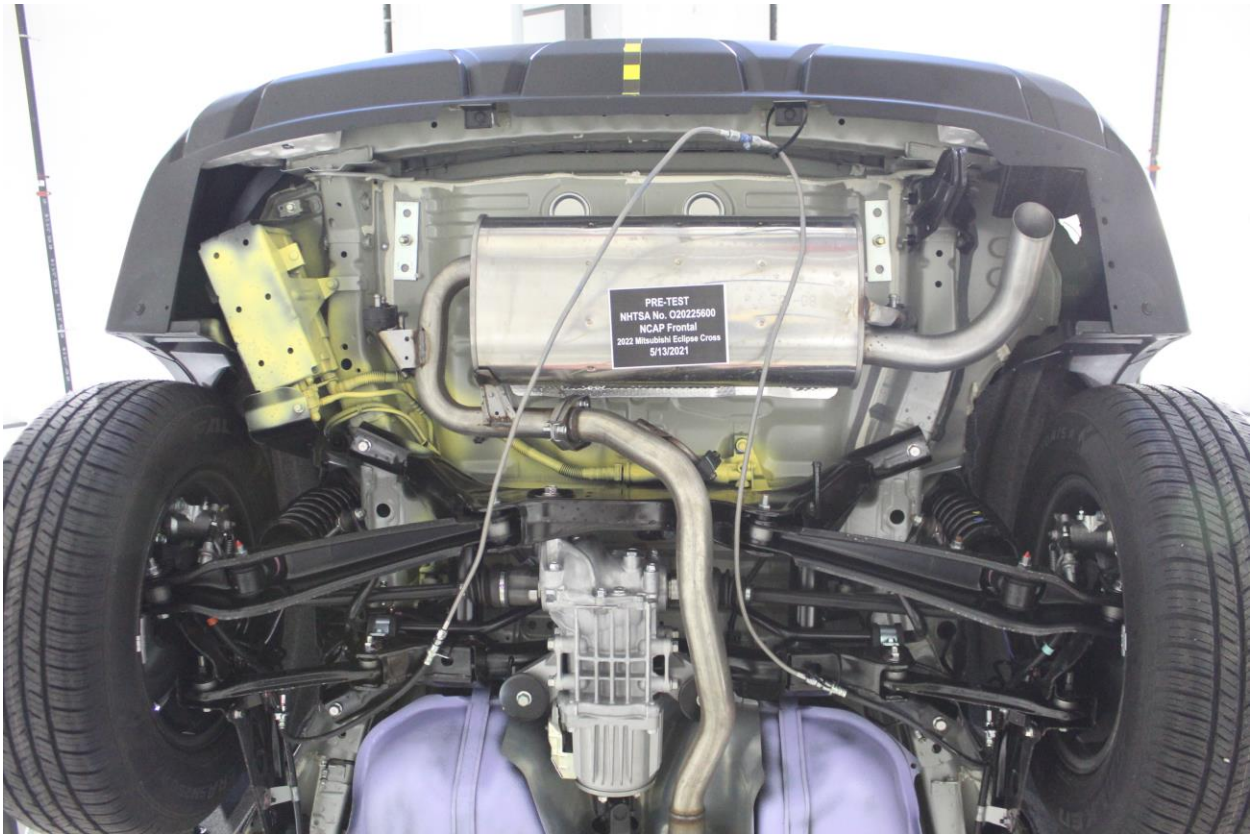



**Figure A-26: Pre-Test Rear Underbody View**

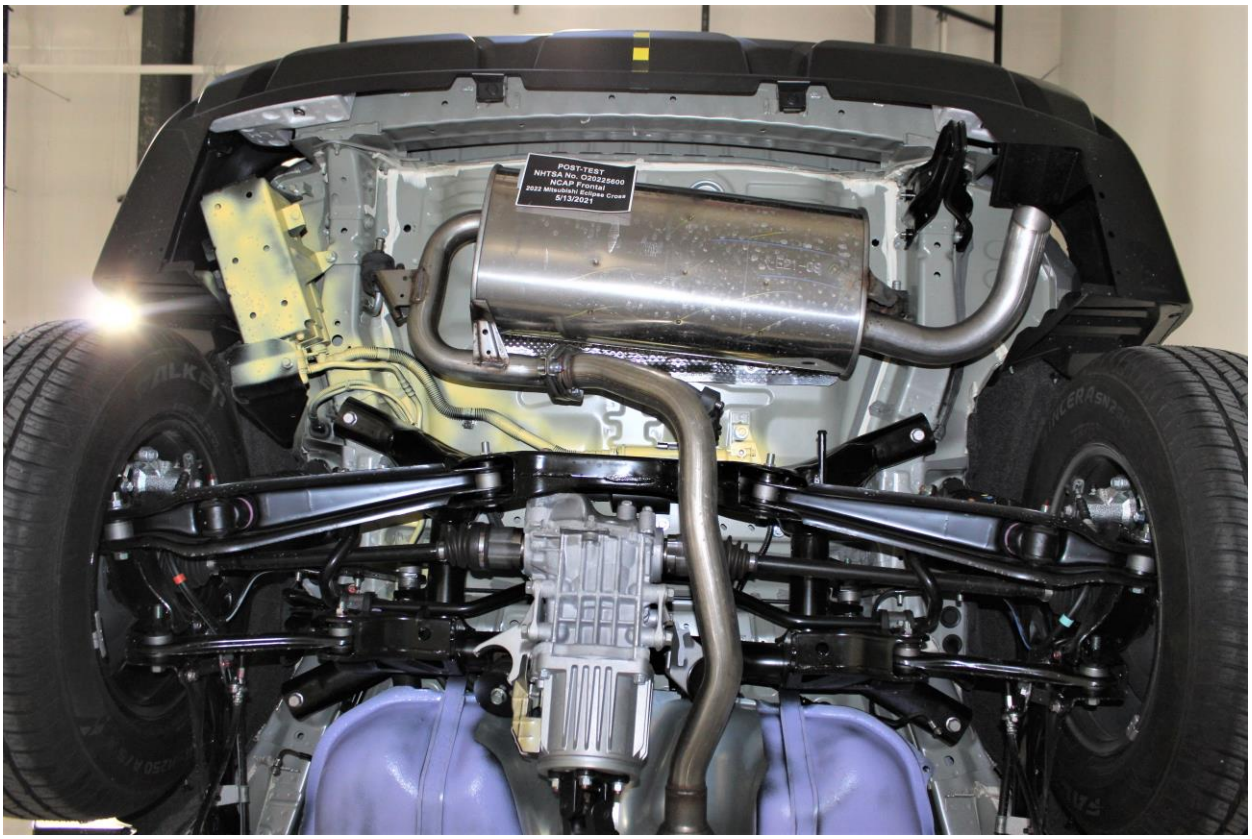



**Figure A-27: Post-Test Rear Underbody View**


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


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

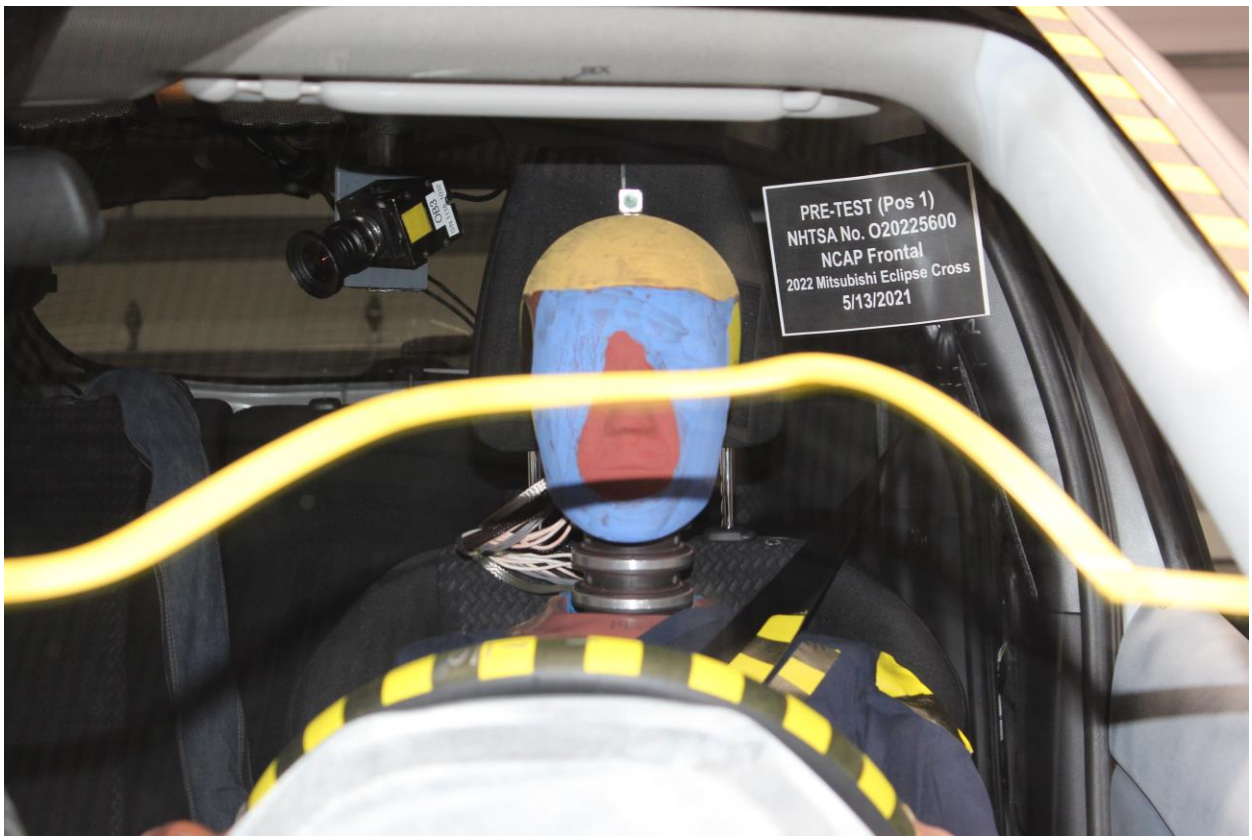



**Figure A-30: Pre-Test Driver Dummy Front View**


**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**

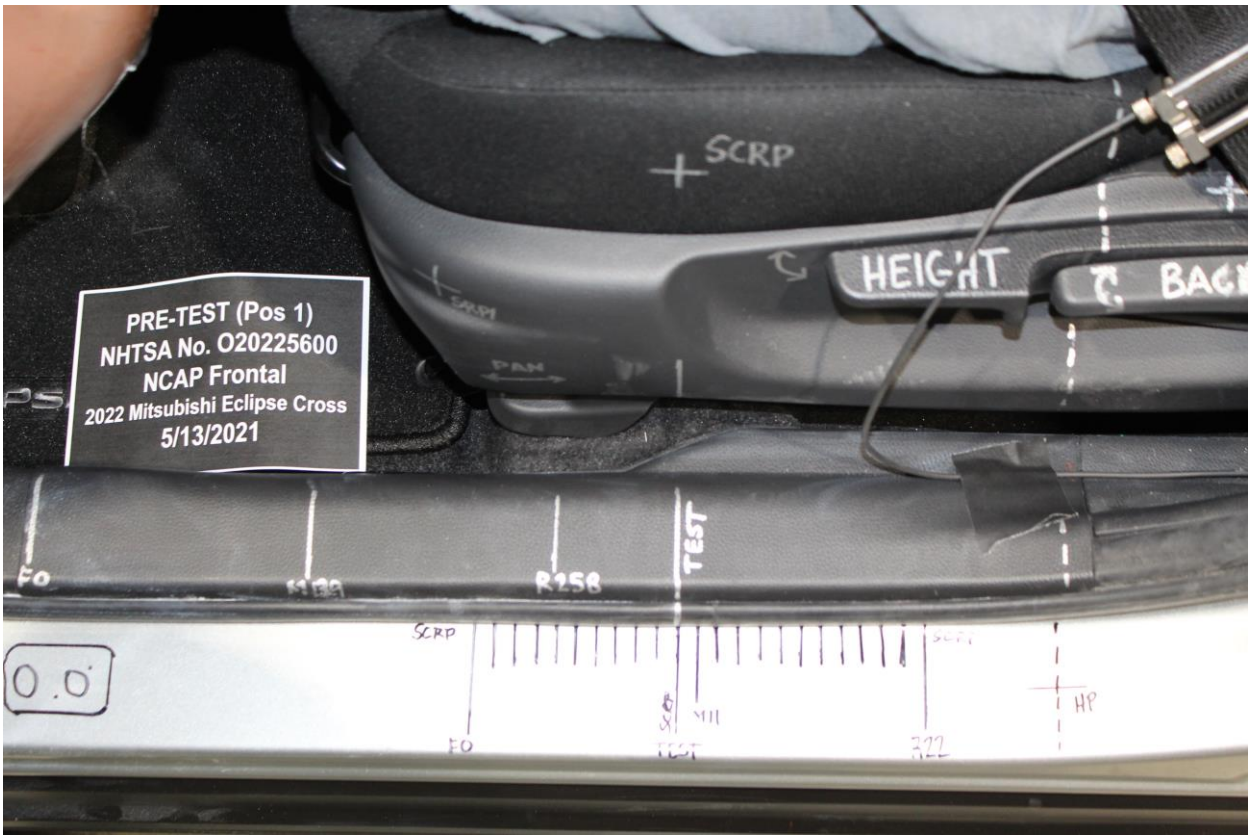



**Figure A-36: Pre-Test Driver's Seat Fore-Aft Markings**


**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**

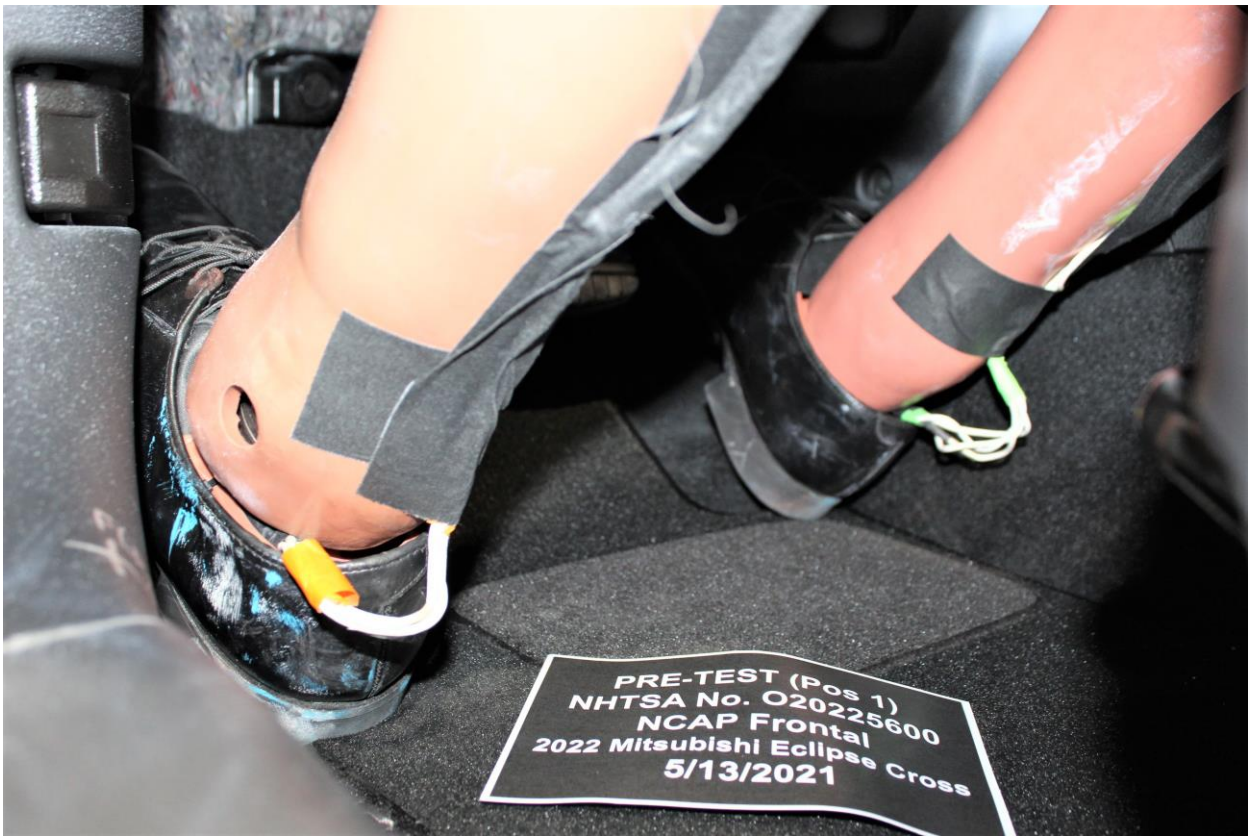



**Figure A-42: Pre-Test Driver Dummy Feet**


**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**

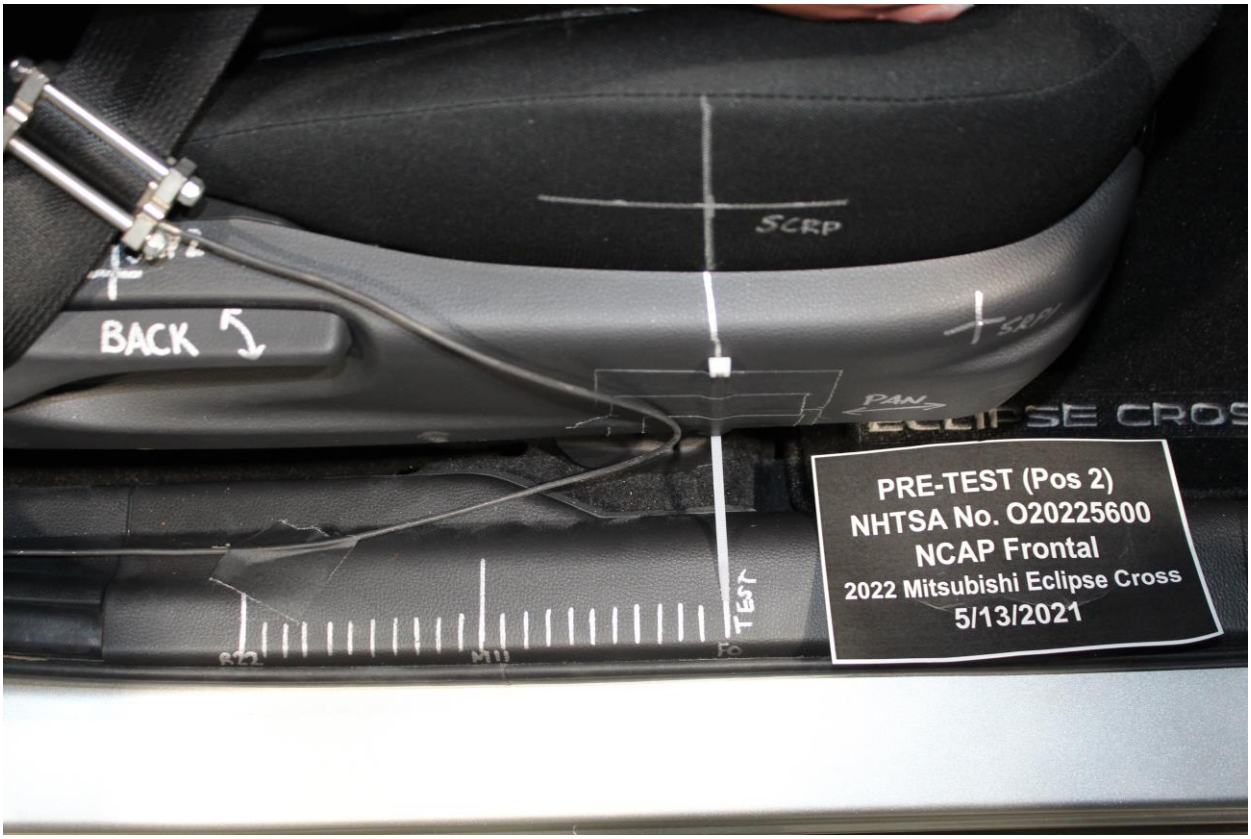



**Figure A-59: Pre-Test Passenger's Seat Fore-Aft Markings**


**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**

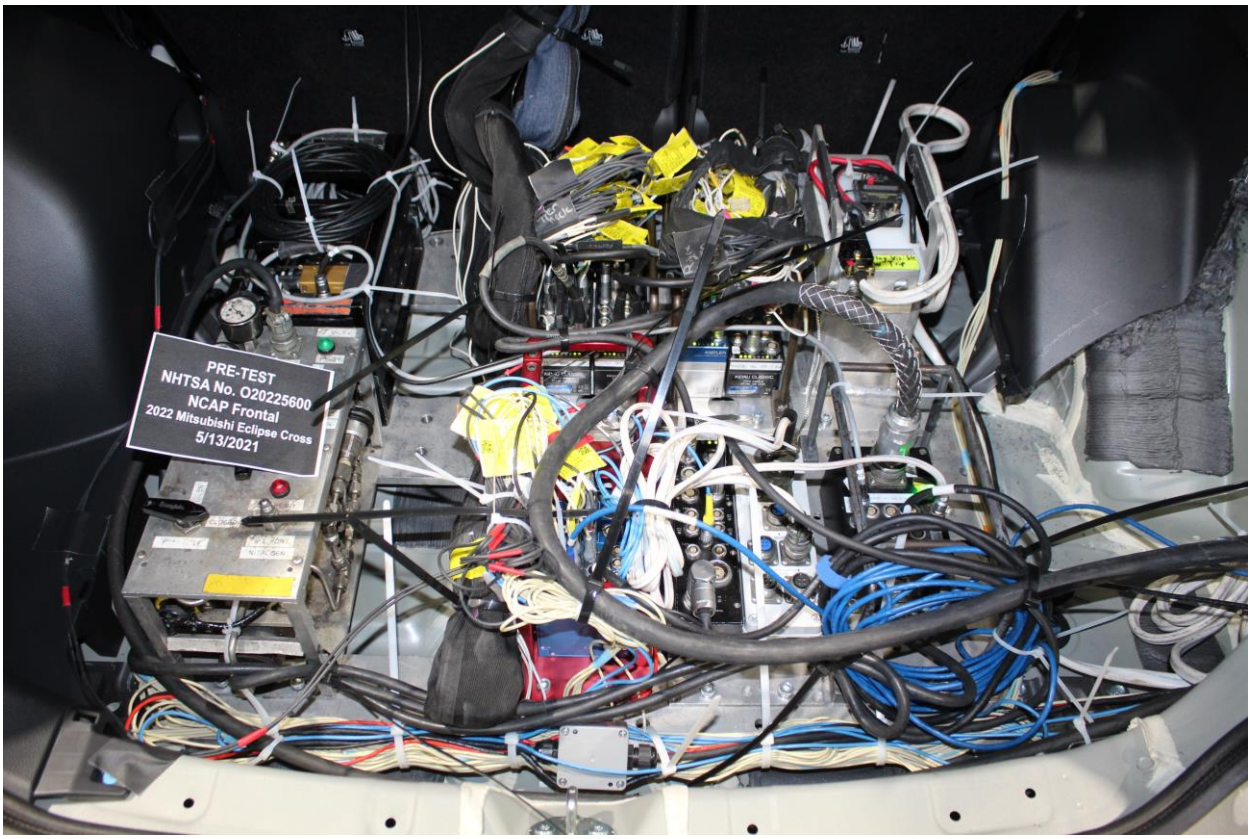



**Figure A-74: Photograph of Ballast Installed in Vehicle**

# 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 0º on Static Rollover Device**

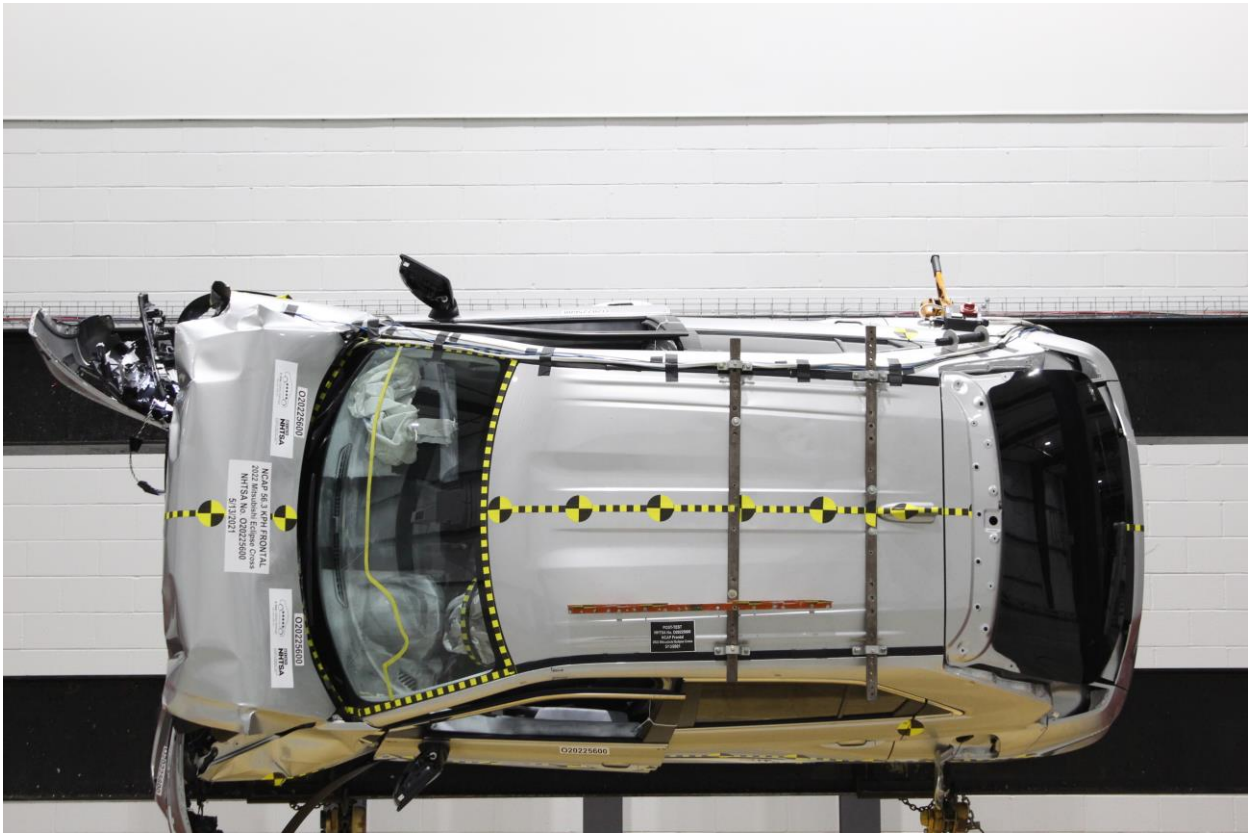



**Figure A-78: Vehicle at 90º on Static Rollover Device**

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

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


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


**Figure A-82: 2022 Mitsubishi Eclipse Cross Frontal Impact Event**

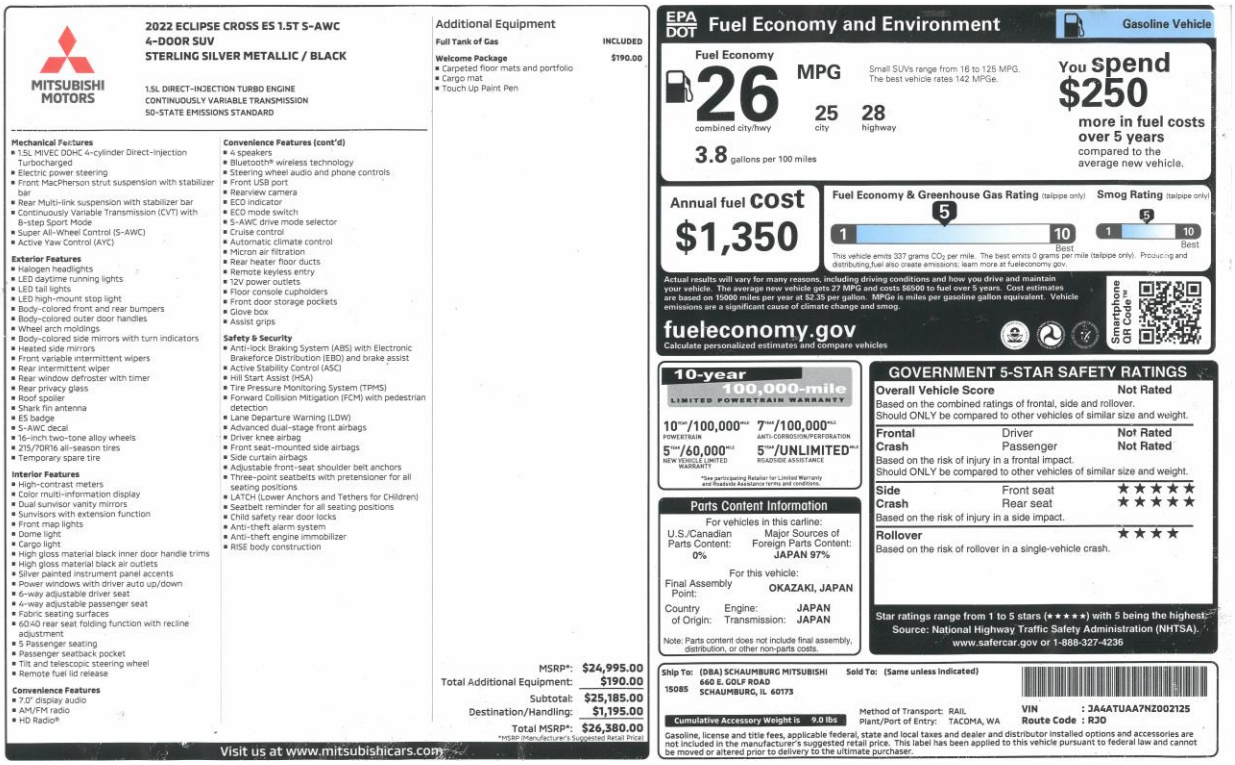



**Figure A-83: Monroney Label Photograph**

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

**Table of Data Plots**



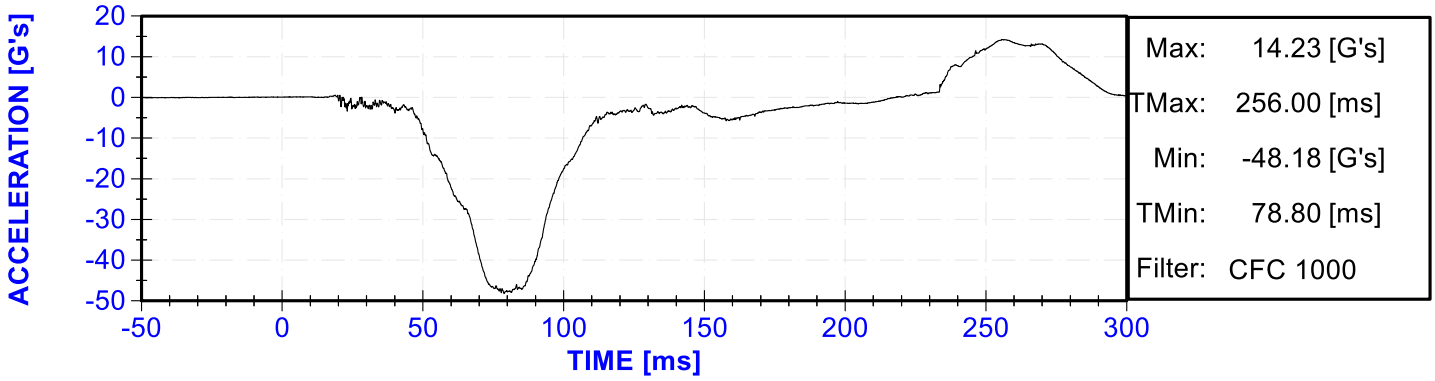
**The following additional dummy and vehicle response data can be found in the R&D section of the NHTSA website at www.NHTSA.gov**

Driver Head X Acceleration Redundant
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

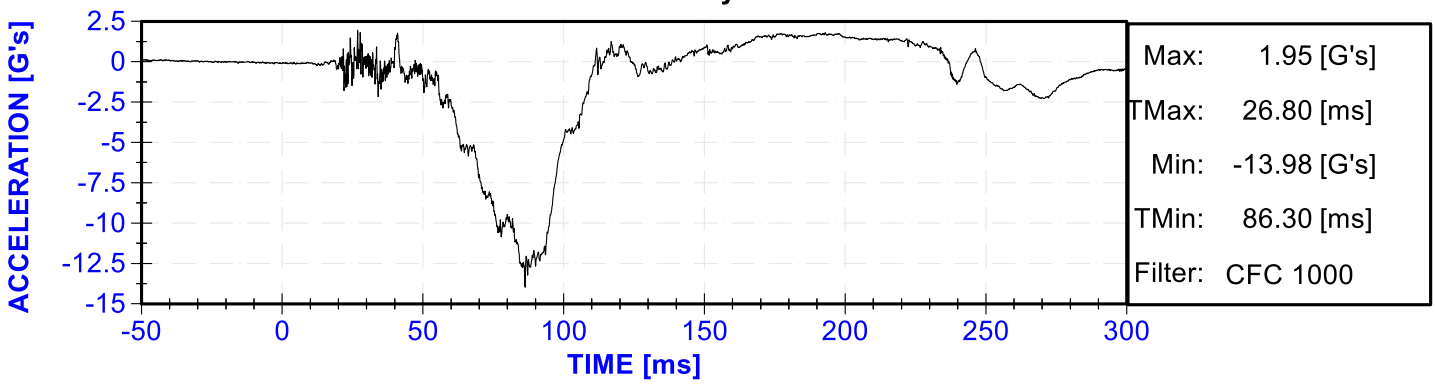
Driver Left Upper Tibia Force Z
Driver Left Lower Tibia Moment X
Driver Left Lower Tibia Moment Y
Driver Left Lower Tibia Force Z
Driver Right Upper Tibia Moment X
Driver Right Upper Tibia Moment Y
Driver Right Upper Tibia Force Z
Driver Right Lower Tibia Moment X
Driver Right Lower Tibia Moment Y
Driver 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

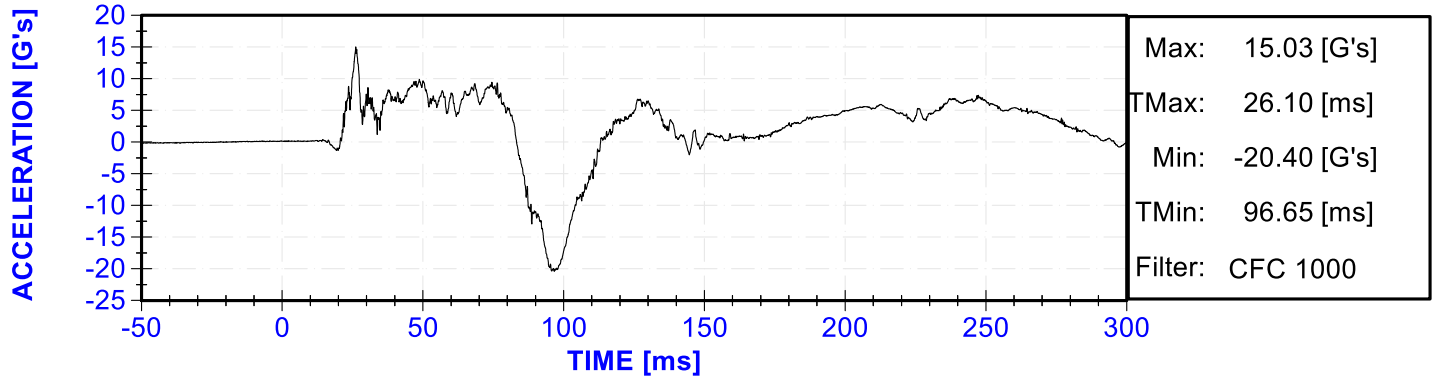
### Driver Head X Acceleration vs. Time Primary



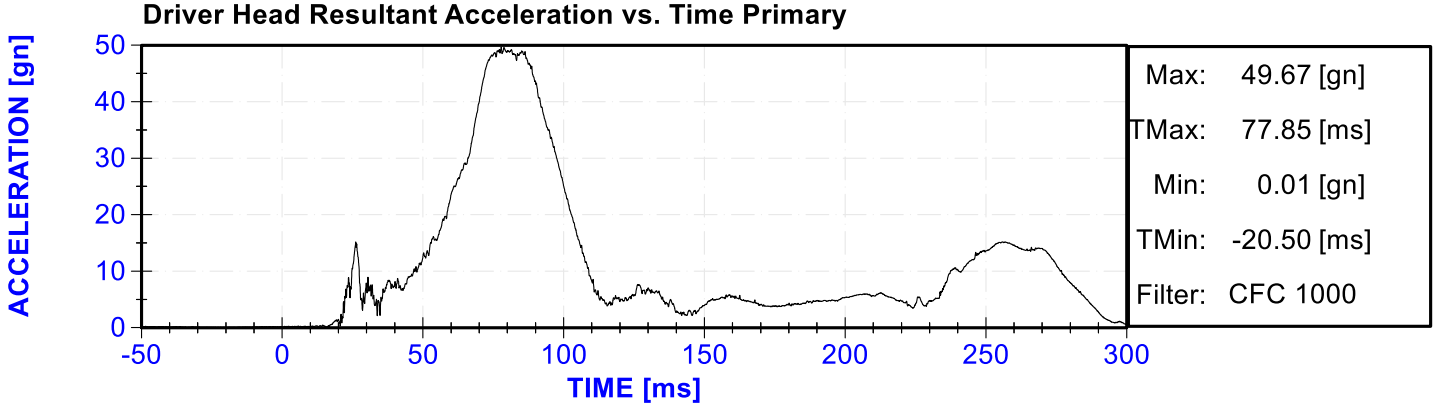

### Driver Head Y Acceleration vs. Time Primary



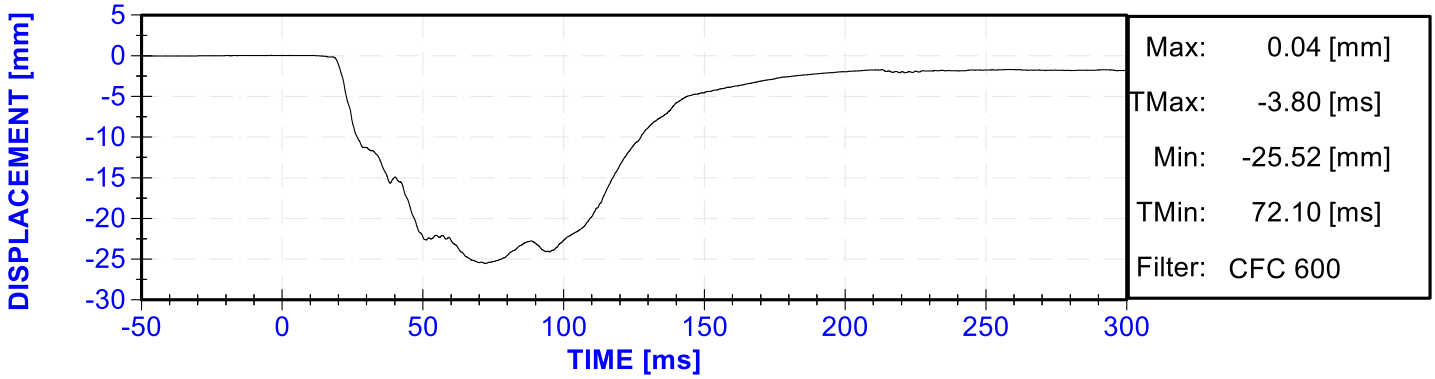

### Driver Head Z Acceleration vs. Time Primary



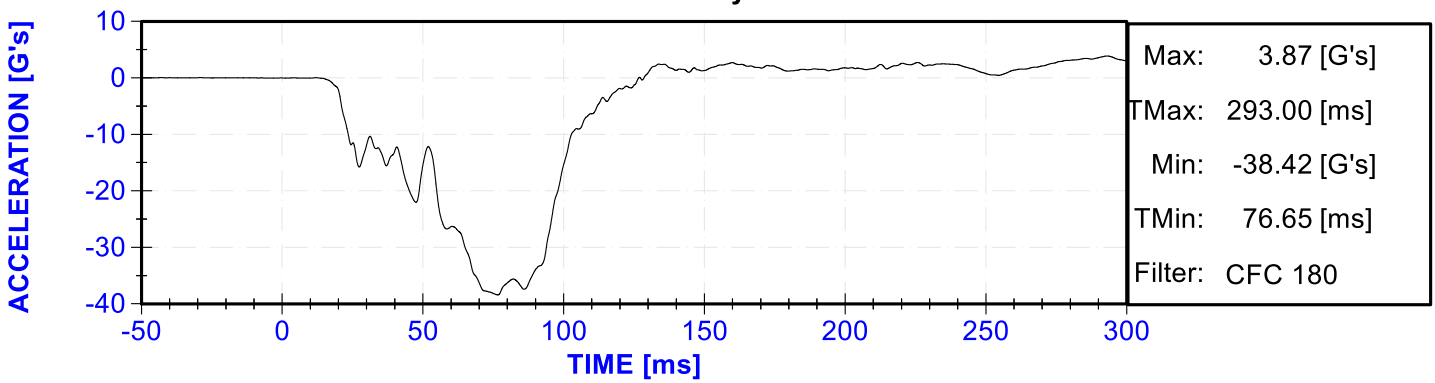

### Driver Head Resultant Acceleration vs. Time Primary



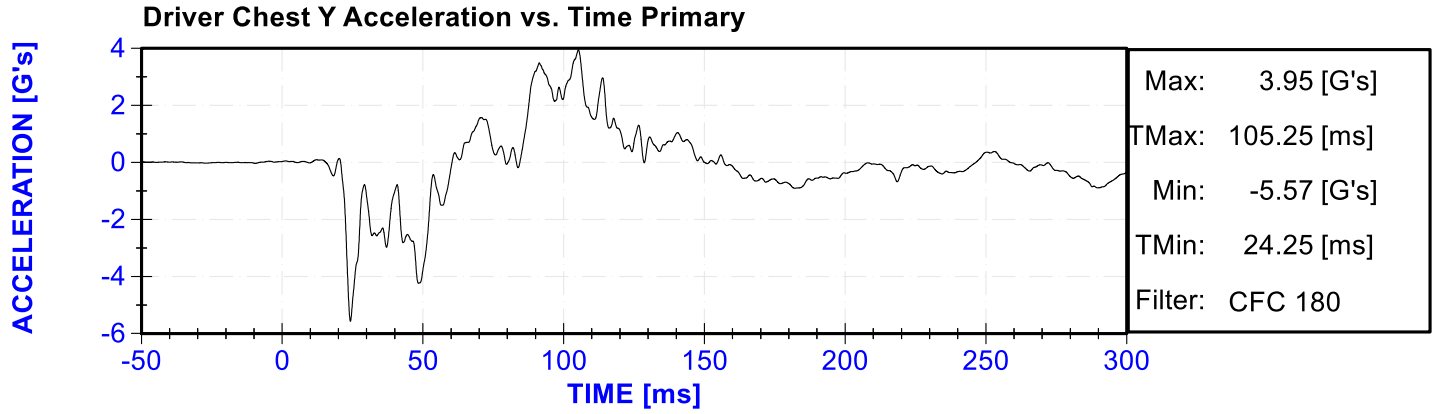
Driver Chest X Deflection vs. Time



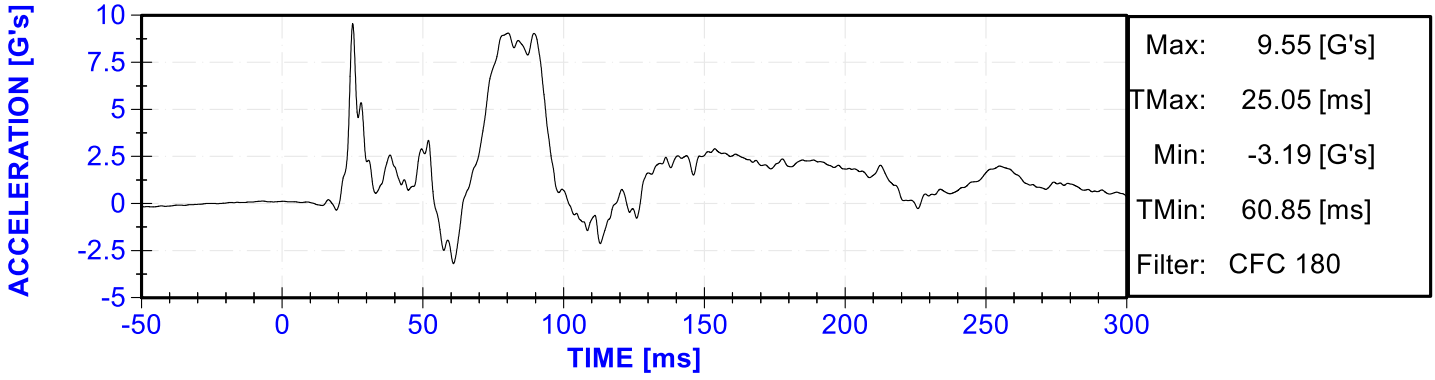

Driver Chest X Acceleration vs. Time Primary



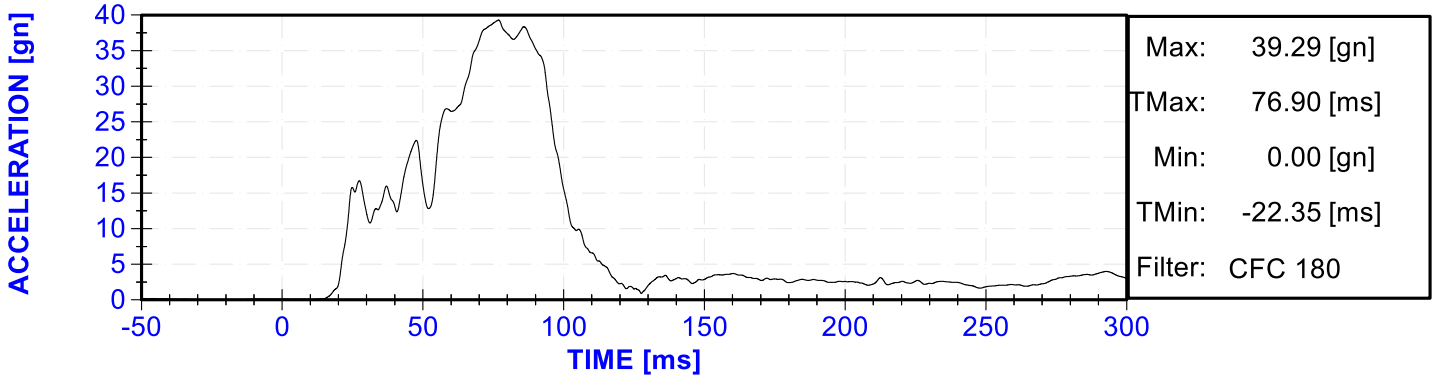

Driver Chest Y Acceleration vs. Time Primary



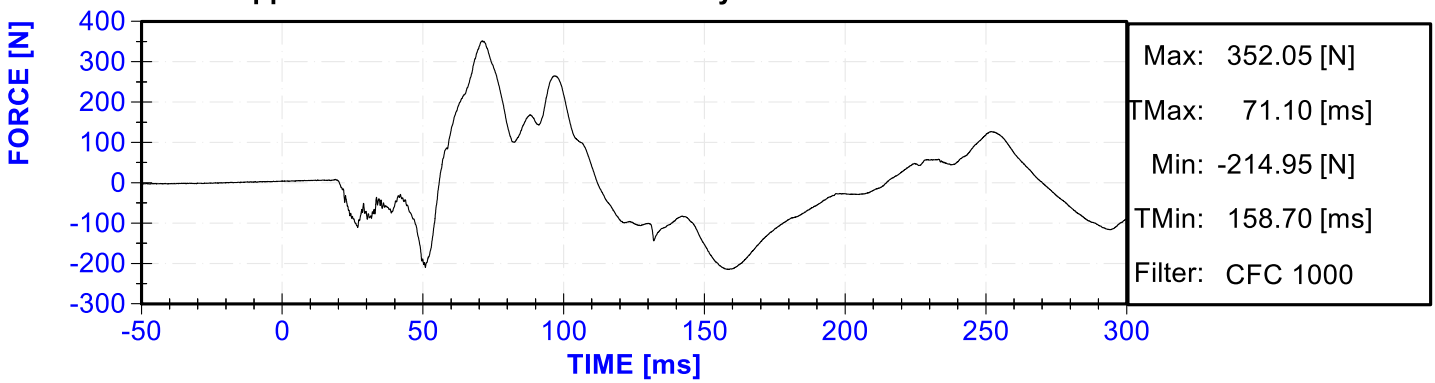

Driver Chest Z Acceleration vs. Time Primary



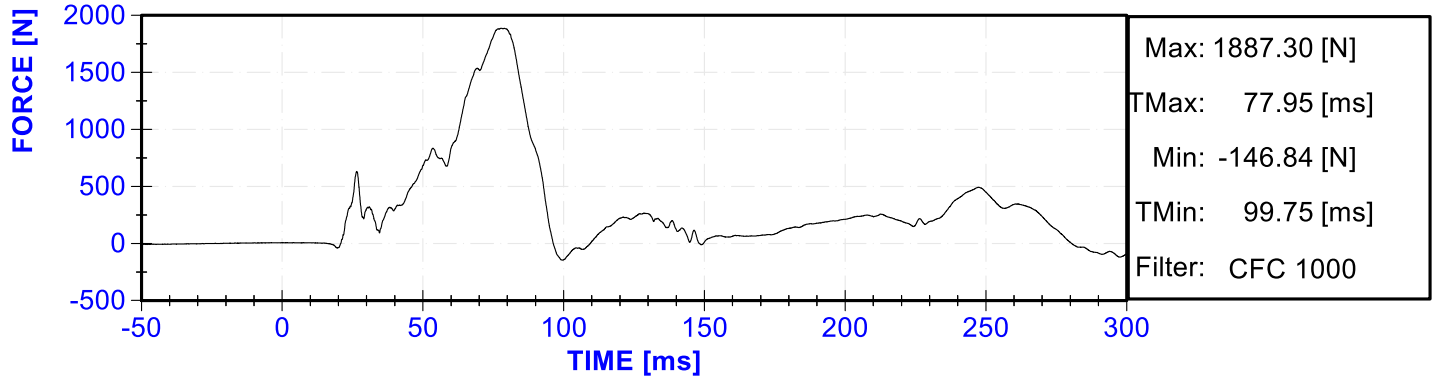
## Driver Chest Resultant Acceleration vs. Time Primary



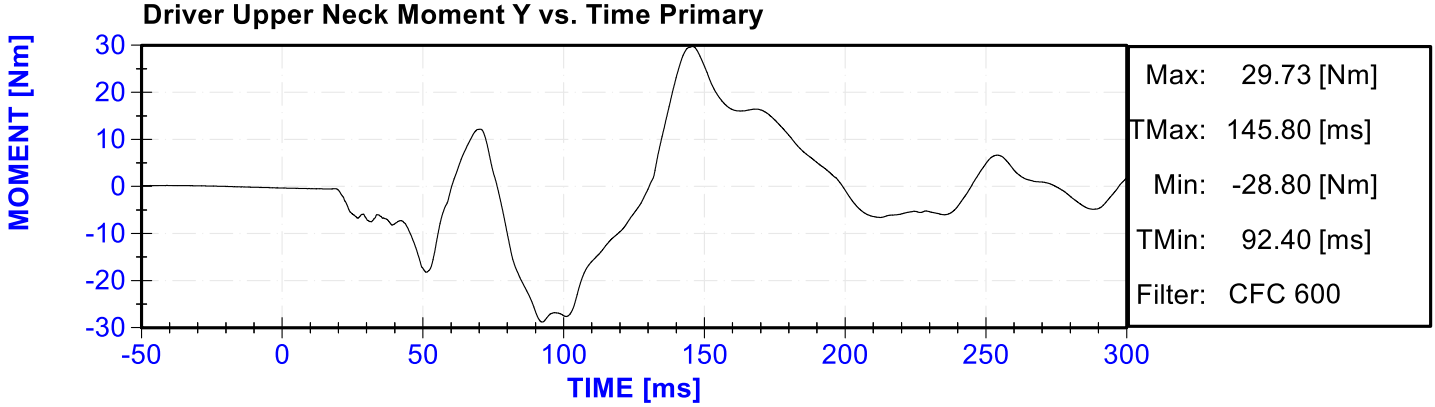

## Driver Upper Neck Force X vs. Time Primary



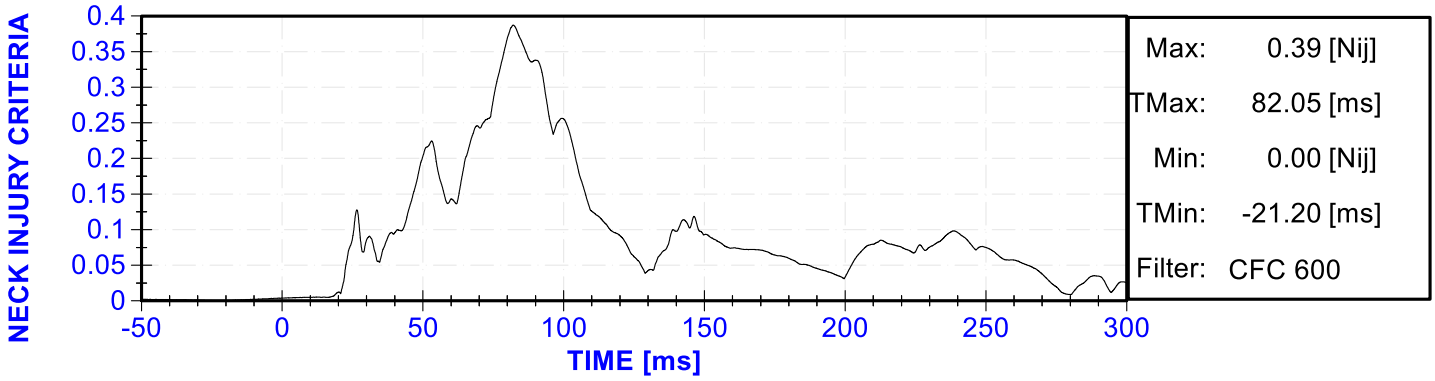

## Driver Upper Neck Force Z vs. Time Primary



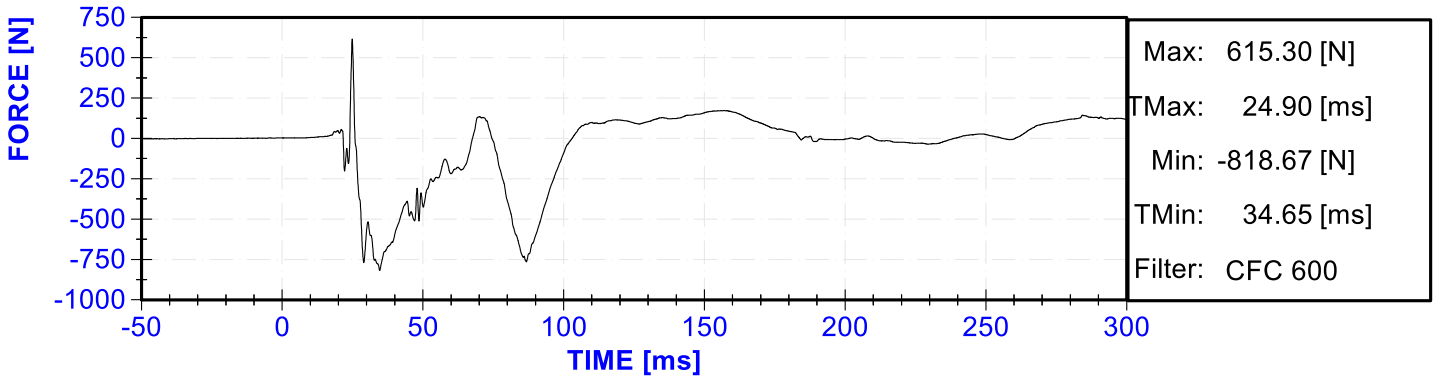

## Driver Upper Neck Moment Y vs. Time Primary



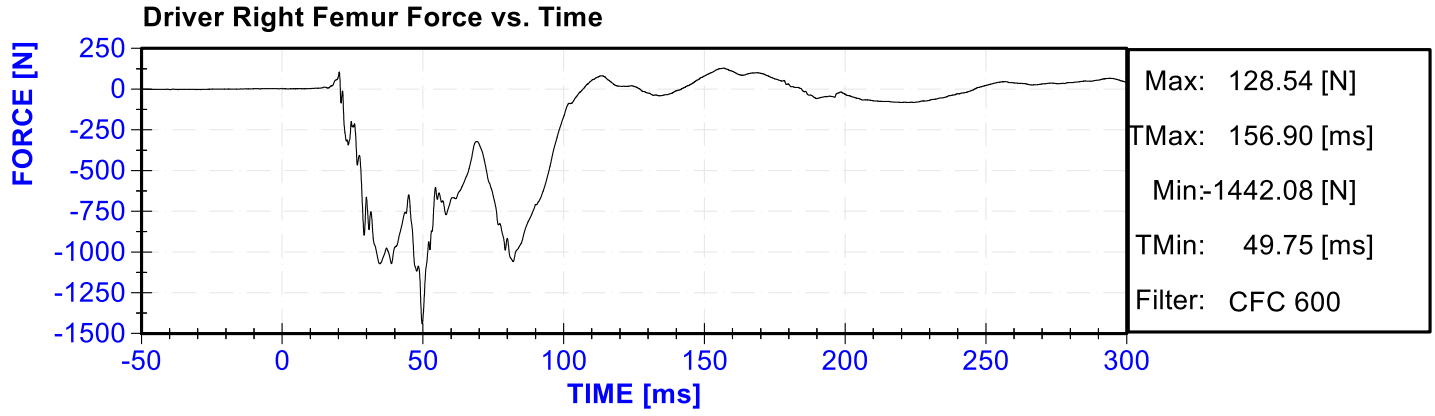
### Driver Nij vs. Time Primary



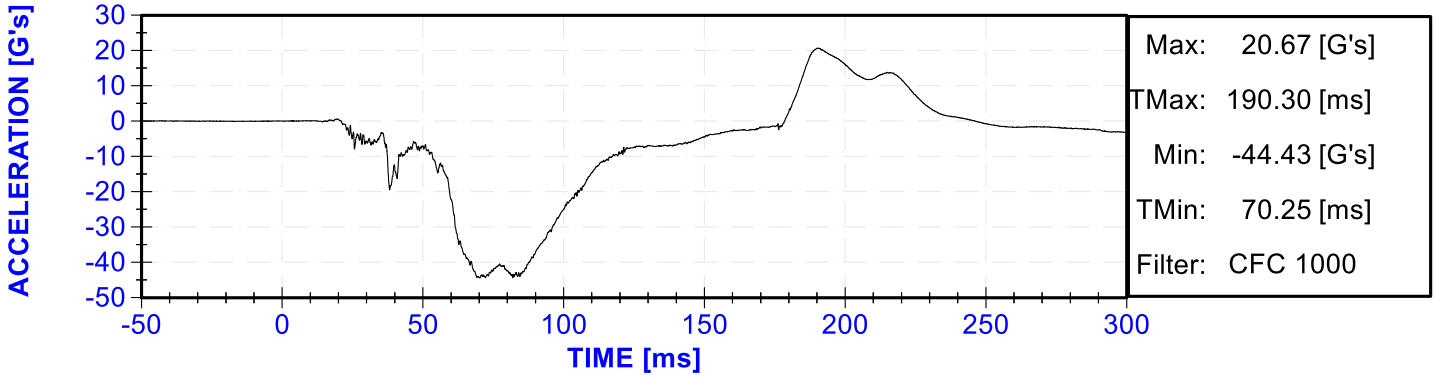

### Driver Left Femur Force vs. Time



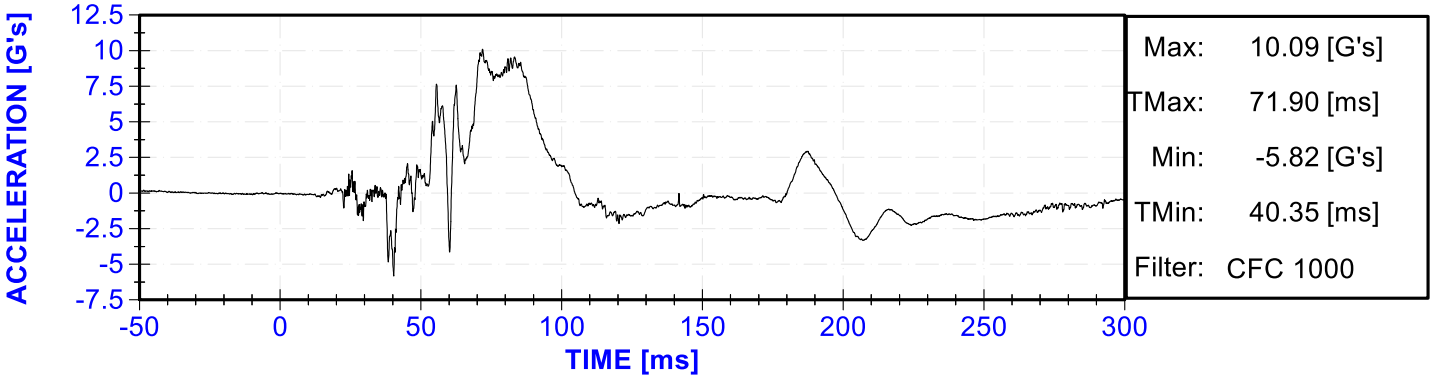

### Driver Right Femur Force vs. Time



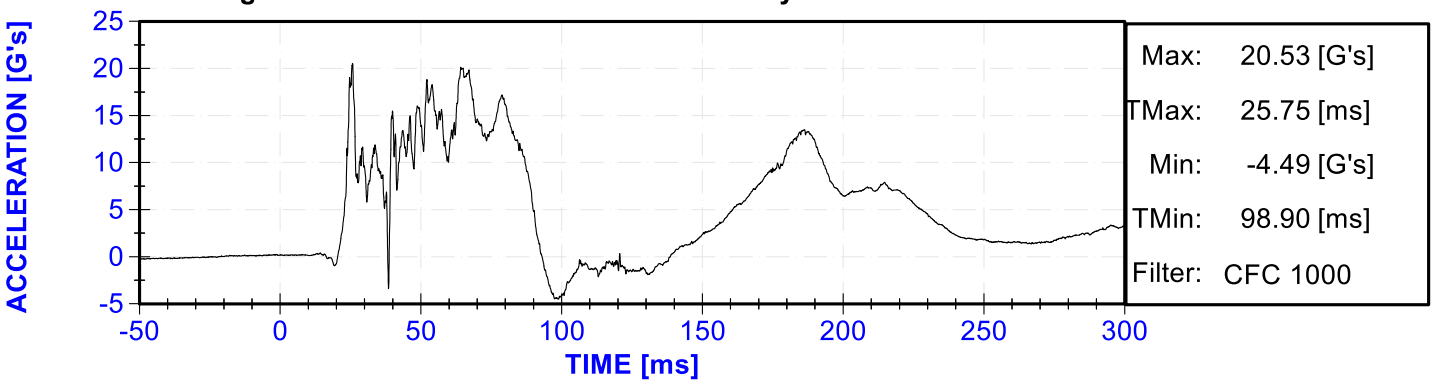

### Passenger Head X Acceleration vs. Time Primary



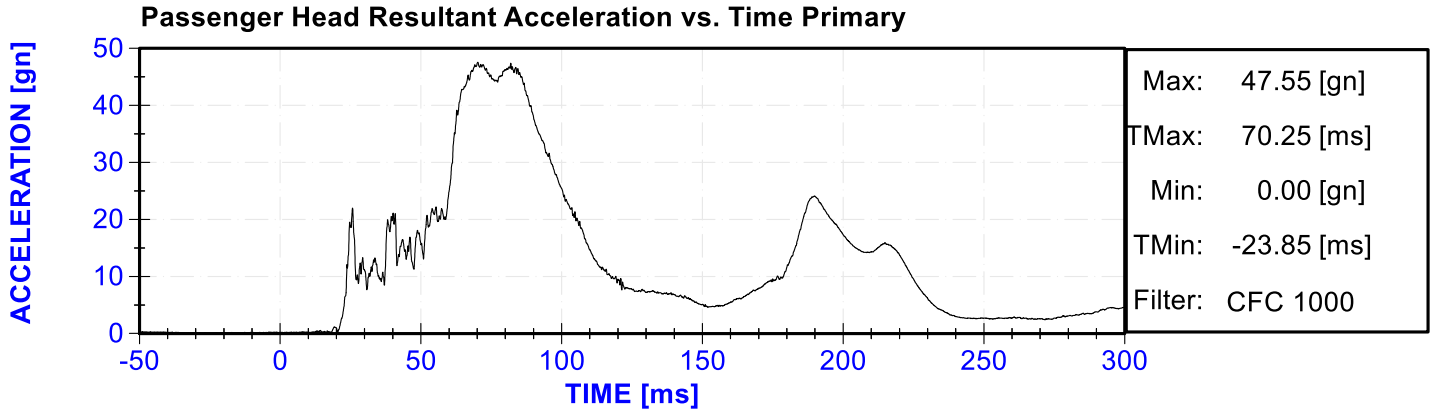
### Passenger Head Y Acceleration vs. Time Primary



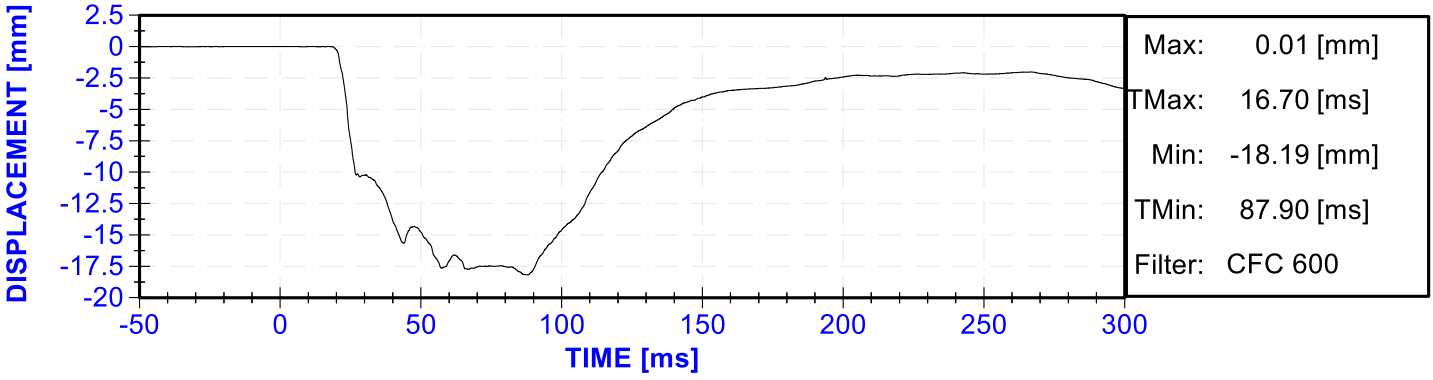

### Passenger Head Z Acceleration vs. Time Primary



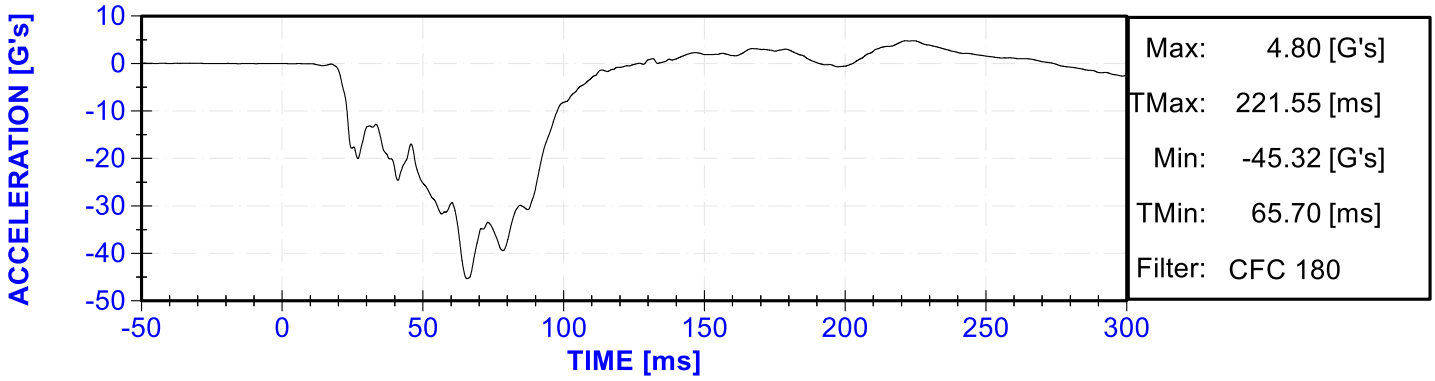

### Passenger Head Resultant Acceleration vs. Time Primary



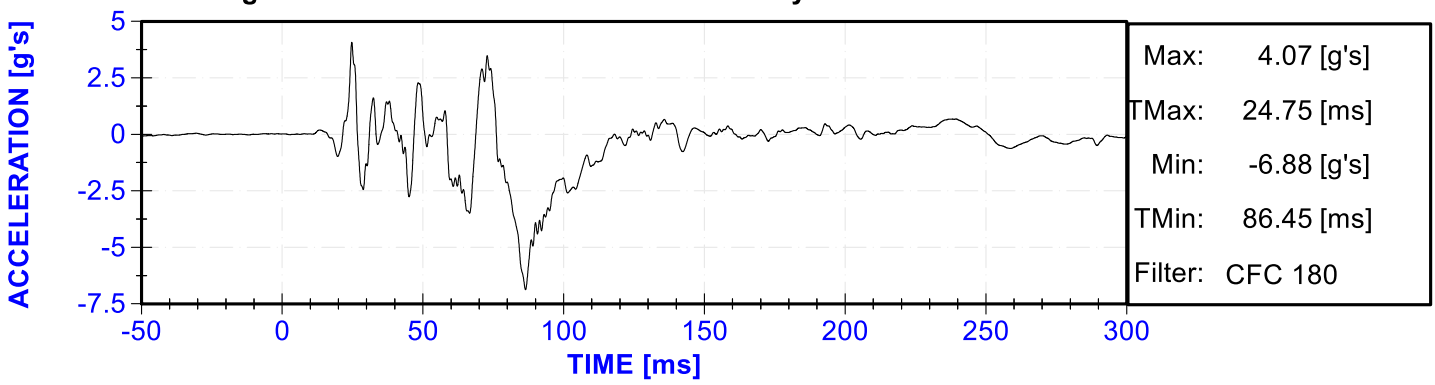

### Passenger Chest X Deflection vs. Time



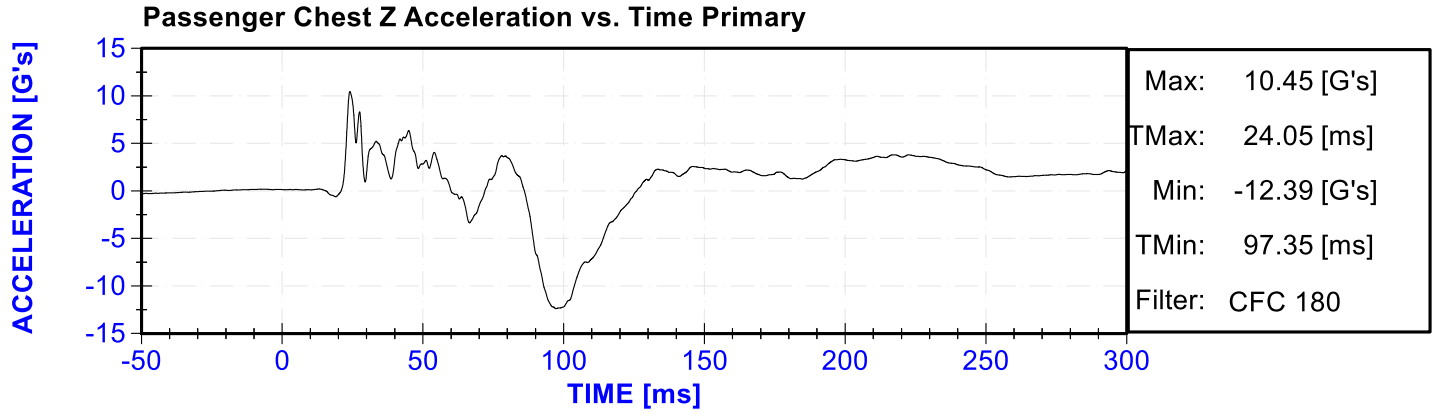
### Passenger Chest X Acceleration vs. Time Primary



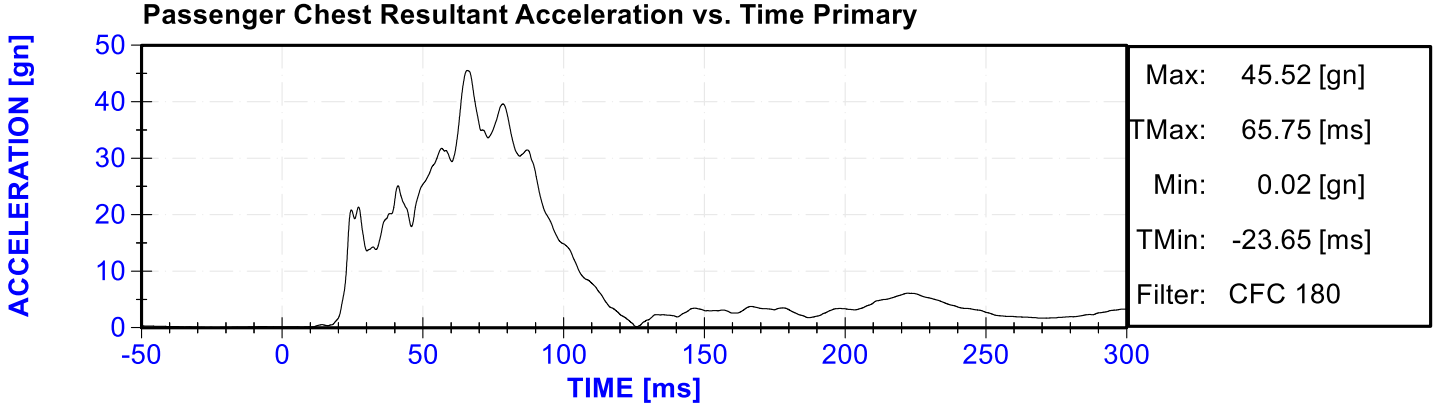

### Passenger Chest Y Acceleration vs. Time Primary



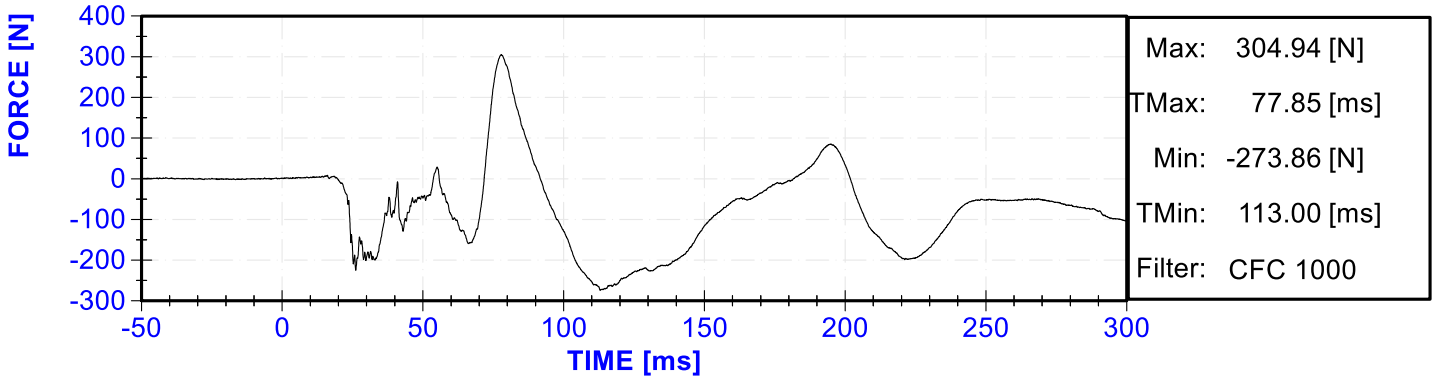

### Passenger Chest Z Acceleration vs. Time Primary



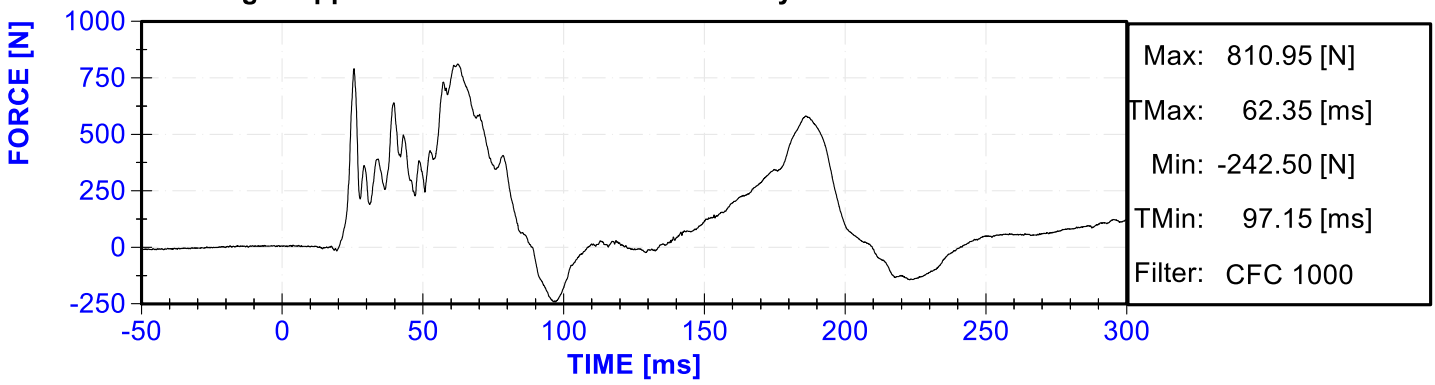

### Passenger Chest Resultant Acceleration vs. Time Primary



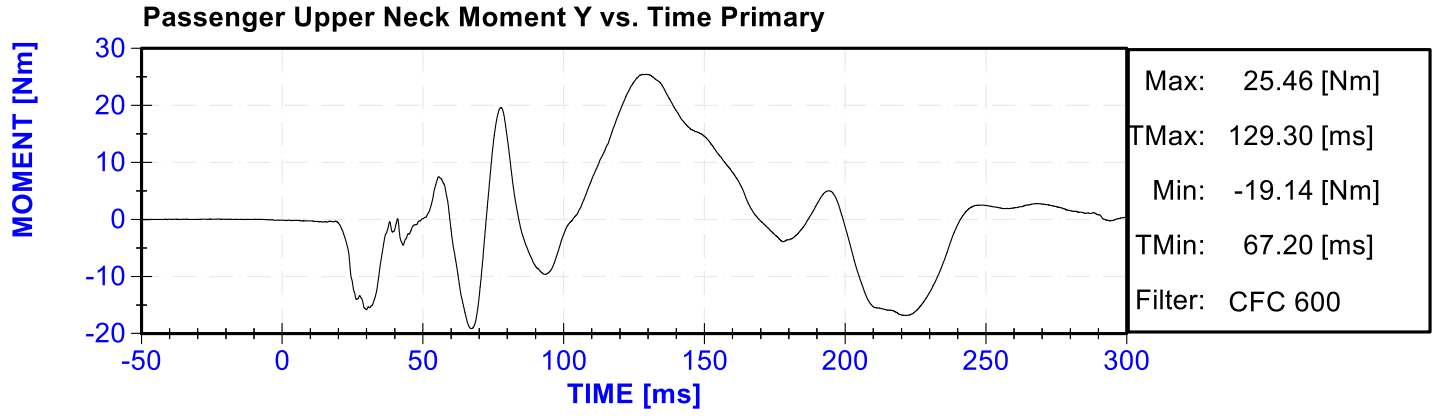
### Passenger Upper Neck Force X vs. Time Primary



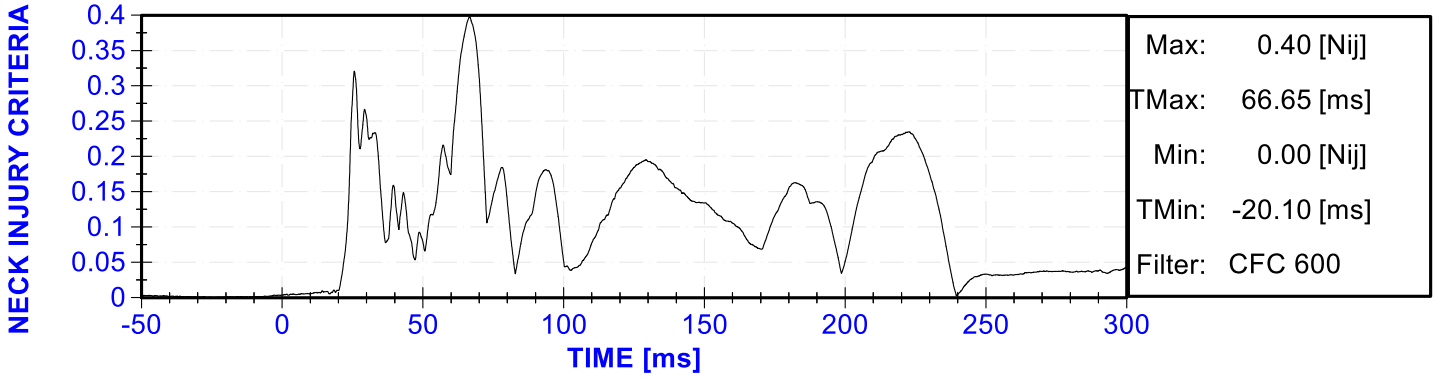

### Passenger Upper Neck Force Z vs. Time Primary

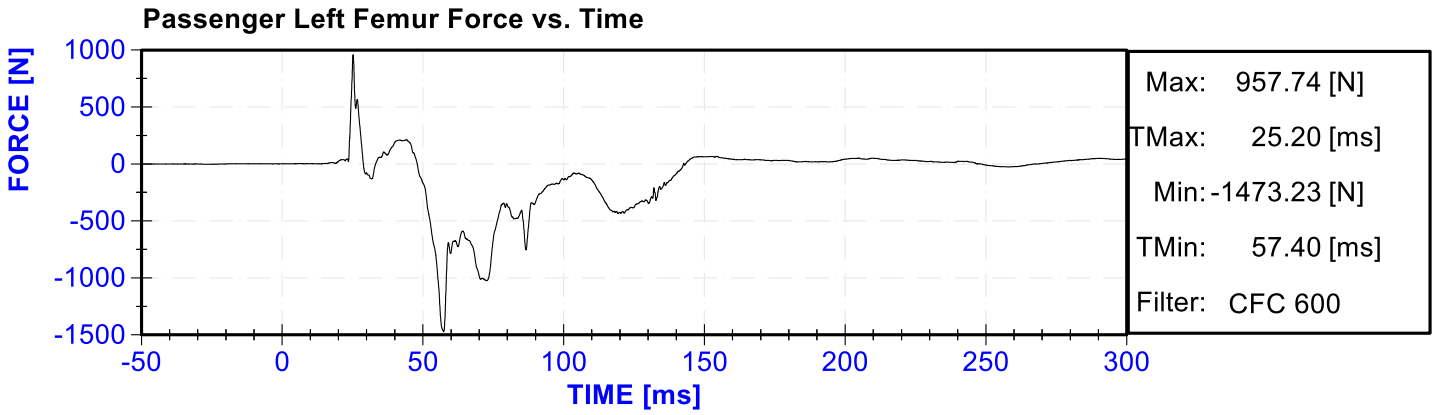


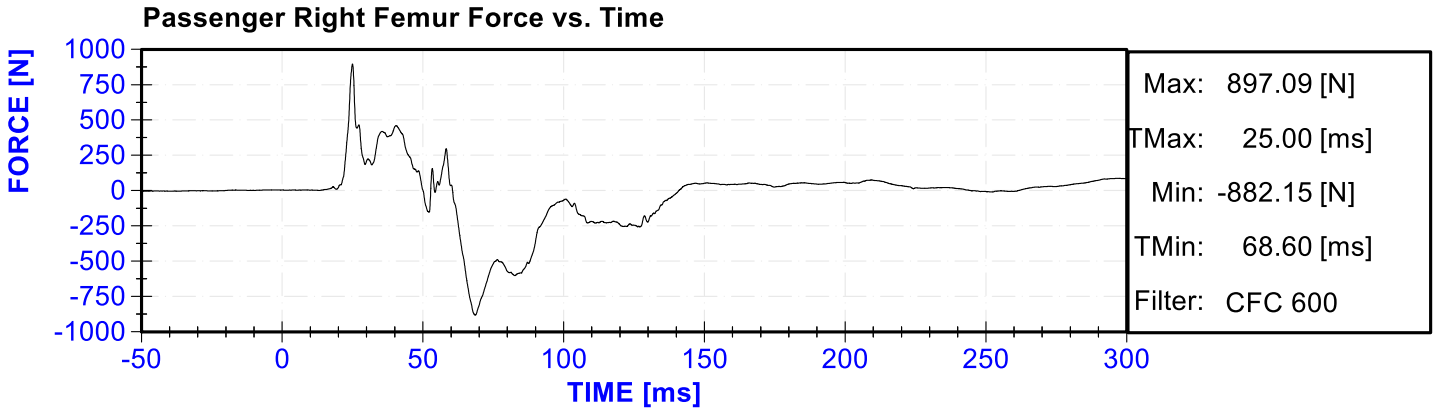

### Passenger Upper Neck Moment Y vs. Time Primary




### Passenger Nij vs. Time Primary




Passenger Left Femur Force vs. Time
FORCE [N]
1000
500
0
-500
-1000
-1500
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 957.74 [N]
TMax: 25.20 [ms]
Min: -1473.23 [N]
TMin: 57.40 [ms]
Filter: CFC 600


Passenger Right Femur Force vs. Time
FORCE [N]
1000
750
500
250
0
-250
-500
-750
-1000
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 897.09 [N]
TMax: 25.00 [ms]
Min: -882.15 [N]
TMin: 68.60 [ms]
Filter: CFC 600

# APPENDIX C

# DUMMY CALIBRATION AND PERFORMANCE VERIFICATION DATA

**CALIBRATION TEST RESULTS**

**PRE-TEST**

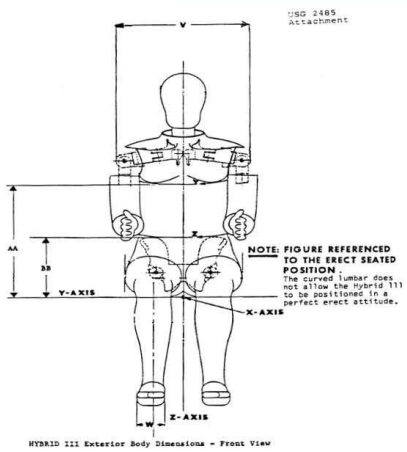
**HYBRID III 50$^{TH}$ PERCENTILE MALE - DRIVER ATD**

**SERIAL NO: 142**

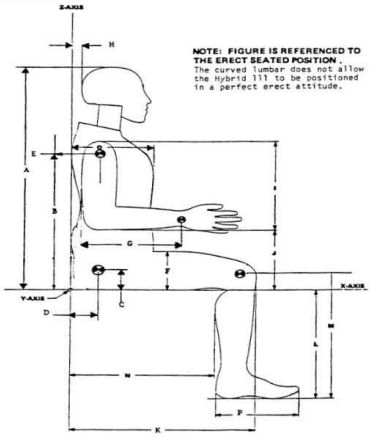
External Measurements - Hybrid 3 - 50th Male

Technician: K. Brogan  Date: 04/30/2021

Dummy Serial Number: 142



HYBRID III Exterior Body Dimensions - Front View



HYBRID III Exterior Body Dimensions - Side View

| Symbol | Description | Specification (in) | | Result (in) | Pass/Fail |
|---|---|---|---|---|---|
| A | Sitting Height | 34.6 | 35.0 | 34.7 | Pass |
| B | Shoulder Pivot Height | 19.9 | 20.5 | 20.3 | 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 | 5.9 | 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 | 23.0 | 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 | 8.6 | 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 | 38.8 | 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 |

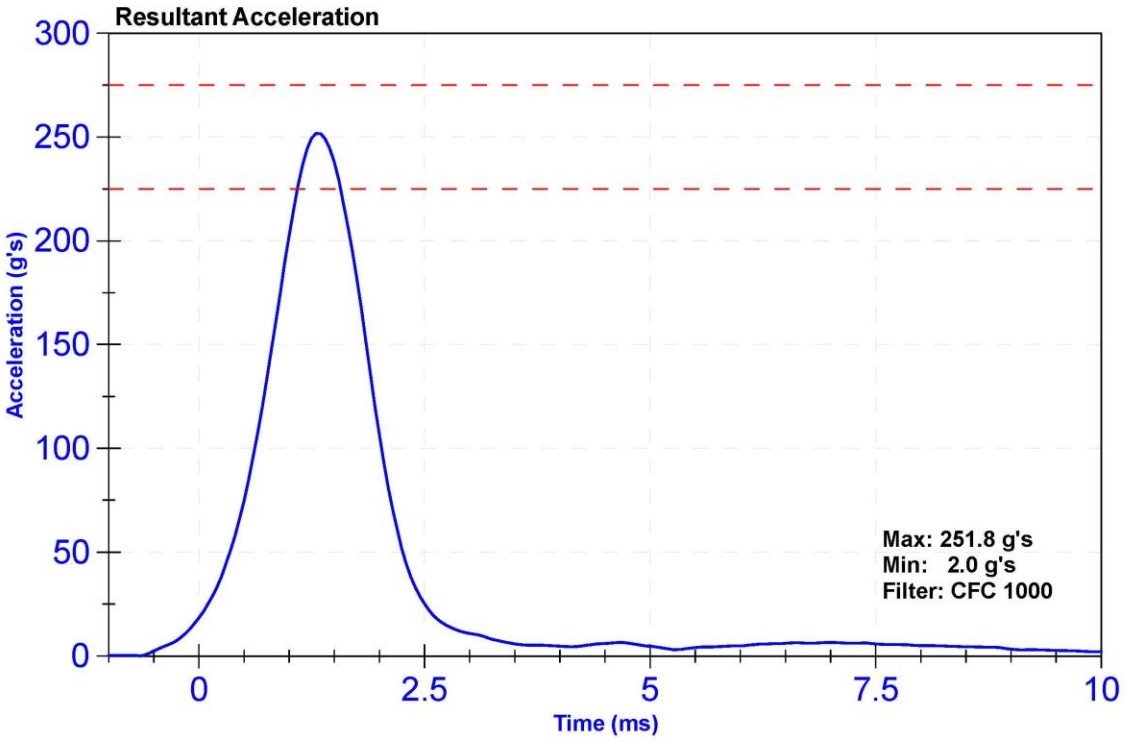
| | | | |
|---|---|---|---|
| ATD Manufacturer | Humanetics | Test Technician | E. Helenbrook |
| ATD Serial Number | 142 | Laboratory Supervisor | K. Brogan |

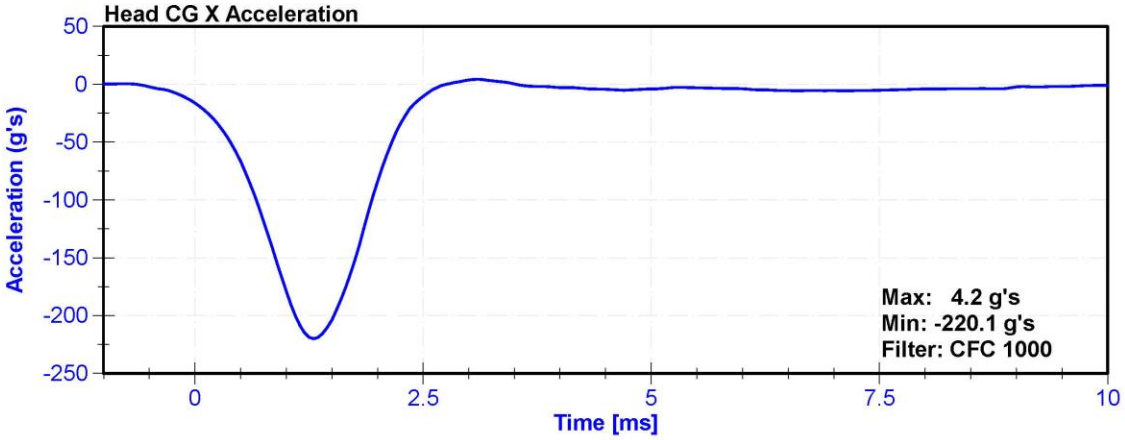
**Results**

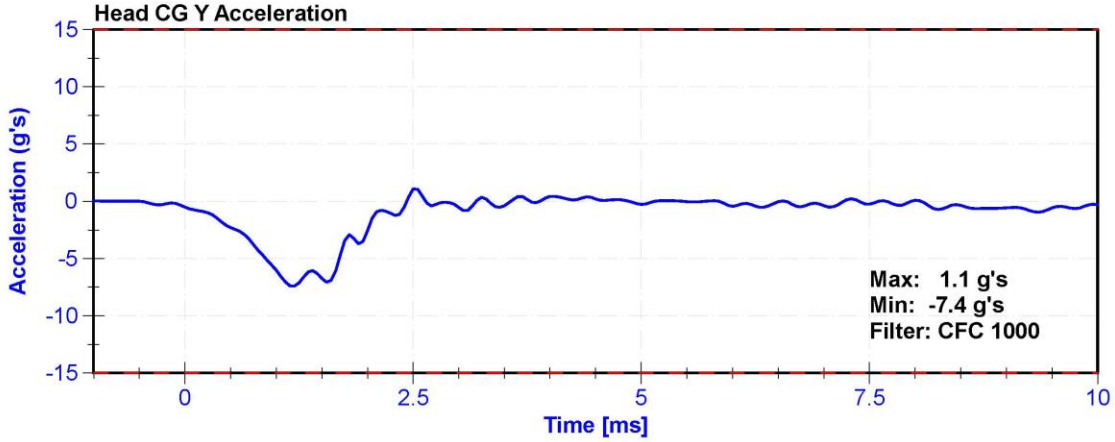
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 18.9 | 25.6 | ºC | 21.5 | Pass |
| Humidity | 10 | 70 | % | 39.5 | Pass |
| Resultant Acceleration | 225 | 275 | g's | 251.8 | Pass |
| Oscillation | 0 | 10 | % | 2.6 | Pass |
| Lateral Acceleration | -15 | 15 | g's | -7.4 | Pass |

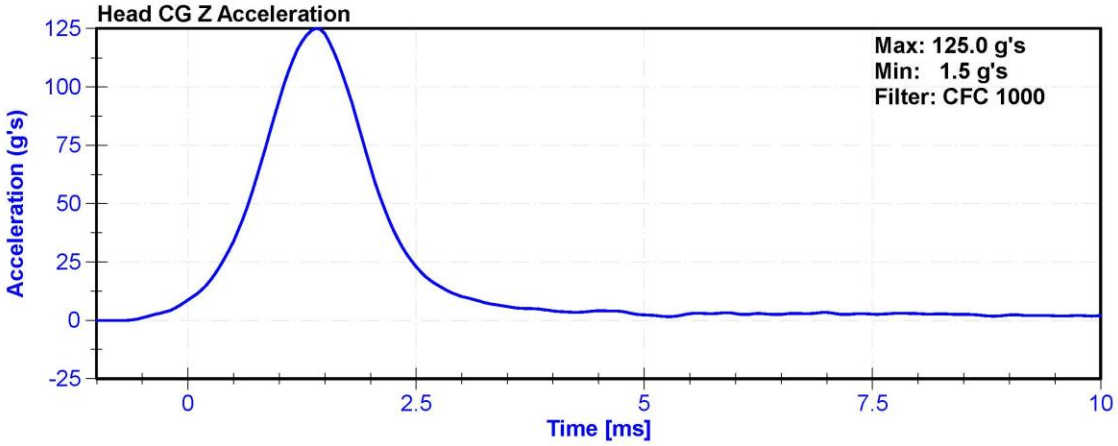
**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| X Accelerometer | ENDEVCO 7264 | P51681 | 11/3/2020 | 5/4/2021 |
| Y Accelerometer | ENDEVCO 7264 | P64151 | 11/3/2020 | 5/4/2021 |
| Z Accelerometer | ENDEVCO 7264 | P52114 | 11/3/2020 | 5/4/2021 |




Head CG X Acceleration
Acceleration (g's)
50
0
-50
-100
-150
-200
-250
0
2.5
5
7.5
10
Time [ms]
Max: 4.2 g's
Min: -220.1 g's
Filter: CFC 1000


Head CG Y Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]
Max: 1.1 g's
Min: -7.4 g's
Filter: CFC 1000


Head CG Z Acceleration
Acceleration (g's)
125
100
75
50
25
0
-25
0
2.5
5
7.5
10
Time [ms]
Max: 125.0 g's
Min: 1.5 g's
Filter: CFC 1000

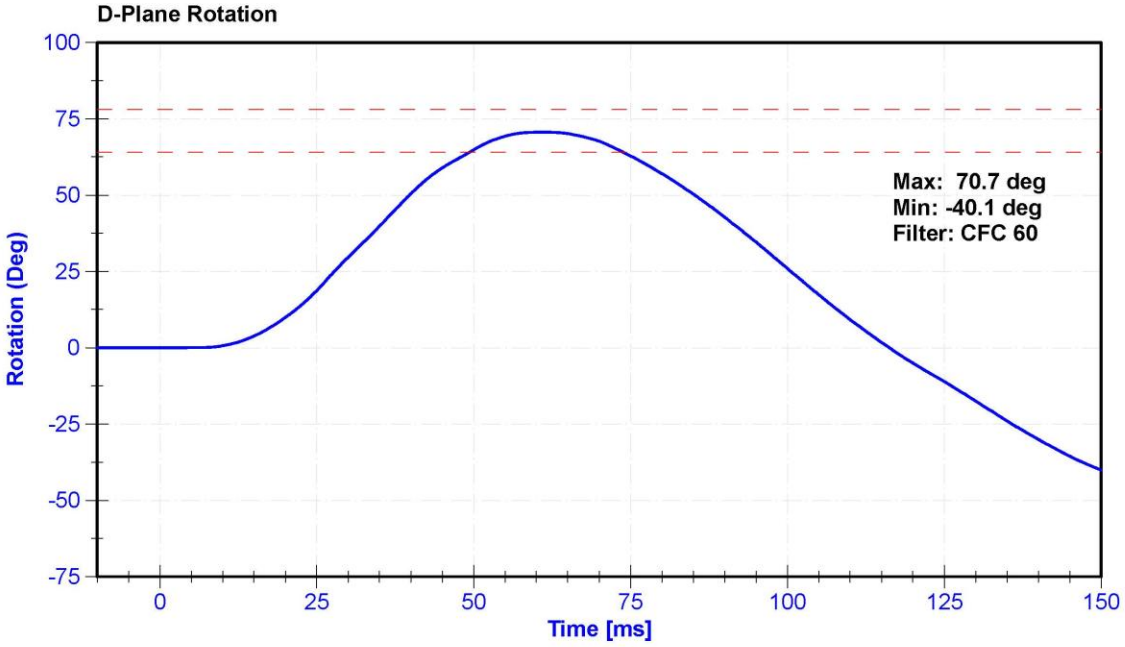
| | | | |
|---|---|---|---|
| ATD Manufacturer | Humanetics | Test Technician | E. Helenbrook |
| ATD Serial Number | 142 | Laboratory Supervisor | K. Brogan |

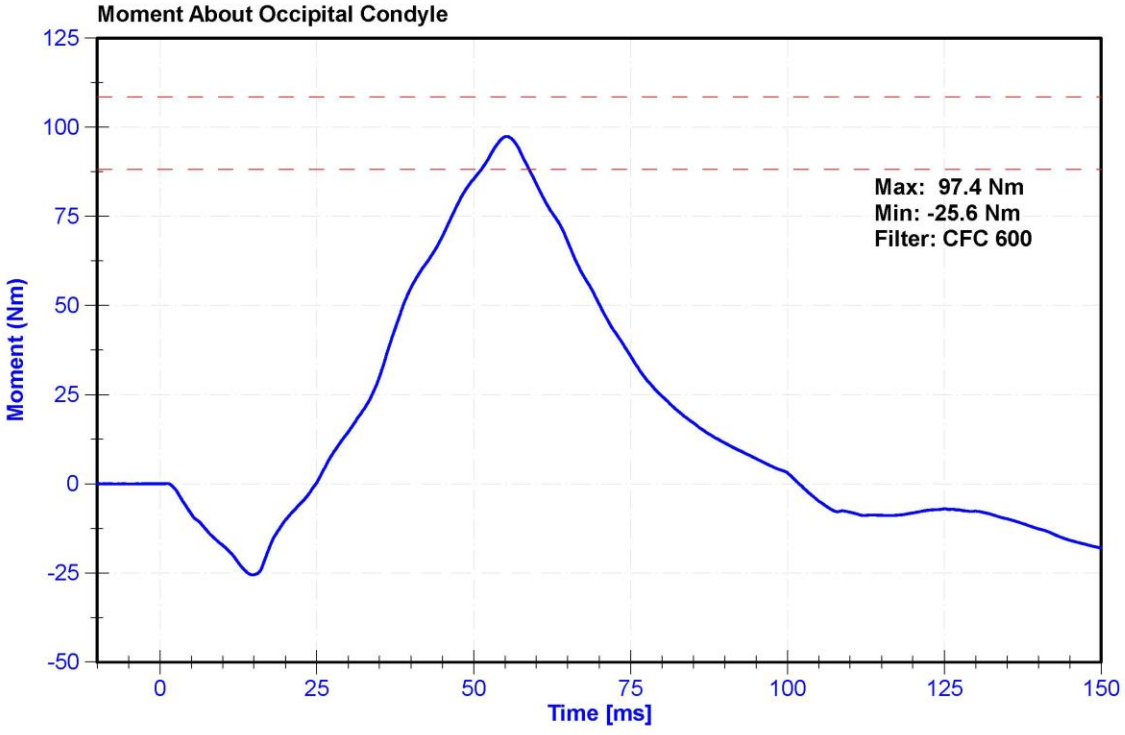
**Results**

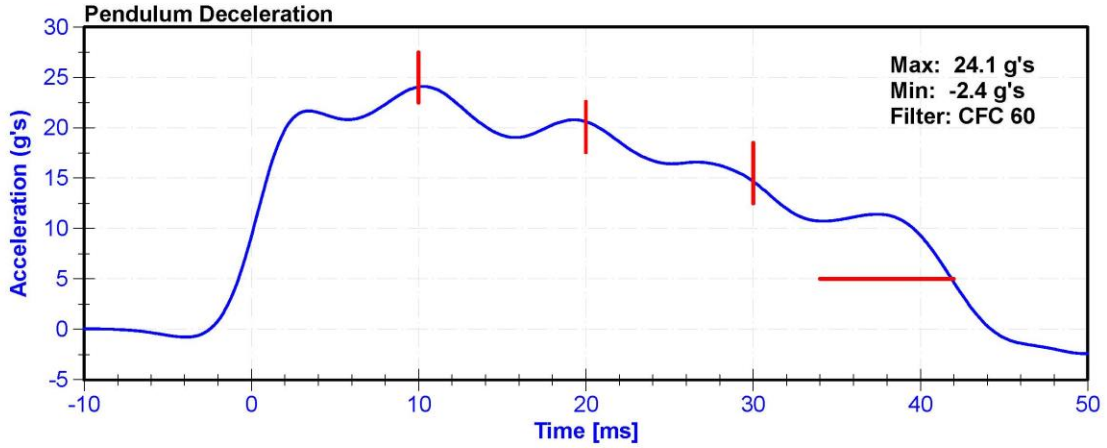
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | ºC | 21.5 | Pass |
| Humidity | 10 | 70 | % | 39.5 | Pass |
| Velocity | 6.89 | 7.13 | m/s | 6.950 | Pass |
| Pendulum Deceleration at 10ms | 22.5 | 27.5 | g's | 24.07 | Pass |
| Pendulum Deceleration at 20ms | 17.6 | 22.6 | g's | 20.62 | Pass |
| Pendulum Deceleration at 30ms | 12.5 | 18.5 | g's | 14.69 | Pass |
| Max. Pendulum Deceleration After 30ms | 0 | 29 | g's | 24.1 | Pass |
| Pendulum Deceleration Time to 5 g's | 34 | 42 | ms | 41.9 | Pass |
| Maximum D Plane Rotation | 64 | 78 | deg | 70.7 | Pass |
| Time to Maximum Rotation | 57 | 64 | ms | 61.0 | Pass |
| Rotation Decay to Zero | 113 | 127 | ms | 116.3 | Pass |
| Moment About Occipital Condyle | 88.1 | 108.4 | Nm | 97.38 | Pass |
| Time to Maximum Moment | 47 | 58 | ms | 55.3 | Pass |
| Moment Decay to Zero | 97 | 107 | ms | 101.9 | Pass |

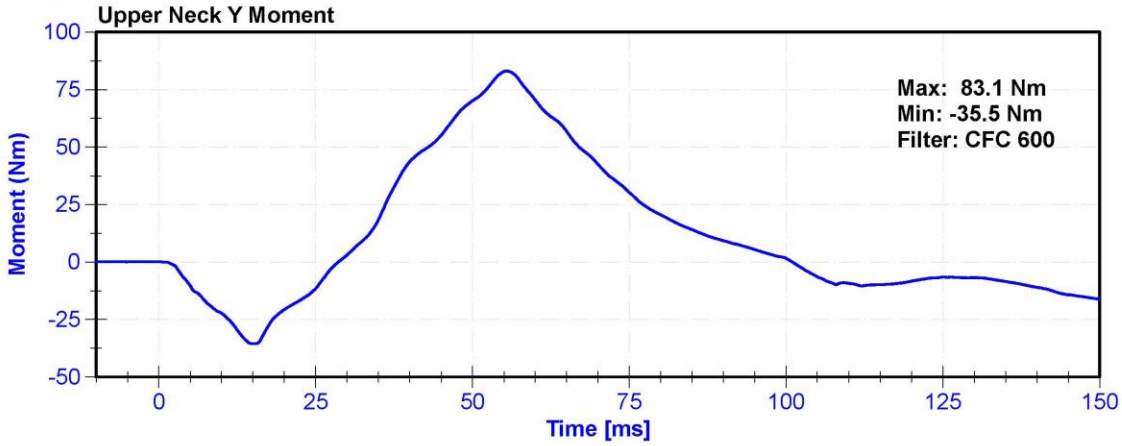
**Transducer Calibrations**

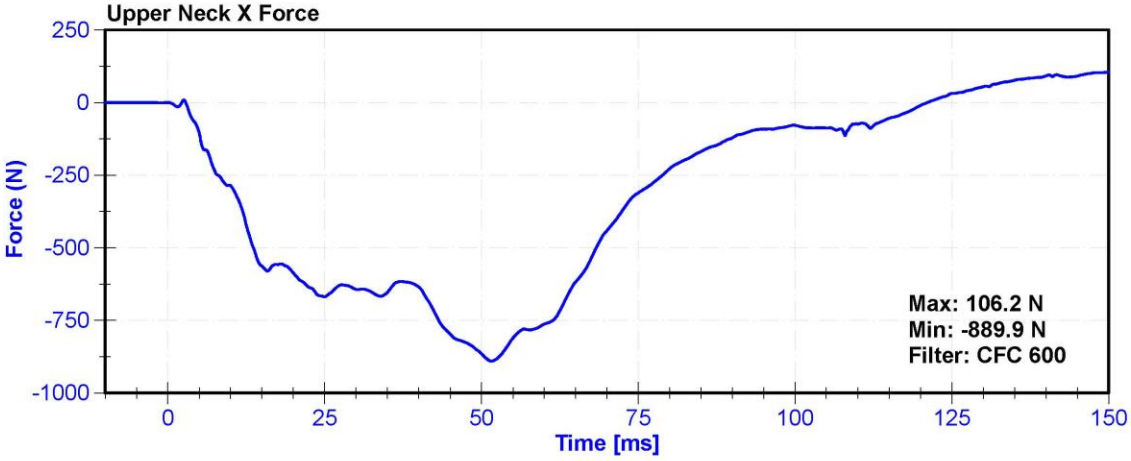
| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7231CT | AC-C16503 Striker | 2/5/2021 | 2/5/2022 |
| Pendulum Potentiometer | ETI SP22G | DS-PendPot | 12/9/2020 | 12/9/2021 |
| Condyle Potentiometer | ETI SP22G | DS-CondPot | 12/3/2020 | 12/3/2021 |
| Upper Neck Load Cell | DENTON 1716A | LC-2186Fx | 11/10/2020 | 11/10/2021 |


D-Plane Rotation
Rotation (Deg)
100
75
50
25
0
-25
-50
-75
0
25
50
75
100
125
150
Time [ms]
Max: 70.7 deg
Min: -40.1 deg
Filter: CFC 60


Moment About Occipital Condyle
Moment (Nm)
125
100
75
50
25
0
-25
-50
0
25
50
75
100
125
150
Time [ms]
Max: 97.4 Nm
Min: -25.6 Nm
Filter: CFC 600


Pendulum Deceleration
Acceleration (g's)
Time [ms]
Max: 24.1 g's
Min: -2.4 g's
Filter: CFC 60


Upper Neck Y Moment
Moment (Nm)
Time [ms]
Max: 83.1 Nm
Min: -35.5 Nm
Filter: CFC 600


Upper Neck X Force
Force (N)
Time [ms]
Max: 106.2 N
Min: -889.9 N
Filter: CFC 600

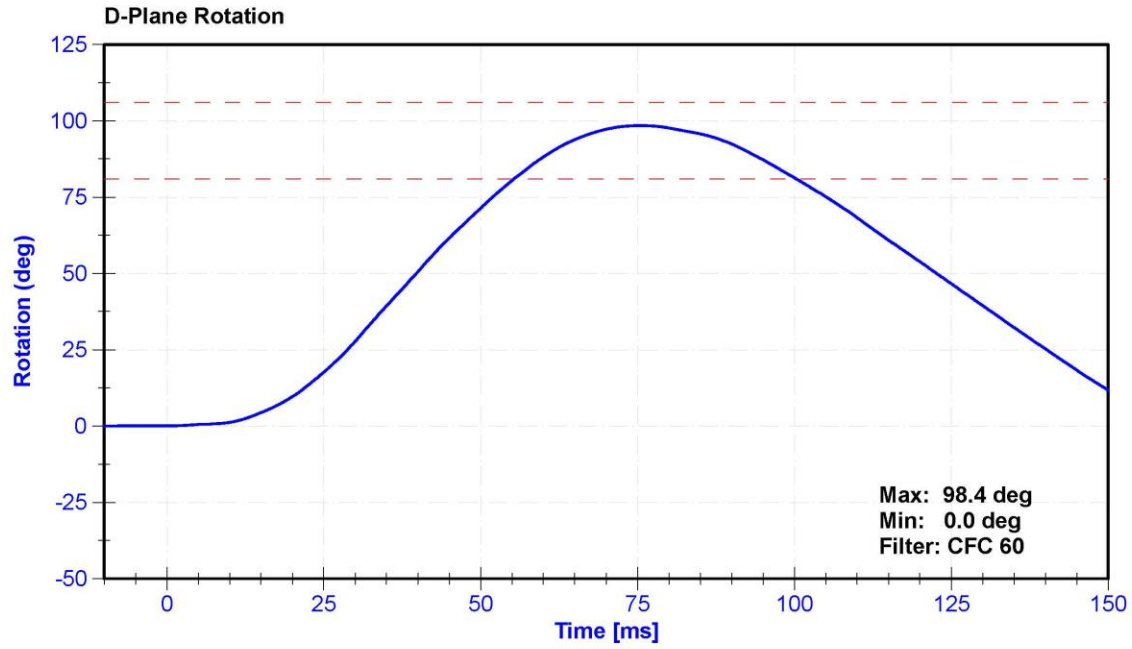
| | | | |
|---|---|---|---|
| ATD Manufacturer | Humanetics | Test Technician | E. Helenbrook |
| ATD Serial Number | 142 | Laboratory Supervisor | K. Brogan |

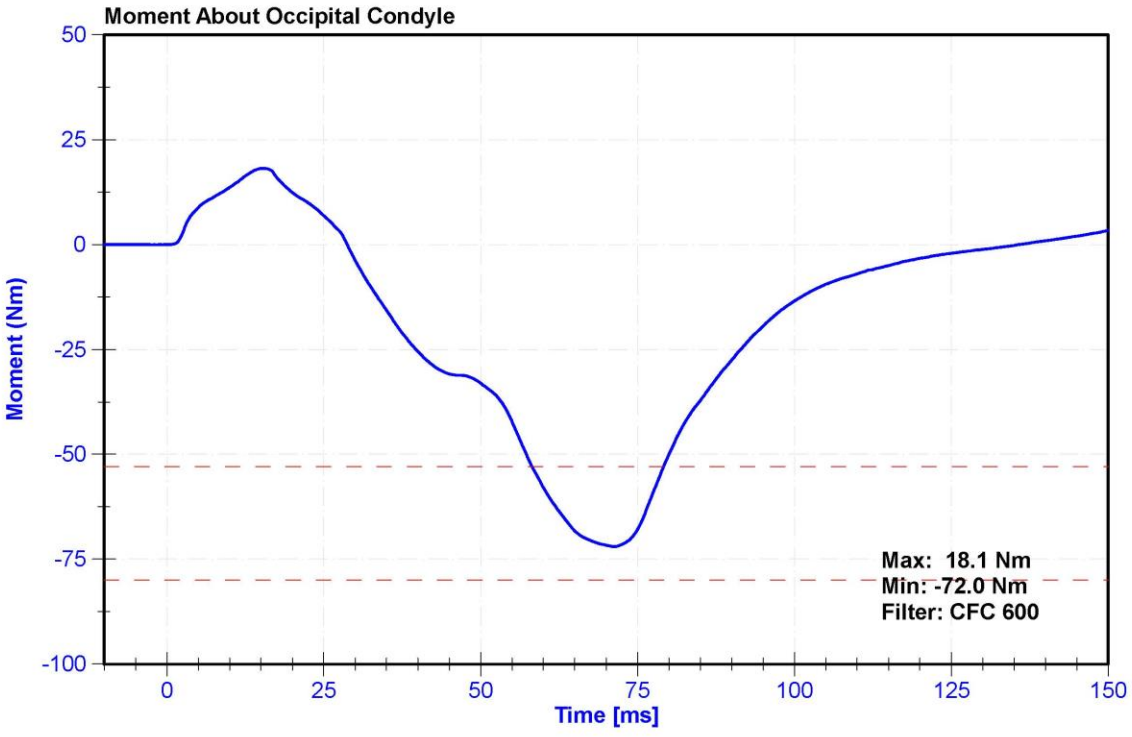
**Results**

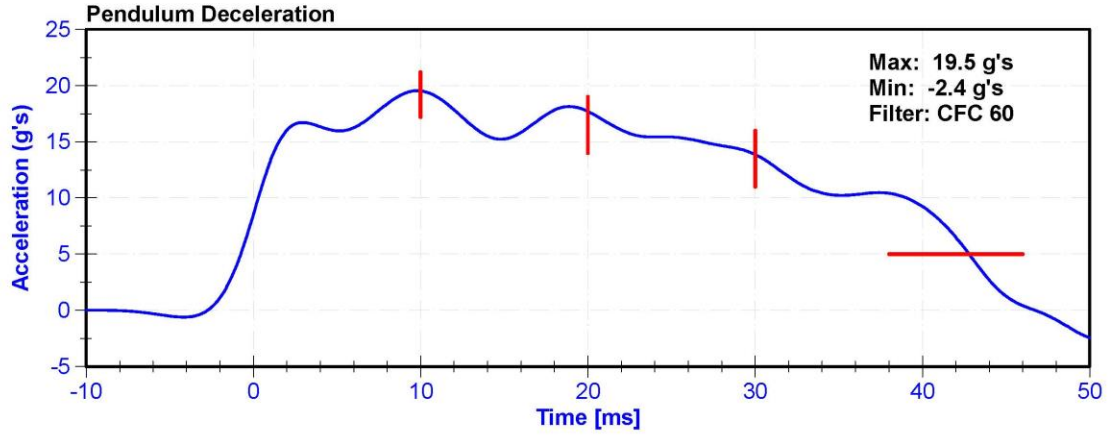
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | ºC | 21.4 | Pass |
| Humidity | 10 | 70 | % | 39.5 | Pass |
| Velocity | 5.94 | 6.19 | m/s | 5.990 | Pass |
| Pendulum Deceleration at 10ms | 17.2 | 21.2 | g's | 19.53 | Pass |
| Pendulum Deceleration at 20ms | 14 | 19 | g's | 17.7 | Pass |
| Pendulum Deceleration at 30ms | 11 | 16 | g's | 13.9 | Pass |
| Max. Pendulum Deceleration After 30ms | 0 | 22 | g's | 19.5 | Pass |
| Pendulum Deceleration Time to 5 g's | 38 | 46 | ms | 42.8 | Pass |
| Maximum D Plane Rotation | 81 | 106 | deg | 98.4 | Pass |
| Time to Maximum Rotation | 72 | 82 | ms | 75.5 | Pass |
| Rotation Decay to Zero | 147 | 174 | ms | 159.2 | Pass |
| Minimum Moment About OC | -80 | -52.9 | Nm | -72.00 | Pass |
| Time to Minimum Moment | 65 | 79 | ms | 71.2 | Pass |
| Moment Decay to Zero | 120 | 148 | ms | 135.9 | Pass |

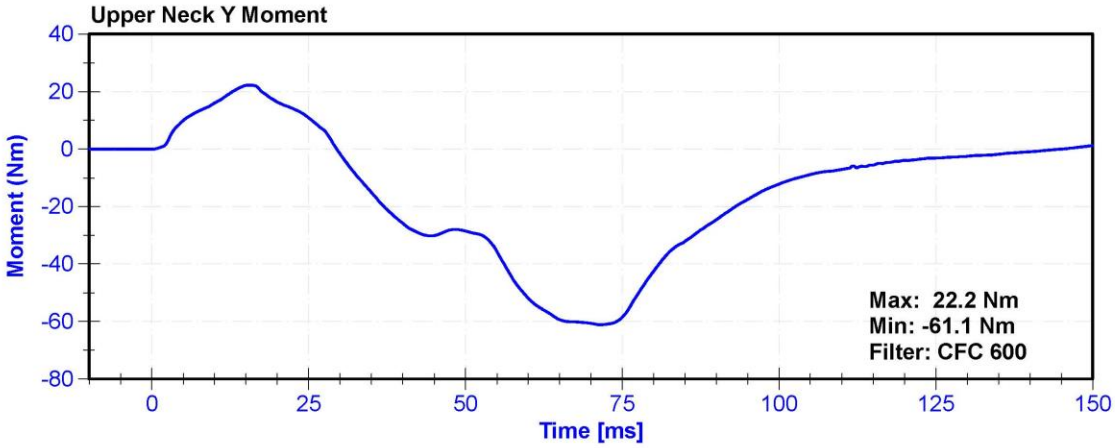
**Transducer Calibrations**

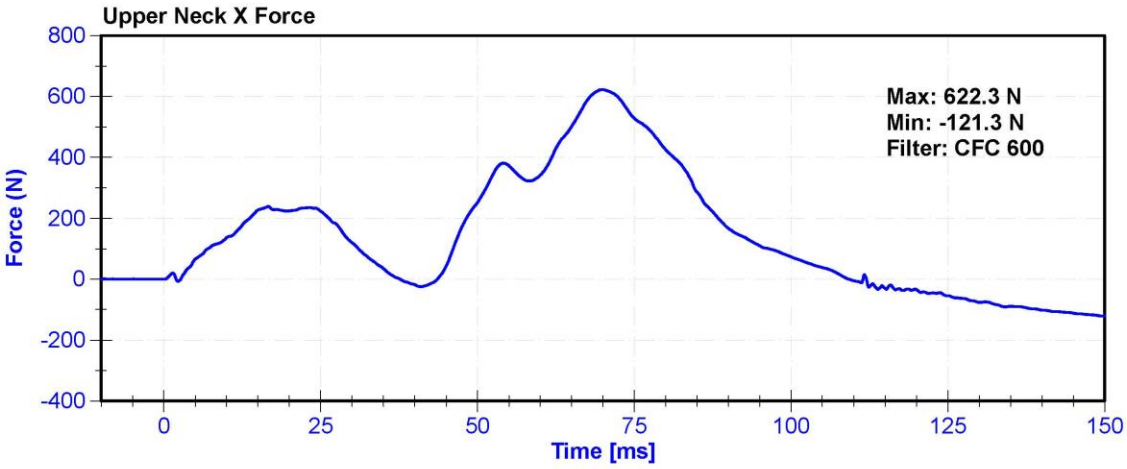
| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7231CT | AC-C16503 Striker | 2/5/2021 | 2/5/2022 |
| Pendulum Potentiometer | ETI SP22G | DS-PendPot | 12/9/2020 | 12/9/2021 |
| Condyle Potentiometer | ETI SP22G | DS-CondPot | 12/3/2020 | 12/3/2021 |
| Upper Neck Load Cell | DENTON 1716A | LC-2186Fx | 11/10/2020 | 11/10/2021 |


D-Plane Rotation
Rotation (deg)
125
100
75
50
25
0
-25
-50
0
25
50
75
100
125
150
Time [ms]
Max: 98.4 deg
Min: 0.0 deg
Filter: CFC 60


Moment About Occipital Condyle
Moment (Nm)
50
25
0
-25
-50
-75
-100
0
25
50
75
100
125
150
Time [ms]
Max: 18.1 Nm
Min: -72.0 Nm
Filter: CFC 600


Pendulum Deceleration
Acceleration (g's)
Time [ms]
Max: 19.5 g's
Min: -2.4 g's
Filter: CFC 60


Upper Neck Y Moment
Moment (Nm)
Time [ms]
Max: 22.2 Nm
Min: -61.1 Nm
Filter: CFC 600


Upper Neck X Force
Force (N)
Time [ms]
Max: 622.3 N
Min: -121.3 N
Filter: CFC 600

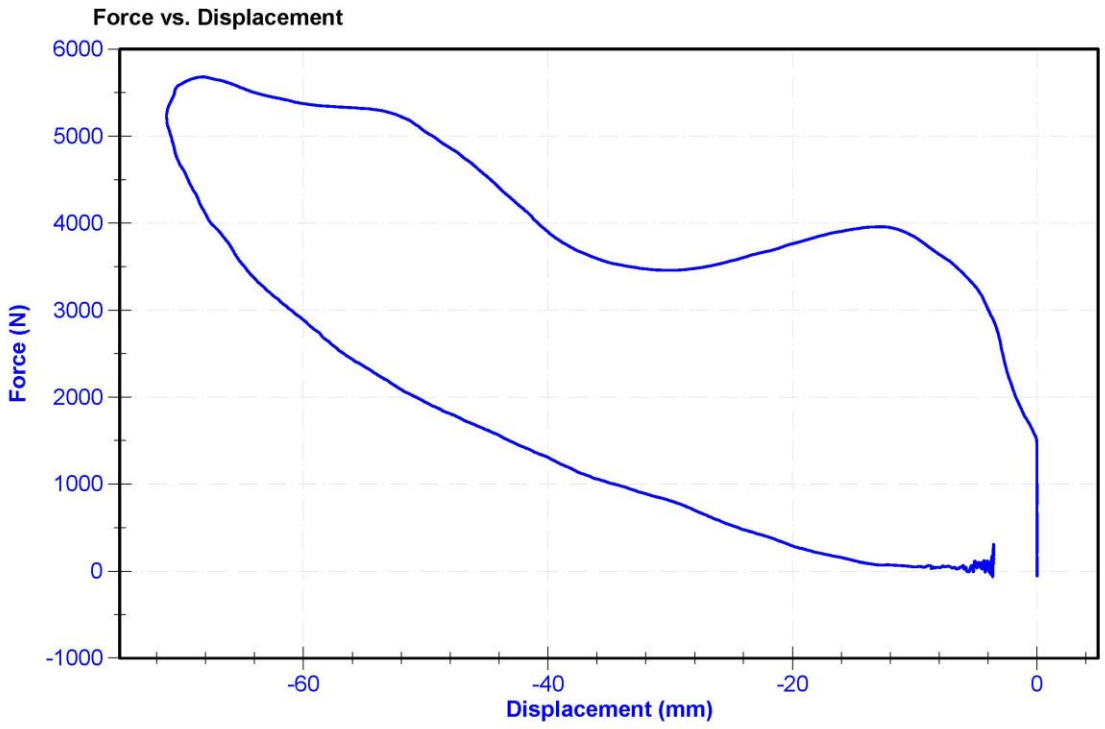
| | | | |
|---|---|---|---|
| ATD Manufacturer | Humanetics | Test Technician | D.Reinhard |
| ATD Serial Number | 142 | Laboratory Supervisor | K. Brogan |

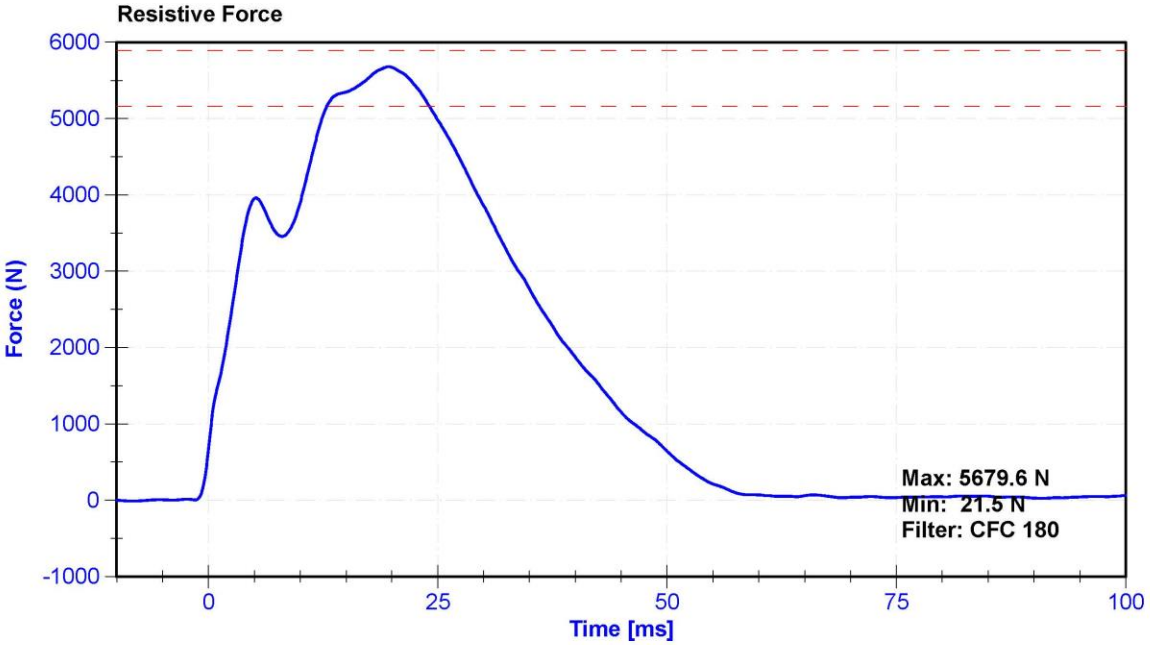
**Results**

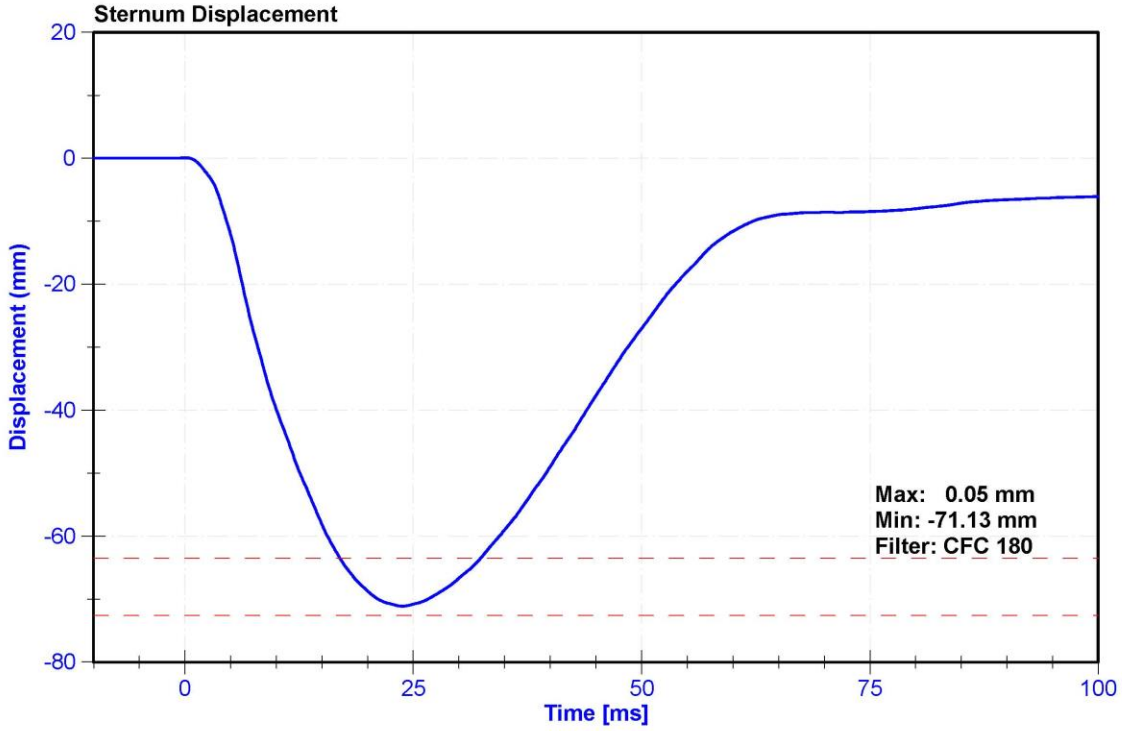
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | ºC | 21.5 | Pass |
| Humidity | 10 | 70 | % | 32 | Pass |
| Velocity | 6.59 | 6.83 | m/s | 6.602 | Pass |
| Chest Displacement | -72.6 | -63.5 | mm | -71.13 | Pass |
| Resistive Force | 5160 | 5894 | N | 5679.6 | Pass |
| Hysteresis | 65 | 85 | % | 67.0 | Pass |

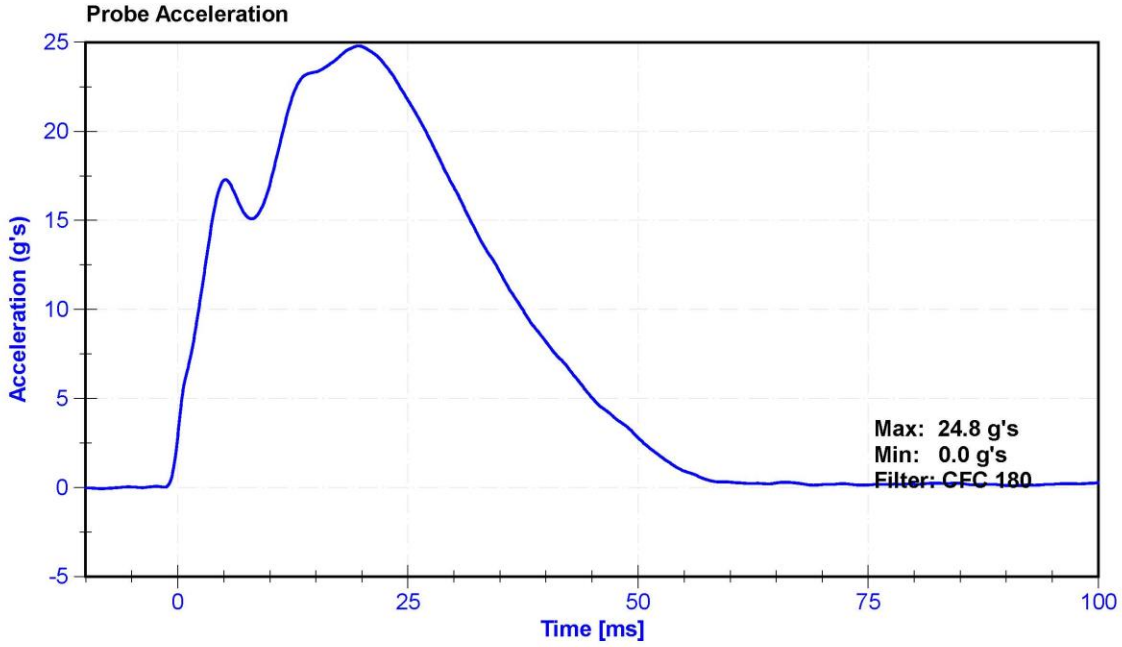
**Transducer Calibrations**

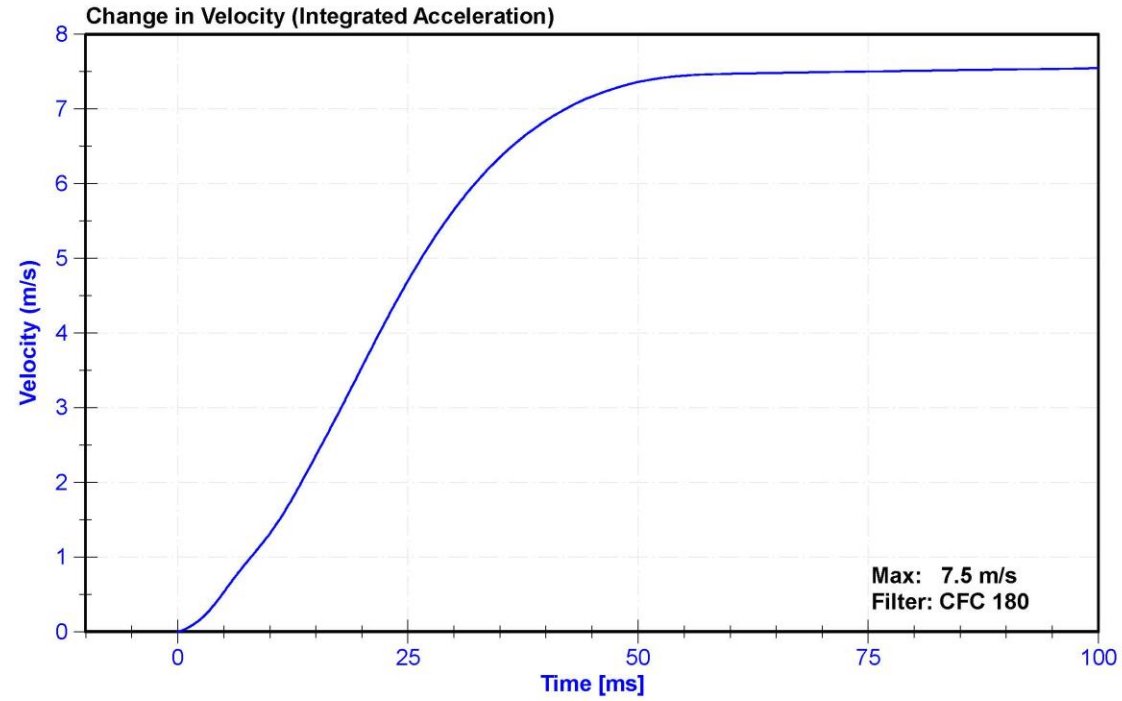
| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | MSI 64C-2000 | A278994 | 12/3/2020 | 12/3/2021 |
| Chest Potentiometer | Servo 6209-2038 | DS-142 | 11/19/2020 | 5/20/2021 |




Resistive Force
Force (N)
6000
5000
4000
3000
2000
1000
0
-1000
0
25
50
75
100
Time [ms]
Max: 5679.6 N
Min: 21.5 N
Filter: CFC 180


Sternum Displacement
Displacement (mm)
20
0
-20
-40
-60
-80
0
25
50
75
100
Time [ms]
Max: 0.05 mm
Min: -71.13 mm
Filter: CFC 180


Probe Acceleration
Acceleration (g's)
25
20
15
10
5
0
-5
0
25
50
75
100
Time [ms]
Max: 24.8 g's
Min: 0.0 g's
Filter: CFC 180


Change in Velocity (Integrated Acceleration)
Velocity (m/s)
8
7
6
5
4
3
2
1
0
0
25
50
75
100
Time [ms]
Max: 7.5 m/s
Filter: CFC 180

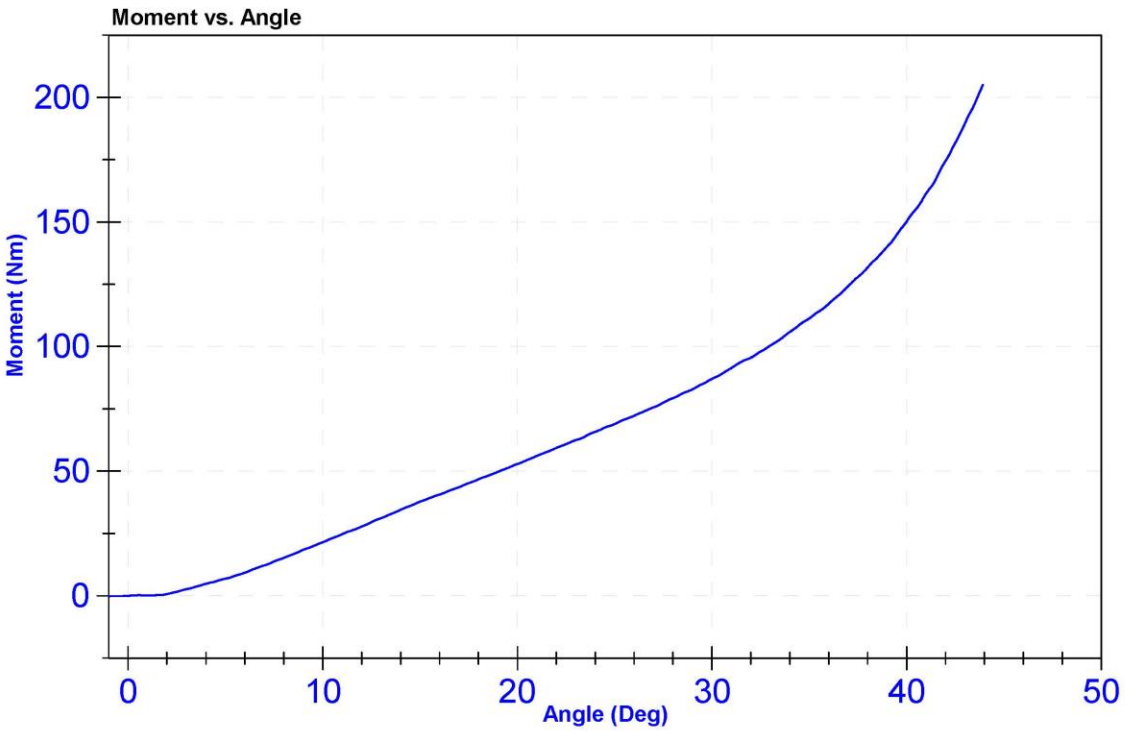
| | | | |
|---|---|---|---|
| ATD Manufacturer | Humanetics | Test Technician | D. Reinhard |
| ATD Serial Number | 142 | Laboratory Supervisor | K. Brogan |

**Results**

| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 18.9 | 25.6 | ºC | 21.5 | Pass |
| Humidity | 10 | 70 | % | 32.2 | Pass |
| Average Velocity | 5 | 10 | deg/s | 7.2 | Pass |
| Angle at 203Nm | 40 | 50 | deg | 43.8 | Pass |
| Moment at 30 degrees | 0 | 94.9 | Nm | 87.1 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Potentiometer | ETI SP22 | DS-0008 | 9/18/2020 | 9/18/2021 |
| Load Cell | Key Trans 2301-02 | LC-115 My | 9/12/2020 | 9/12/2021 |



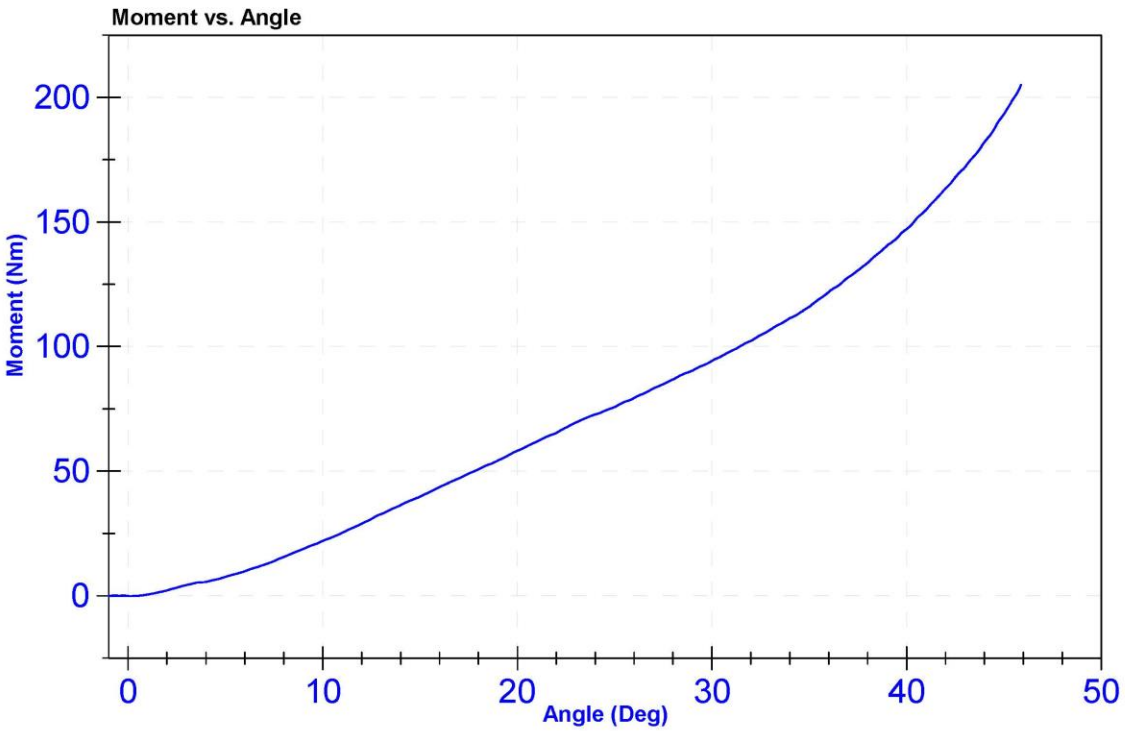
| | | | |
|---|---|---|---|
| ATD Manufacturer | Humanetics | Test Technician | D. Reinhard |
| ATD Serial Number | 142 | Laboratory Supervisor | K. Brogan |

**Results**

| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 18.9 | 25.6 | ºC | 21.5 | Pass |
| Humidity | 10 | 70 | % | 32.2 | Pass |
| Average Velocity | 5 | 10 | deg/s | 7.3 | Pass |
| Angle at 203Nm | 40 | 50 | deg | 45.8 | Pass |
| Moment at 30 degrees | 0 | 94.9 | Nm | 94.3 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Potentiometer | ETI SP22 | DS-0008 | 9/18/2020 | 9/18/2021 |
| Load Cell | Key Trans 2301-02 | LC-115 My | 9/12/2020 | 9/12/2021 |



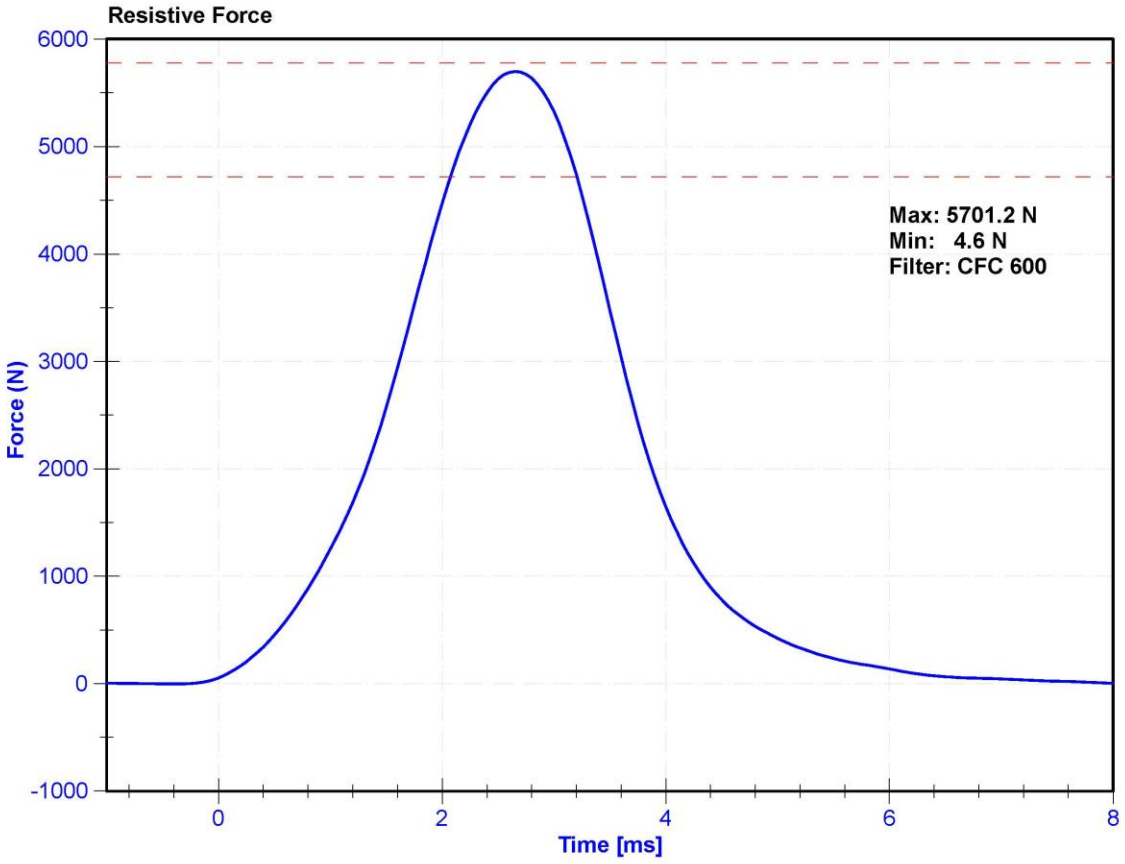
| | | | |
|---|---|---|---|
| ATD Manufacturer | Humanetics | Test Technician | D. Reinhard |
| ATD Serial Number | 142 | Laboratory Supervisor | K. Brogan |

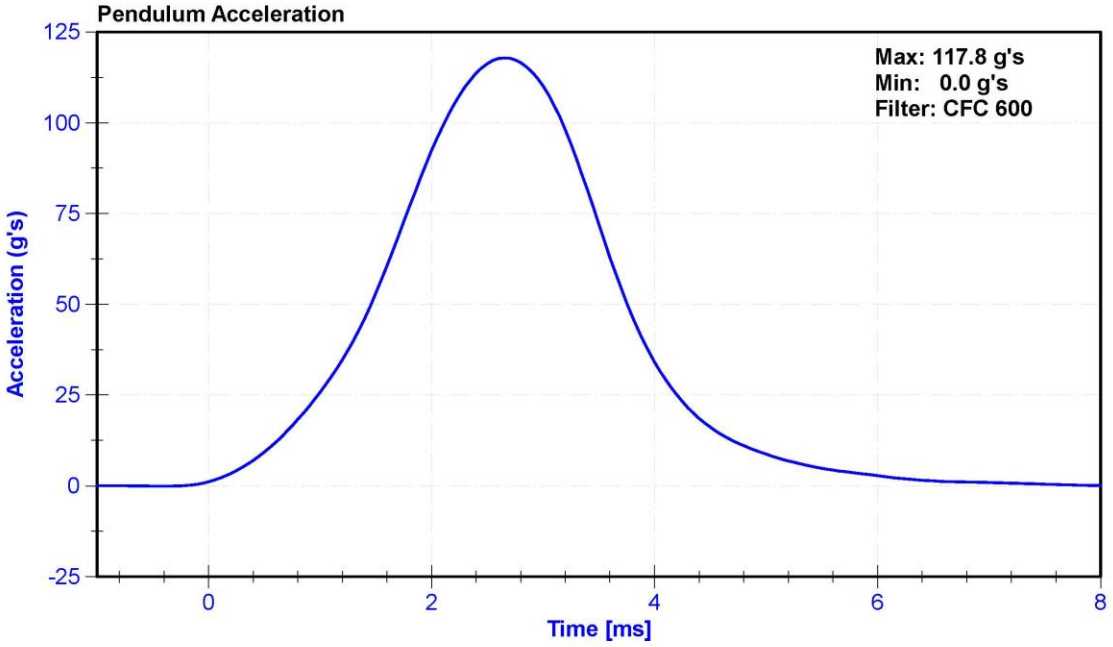
**Results**

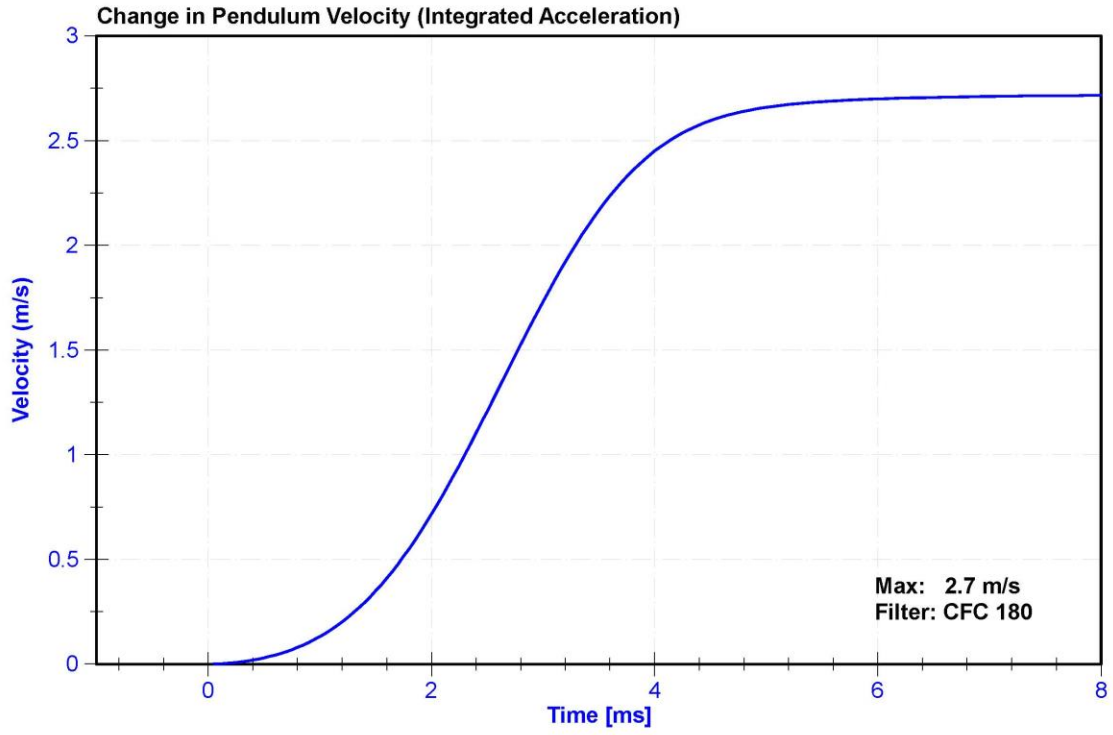
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 18.9 | 25.6 | ºC | 20.9 | Pass |
| Humidity | 10 | 70 | % | 24 | Pass |
| Velocity | 2.07 | 2.13 | m/s | 2.095 | Pass |
| Maximum Resistive Force | 4720 | 5780 | N | 5701.2 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | MSI 64C-2000 | A278994 | 12/3/2020 | 12/3/2021 |




Pendulum Acceleration
Max: 117.8 g's
Min: 0.0 g's
Filter: CFC 600
Acceleration (g's)
125
100
75
50
25
0
-25
0
2
4
6
8
Time [ms]


Change in Pendulum Velocity (Integrated Acceleration)
Velocity (m/s)
3
2.5
2
1.5
1
0.5
0
Max: 2.7 m/s
Filter: CFC 180
0
2
4
6
8
Time [ms]

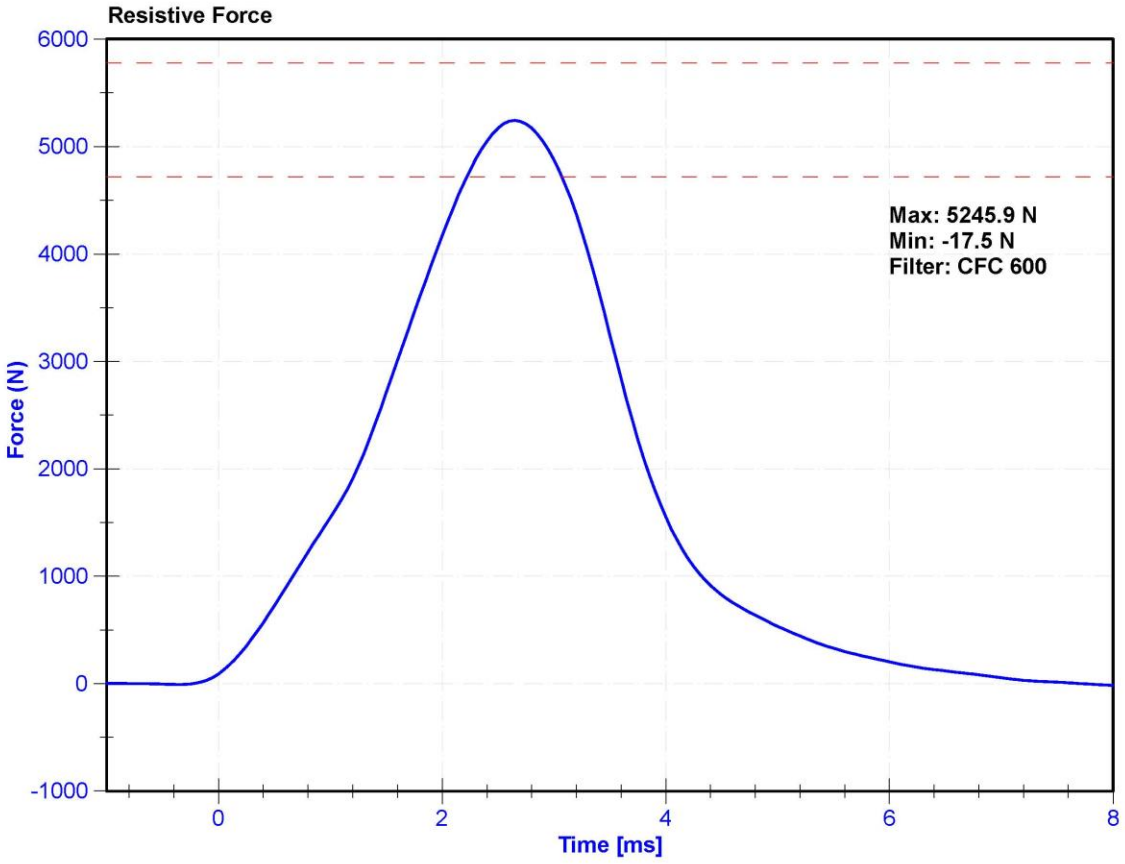
| | | | |
|---|---|---|---|
| ATD Manufacturer | Humanetics | Test Technician | D. Reinhard |
| ATD Serial Number | 142 | Laboratory Supervisor | K. Brogan |

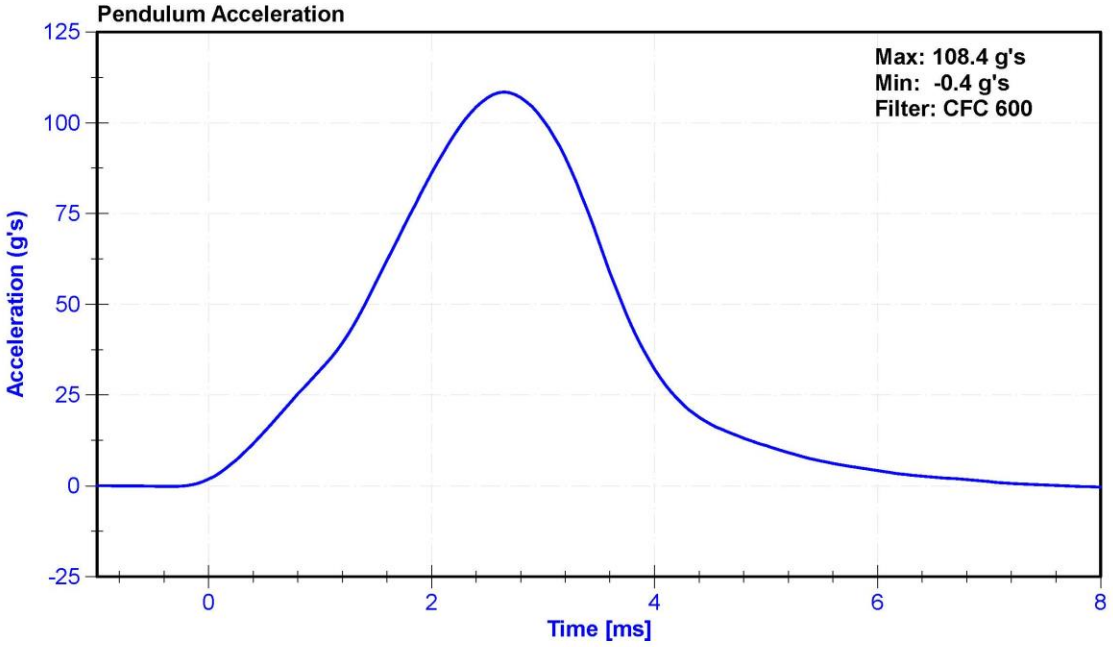
**Results**

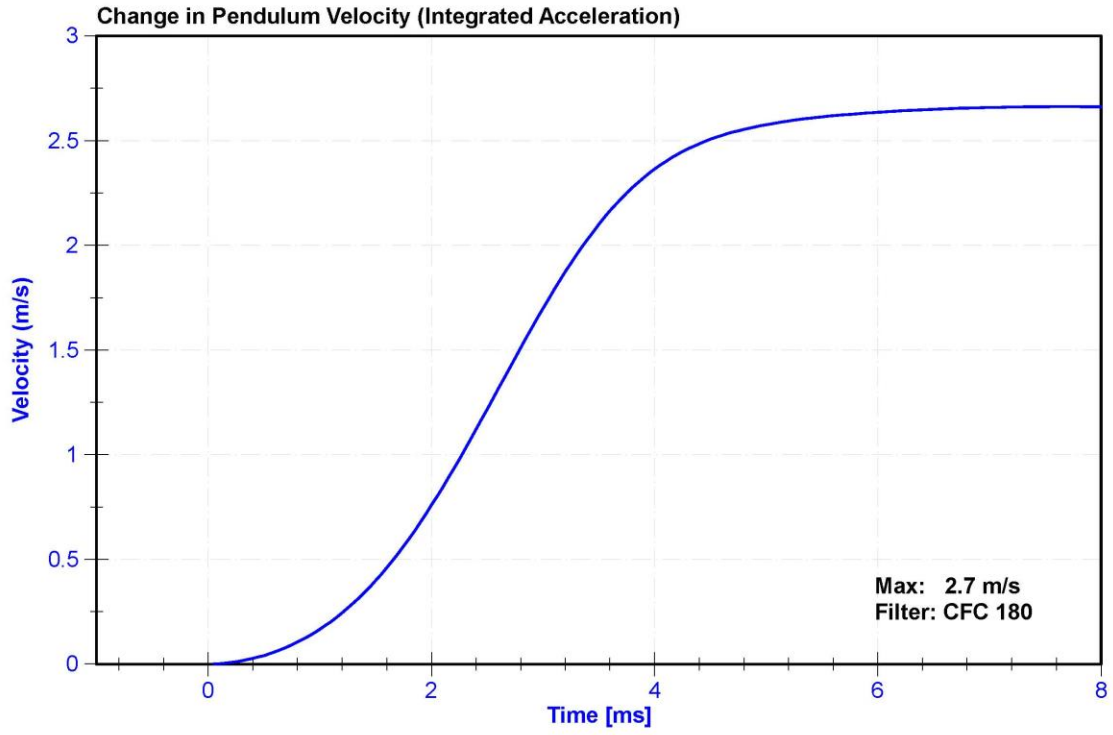
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 18.9 | 25.6 | ºC | 20.9 | Pass |
| Humidity | 10 | 70 | % | 24 | Pass |
| Velocity | 2.07 | 2.13 | m/s | 2.093 | Pass |
| Maximum Resistive Force | 4720 | 5780 | N | 5245.9 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | MSI 64C-2000 | A278994 | 12/3/2020 | 12/3/2021 |




Pendulum Acceleration
Max: 108.4 g's
Min: -0.4 g's
Filter: CFC 600
Acceleration (g's)
125
100
75
50
25
0
-25
0
2
4
6
8
Time [ms]


Change in Pendulum Velocity (Integrated Acceleration)
Velocity (m/s)
3
2.5
2
1.5
1
0.5
0
Max: 2.7 m/s
Filter: CFC 180
0
2
4
6
8
Time [ms]

**CALIBRATION TEST RESULTS**

**PRE-TEST**

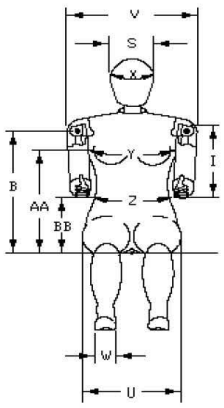
**HYBRID III 5$^{TH}$ PERCENTILE - PASSENGER ATD**

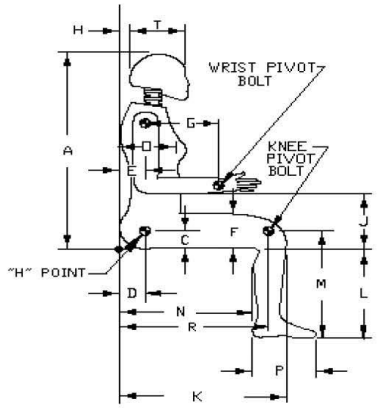
**SERIAL NO: 288**

External Measurements - Hybrid 3 - 5th Female

Technician: K. Brogan  Date: 05/11/2021

Dummy Serial Number: 288




| Symbol | Description | Specification (mm) | | Result (mm) | Pass/Fail |
|---|---|---|---|---|---|
| A | Sitting Height | 775 | 800 | 787 | Pass |
| B | Shoulder Pivot Height | 432 | 457 | 450 | 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 | 77 | Pass |
| F | Thigh Clearance | 119 | 135 | 127 | Pass |
| G | Back of Elbow to Wrist Pivot | 244 | 259 | 255 | Pass |
| H | Head Back to Backline | 43 | 48 | 45 | Pass |
| I | Shoulder to Elbow Length | 277 | 297 | 284 | Pass |
| J | Elbow Rest Height | 183 | 203 | 192 | Pass |
| K | Buttock to Knee Length | 521 | 546 | 538 | Pass |
| L | Popliteal Height | 356 | 376 | 365 | Pass |
| M | Knee Pivot Height | 394 | 419 | 410 | Pass |
| N | Buttock Popliteal Length | 414 | 439 | 429 | Pass |
| O | Chest Depth without Jacket | 175 | 191 | 182 | Pass |
| P | Foot Length (right) | 219 | 234 | 221 | Pass |
| R | Buttock To Knee Pivot Length | 457 | 483 | 465 | Pass |
| S | Head Breadth | 137 | 147 | 141 | Pass |
| T | Head Depth | 178 | 188 | 183 | Pass |
| U | Hip Breadth | 300 | 315 | 310 | Pass |
| V | Shoulder Breadth | 351 | 366 | 361 | Pass |
| W | Foot Breadth | 79 | 94 | 85 | Pass |
| X | Head Circumference | 528 | 549 | 537 | Pass |
| Y | Chest Circumference with Jacket | 851 | 881 | 865 | Pass |
| Z | Waist Circumference | 460 | 790 | 777 | Pass |
| AA | Reference Location (Chest Circumference) | 333 | 358 | 345 | Pass |
| BB | Reference Location (Waist Circumference) | 160 | 170 | 164 | Pass |

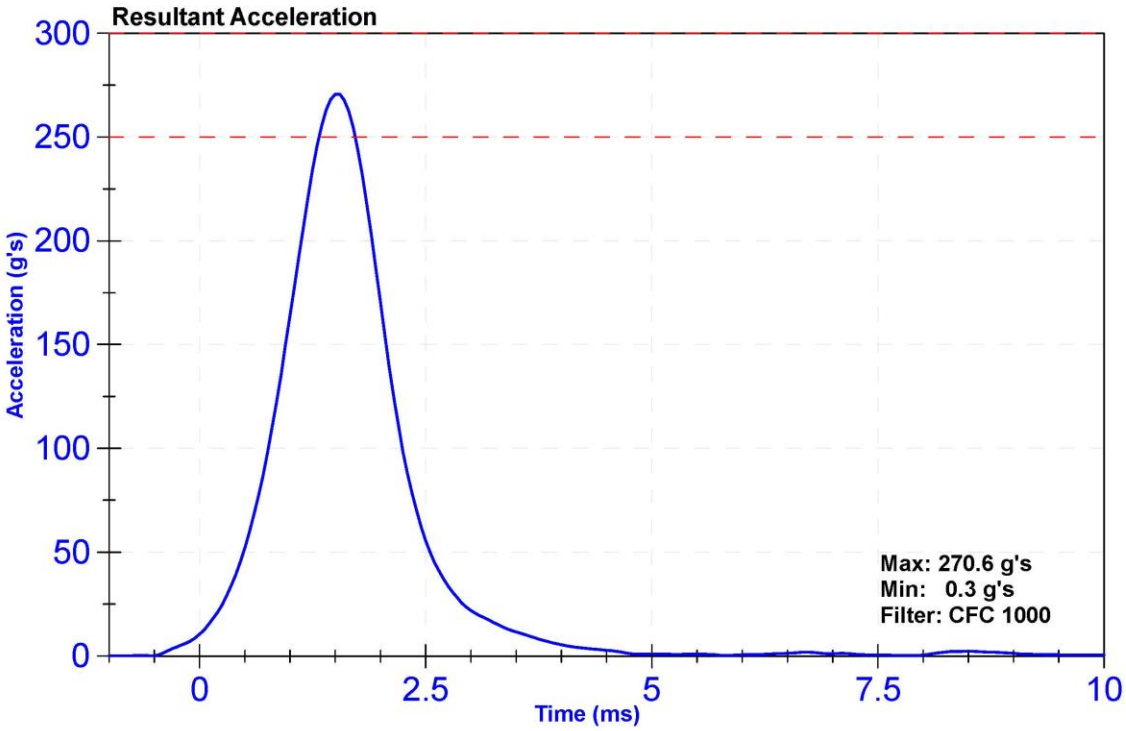
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | E. Helenbrook |
| ATD Serial Number | 288 | Laboratory Supervisor | K. Brogan |

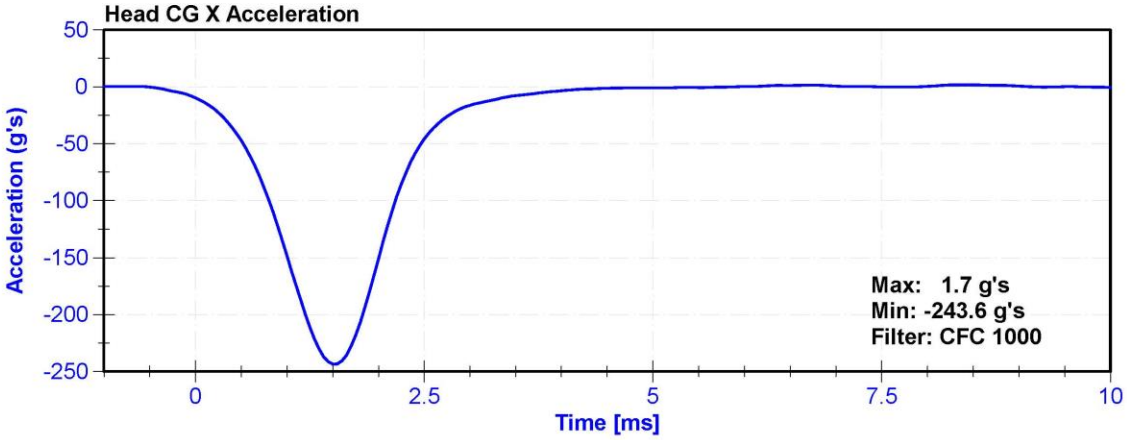
**Results**

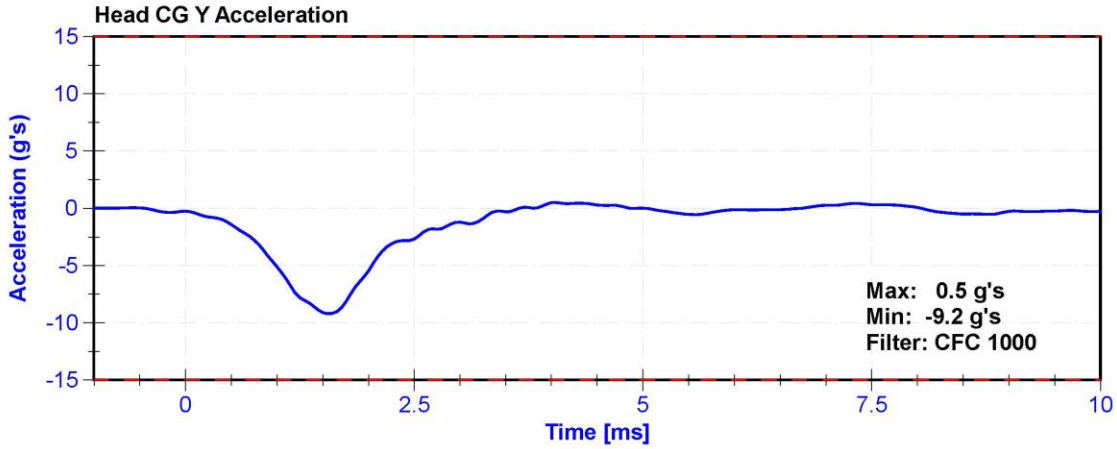
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 18.9 | 25.6 | ºC | 21.5 | Pass |
| Humidity | 10 | 70 | % | 34.2 | Pass |
| Resultant Acceleration | 250 | 300 | g's | 270.6 | Pass |
| Oscillation | 0 | 10 | % | 0.8 | Pass |
| Lateral Acceleration | -15 | 15 | g's | -9.2 | Pass |

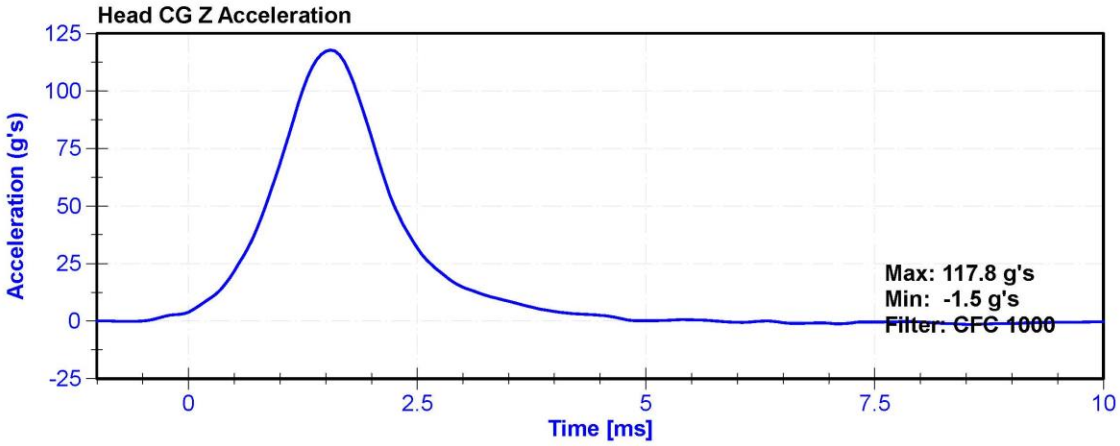
**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| X Accelerometer | ENDEVCO 7264CT | AC-P58780 | 4/5/2021 | 10/4/2021 |
| Y Accelerometer | ENDEVCO 7264 | AC-P83320 | 4/5/2021 | 10/4/2021 |
| Z Accelerometer | ENDEVCO 7264CT | AC-P58997 | 4/5/2021 | 10/4/2021 |




Head CG X Acceleration
Acceleration (g's)
50
0
-50
-100
-150
-200
-250
0
2.5
5
7.5
10
Time [ms]
Max: 1.7 g's
Min: -243.6 g's
Filter: CFC 1000


Head CG Y Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]
Max: 0.5 g's
Min: -9.2 g's
Filter: CFC 1000


Head CG Z Acceleration
Acceleration (g's)
125
100
75
50
25
0
-25
0
2.5
5
7.5
10
Time [ms]
Max: 117.8 g's
Min: -1.5 g's
Filter: CFC 1000

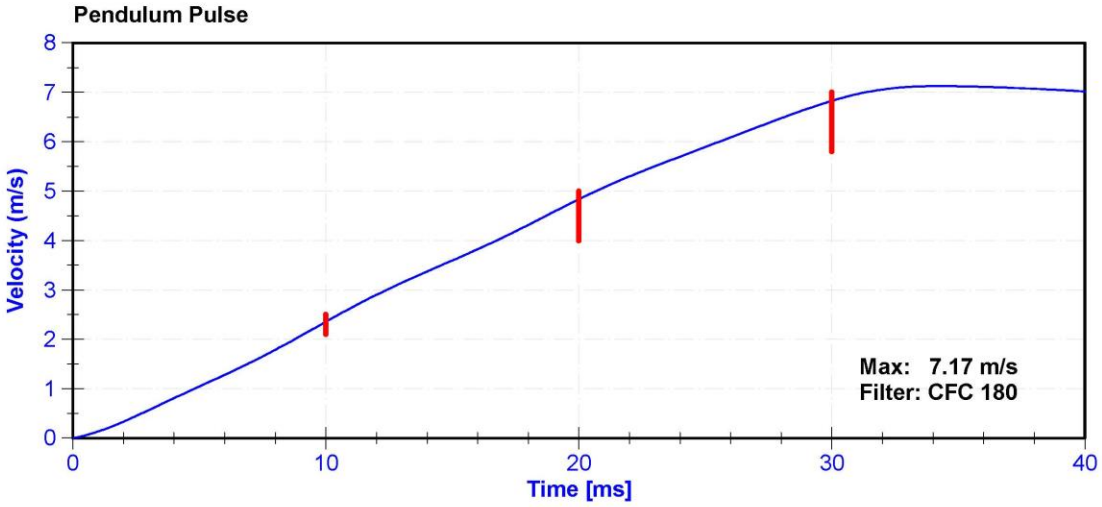
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | E. Helenbrook |
| ATD Serial Number | 288 | Laboratory Supervisor | K. Brogan |

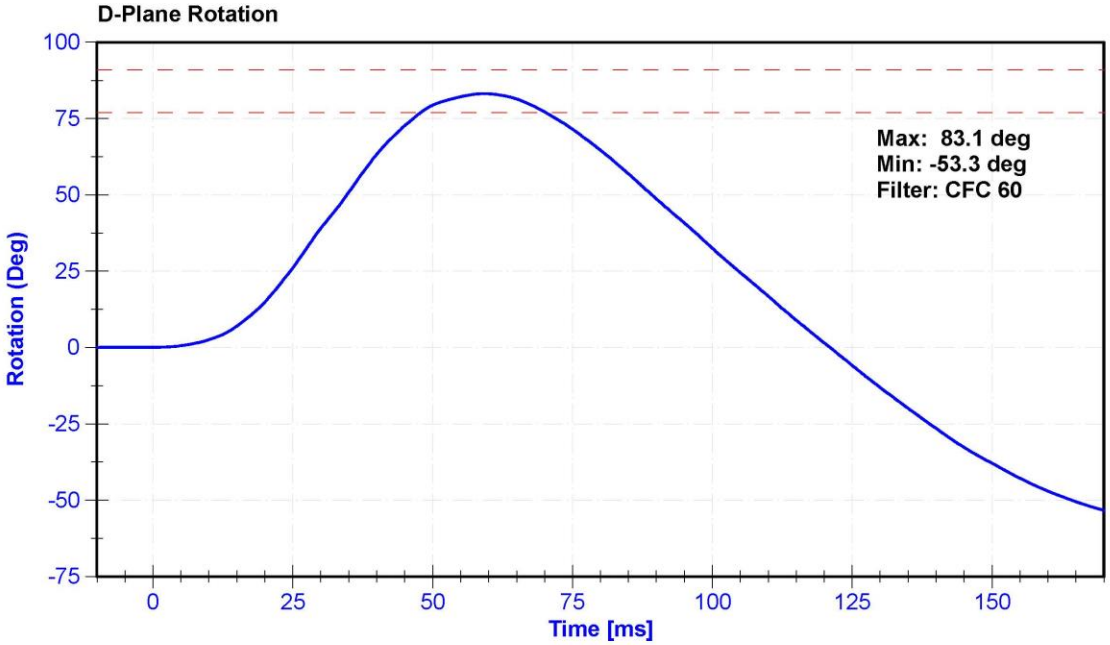
**Results**

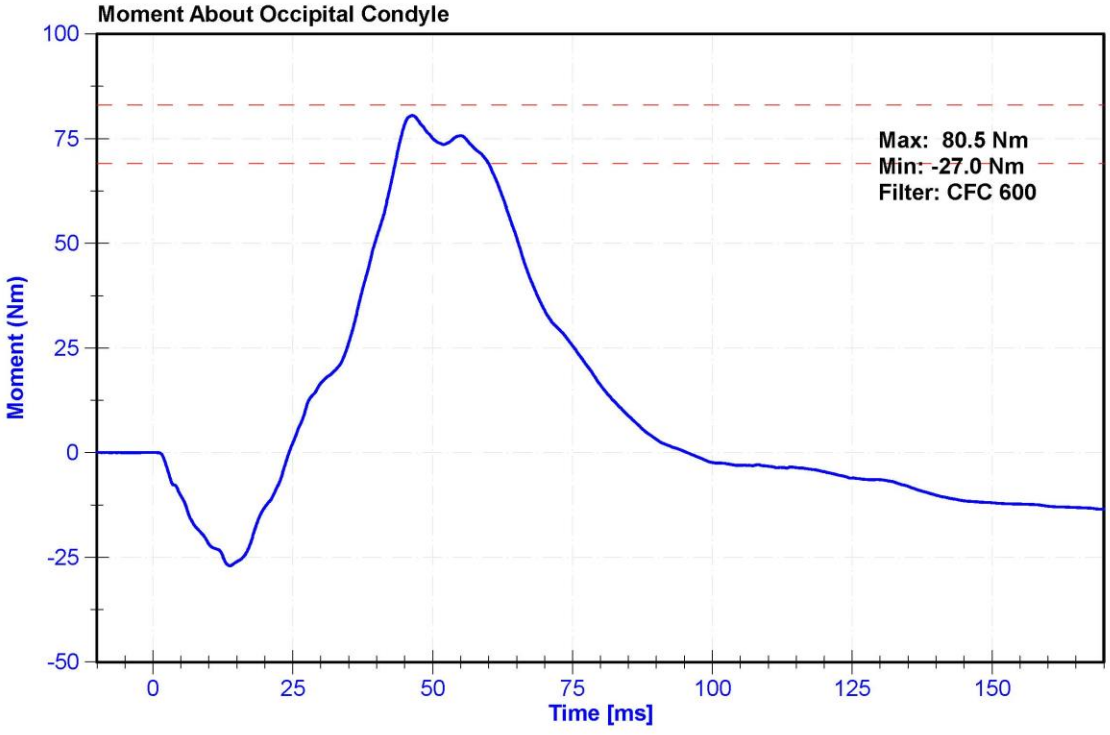
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | ºC | 21.2 | Pass |
| Humidity | 10 | 70 | % | 43.2 | Pass |
| Velocity | 6.89 | 7.13 | m/s | 6.968 | Pass |
| Pendulum Impulse at 10ms | 2.1 | 2.5 | m/s | 2.36 | Pass |
| Pendulum Impulse at 20ms | 4.0 | 5.0 | m/s | 4.84 | Pass |
| Pendulum Impulse at 30ms | 5.8 | 7.0 | m/s | 6.83 | Pass |
| Max D Plane Rotation | 77 | 91 | deg | 83.1 | Pass |
| Max Moment During Rotation Interval | 69 | 83 | Nm | 80.5 | Pass |
| Moment Decay to 10.0 Nm | 80 | 100 | ms | 84.1 | Pass |

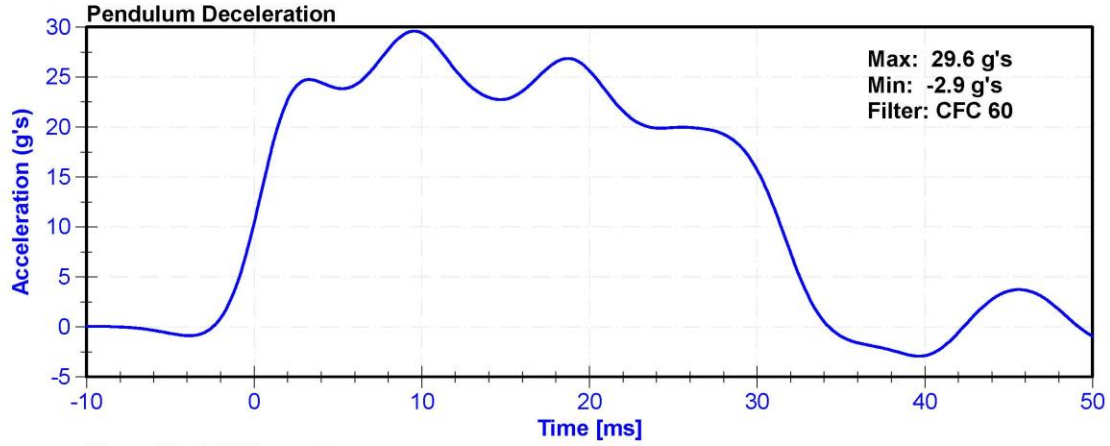
**Transducer Calibrations**

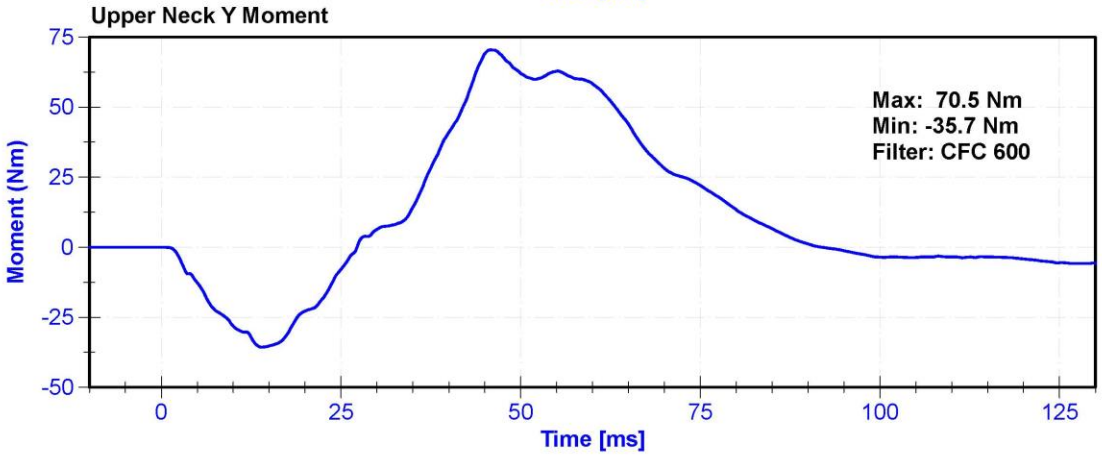
| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7231CT | AC-C16503 Striker | 2/5/2021 | 2/5/2022 |
| Pendulum Potentiometer | ETI SP22G | DS-LABPOT1 | 9/17/2020 | 9/17/2021 |
| Condyle Potentiometer | ETI SP22G | DS-LABPOT2 | 9/17/2020 | 9/17/2021 |
| Upper Neck Load Cell | FTSS 1716 | LC-851 Fx | 7/9/2020 | 7/9/2021 |

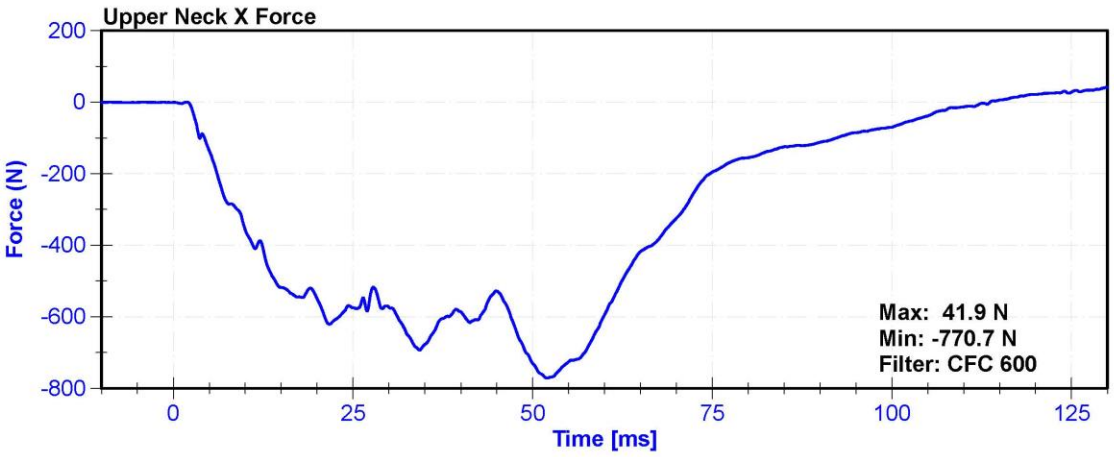



D-Plane Rotation
Rotation (Deg)
100
75
50
25
0
-25
-50
-75
0
25
50
75
100
125
150
Time [ms]
Max: 83.1 deg
Min: -53.3 deg
Filter: CFC 60


Moment About Occipital Condyle
Moment (Nm)
100
75
50
25
0
-25
-50
0
25
50
75
100
125
150
Time [ms]
Max: 80.5 Nm
Min: -27.0 Nm
Filter: CFC 600


Pendulum Deceleration
Acceleration (g's)
Time [ms]
Max: 29.6 g's
Min: -2.9 g's
Filter: CFC 60


Upper Neck Y Moment
Moment (Nm)
Time [ms]
Max: 70.5 Nm
Min: -35.7 Nm
Filter: CFC 600


Upper Neck X Force
Force (N)
Time [ms]
Max: 41.9 N
Min: -770.7 N
Filter: CFC 600

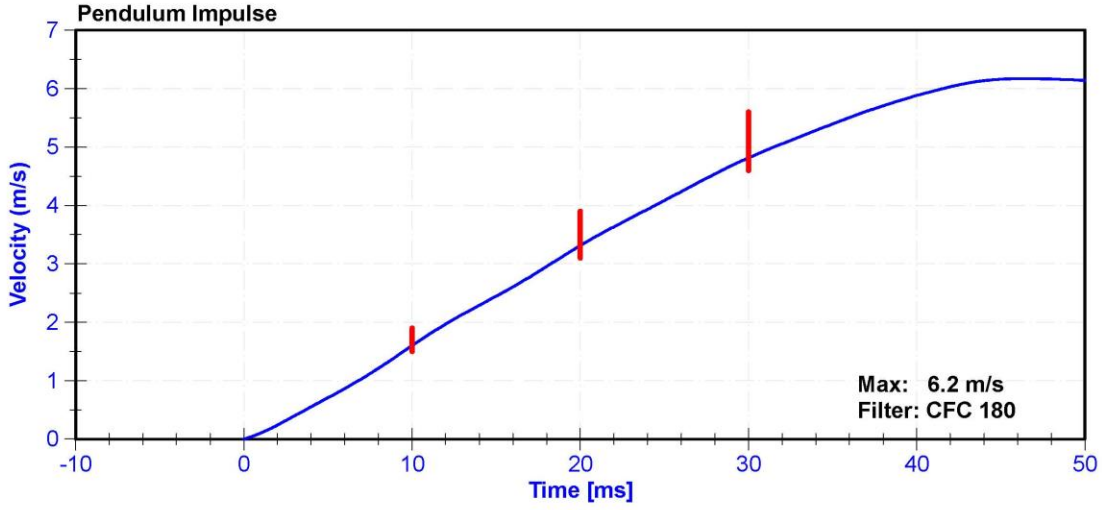
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | E. Helenbrook |
| ATD Serial Number | 288 | Laboratory Supervisor | K. Brogan |

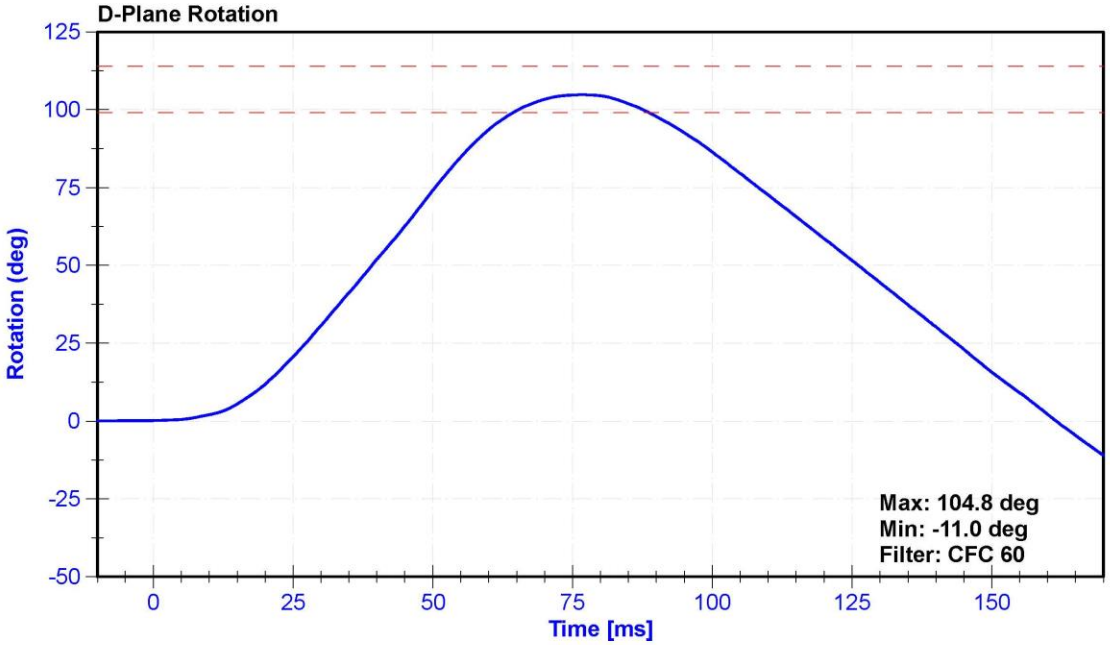
**Results**

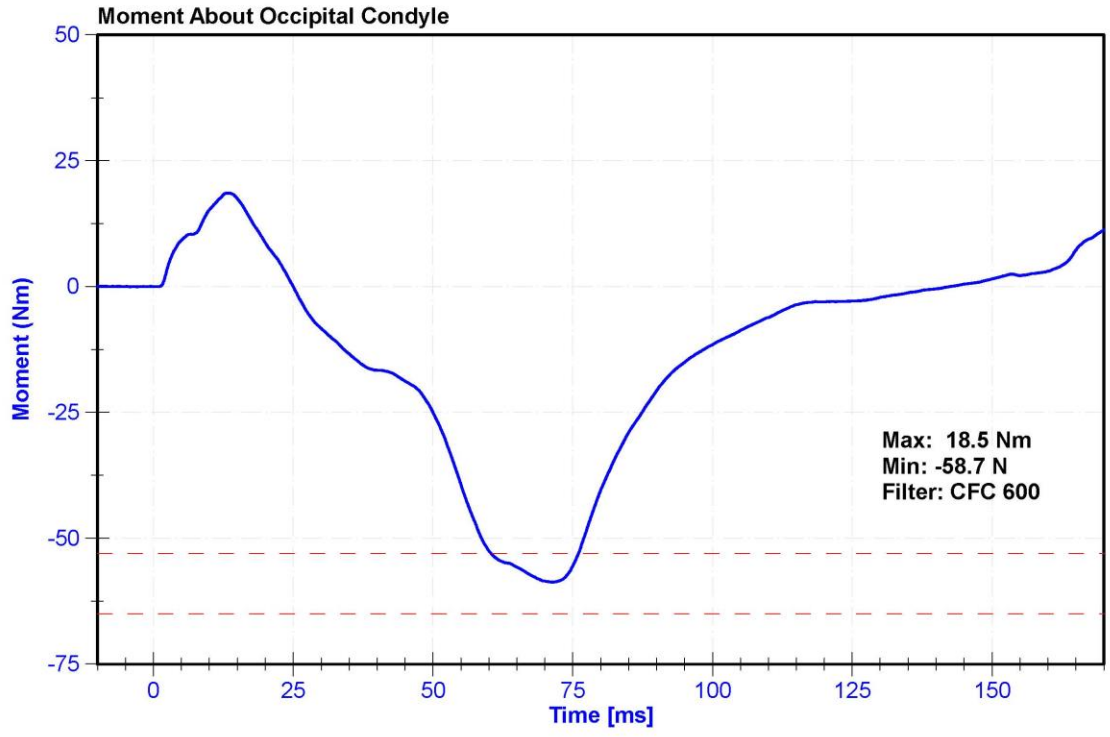
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | ºC | 21.3 | Pass |
| Humidity | 10 | 70 | % | 32.4 | Pass |
| Velocity | 5.95 | 6.19 | m/s | 6.016 | Pass |
| Pendulum Impulse at 10ms | 1.5 | 1.9 | m/s | 1.60 | Pass |
| Pendulum Impulse at 20ms | 3.1 | 3.9 | m/s | 3.31 | Pass |
| Pendulum Impulse at 30ms | 4.6 | 5.6 | m/s | 4.82 | Pass |
| D Plane Rotation | 99 | 114 | deg | 104.8 | Pass |
| Moment During Rotation Interval | -65 | -53 | Nm | -58.7 | Pass |
| Moment Decay to -10Nm | 94 | 114 | ms | 102.8 | Pass |

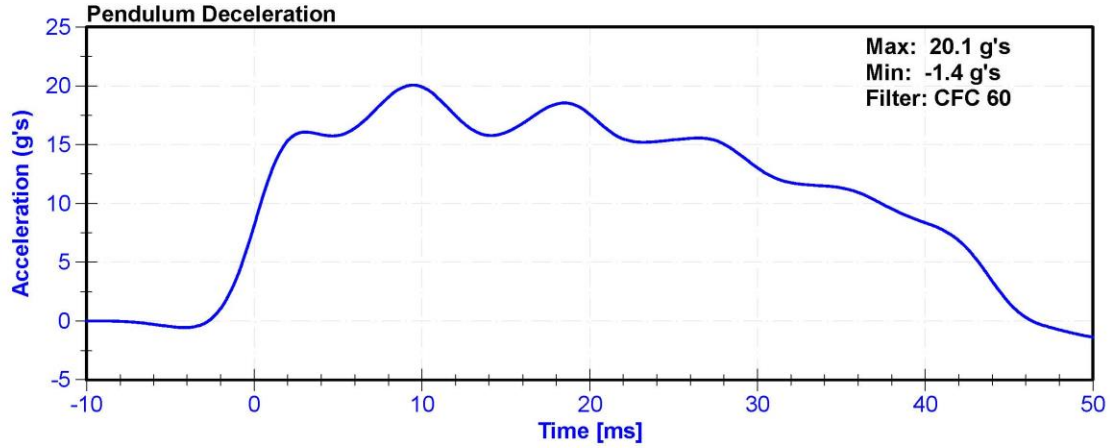
**Transducer Calibrations**

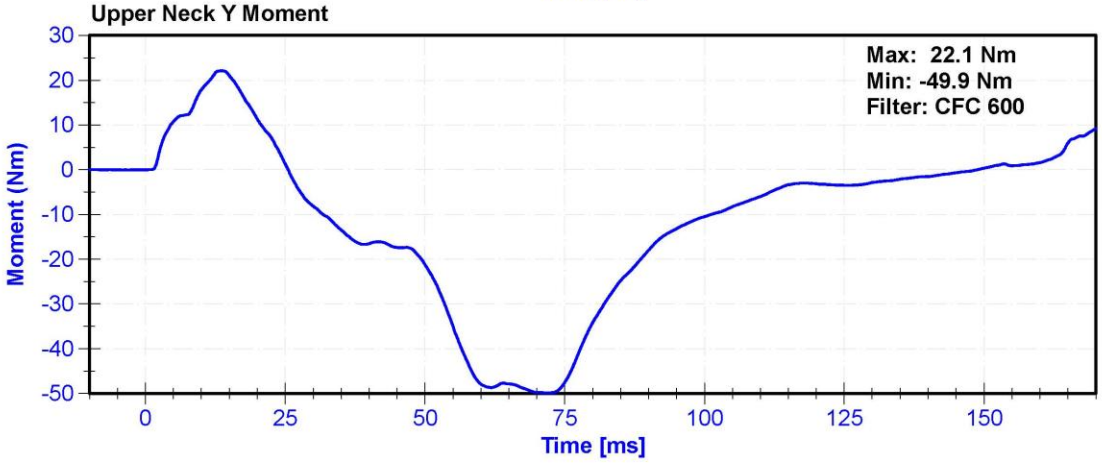
| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7231CT | AC-C16503 Striker | 2/5/2021 | 2/5/2022 |
| Pendulum Potentiometer | ETI SP22G | DS-LABPOT1 | 9/17/2020 | 9/17/2021 |
| Condyle Potentiometer | ETI SP22G | DS-LABPOT2 | 9/17/2020 | 9/17/2021 |
| Upper Neck Load Cell | FTSS 1716 | LC-851 Fx | 7/9/2020 | 7/9/2021 |

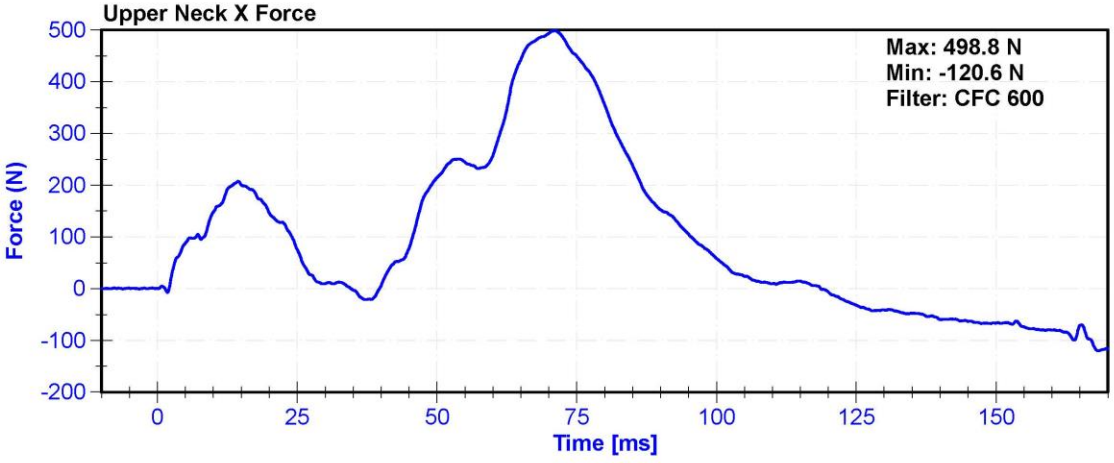



D-Plane Rotation
Rotation (deg)
125
100
75
50
25
0
-25
-50
0
25
50
75
100
125
150
Time [ms]
Max: 104.8 deg
Min: -11.0 deg
Filter: CFC 60


Moment About Occipital Condyle
Moment (Nm)
50
25
0
-25
-50
-75
0
25
50
75
100
125
150
Time [ms]
Max: 18.5 Nm
Min: -58.7 N
Filter: CFC 600


Pendulum Deceleration
Max: 20.1 g's
Min: -1.4 g's
Filter: CFC 60
Acceleration (g's)
Time [ms]


Upper Neck Y Moment
Max: 22.1 Nm
Min: -49.9 Nm
Filter: CFC 600
Moment (Nm)
Time [ms]


Upper Neck X Force
Max: 498.8 N
Min: -120.6 N
Filter: CFC 600
Force (N)
Time [ms]

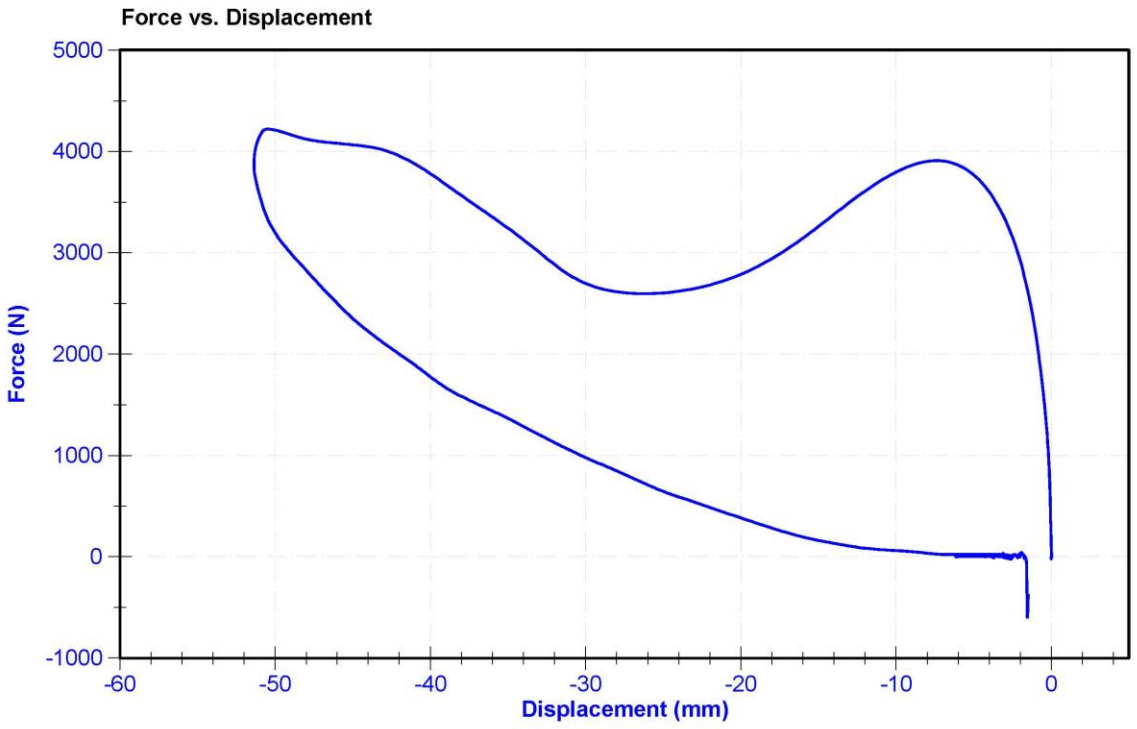
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | E. Helenbrook |
| ATD Serial Number | 288 | Laboratory Supervisor | K. Brogan |

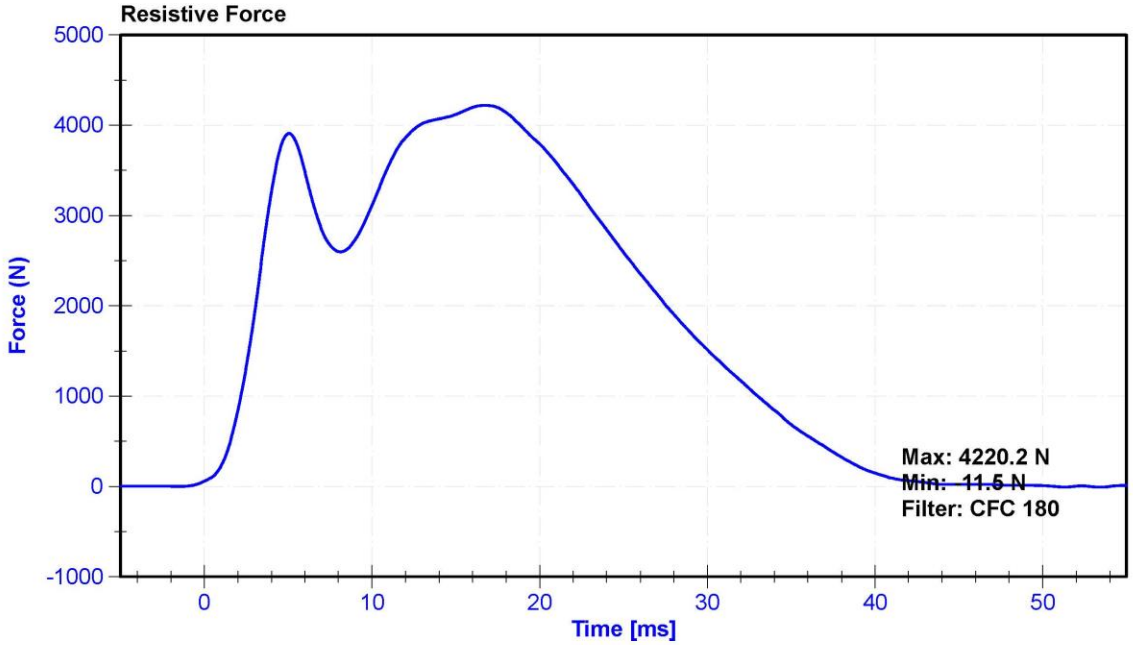
**Results**

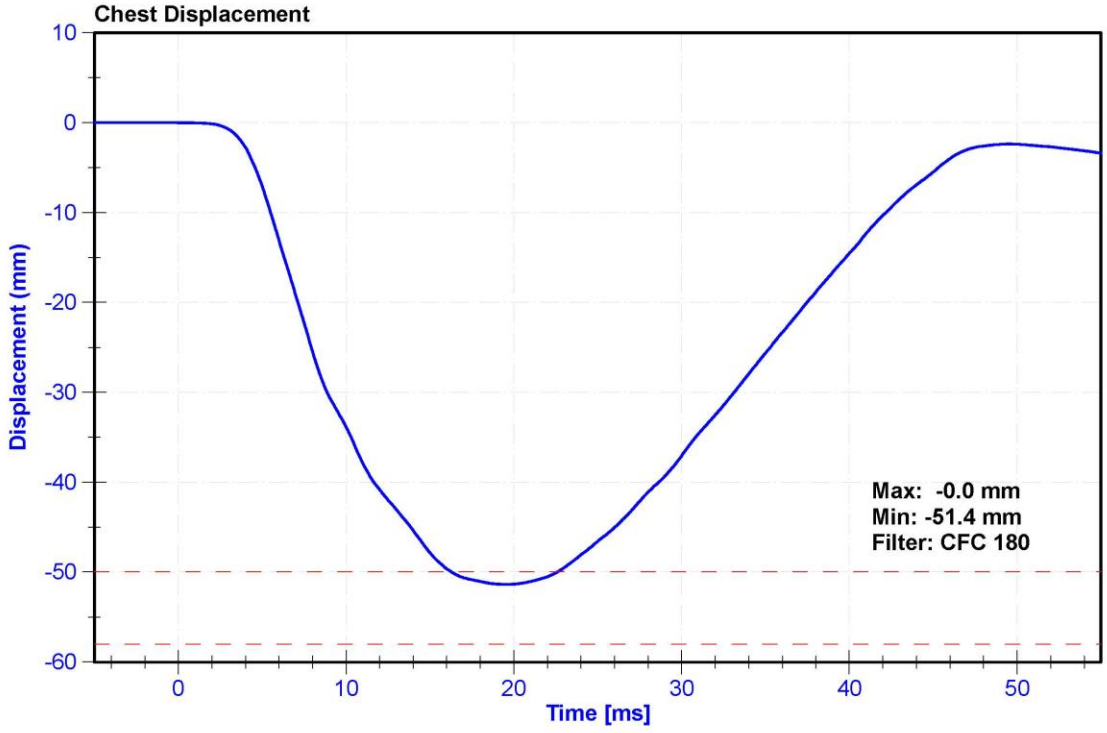
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | ºC | 21.5 | Pass |
| Humidity | 10 | 70 | % | 32.3 | Pass |
| Velocity | 6.59 | 6.83 | m/s | 6.598 | Pass |
| Chest Deflection | -58 | -50 | mm | -51.4 | Pass |
| Maximum Resistive Force (50 to 58mm) | 3900 | 4400 | N | 4220.2 | Pass |
| Maximum Resistive Force (18 to 50mm) | 0 | 4600 | N | 4208.3 | Pass |
| Hysteresis | 69 | 85 | % | 70.2 | Pass |

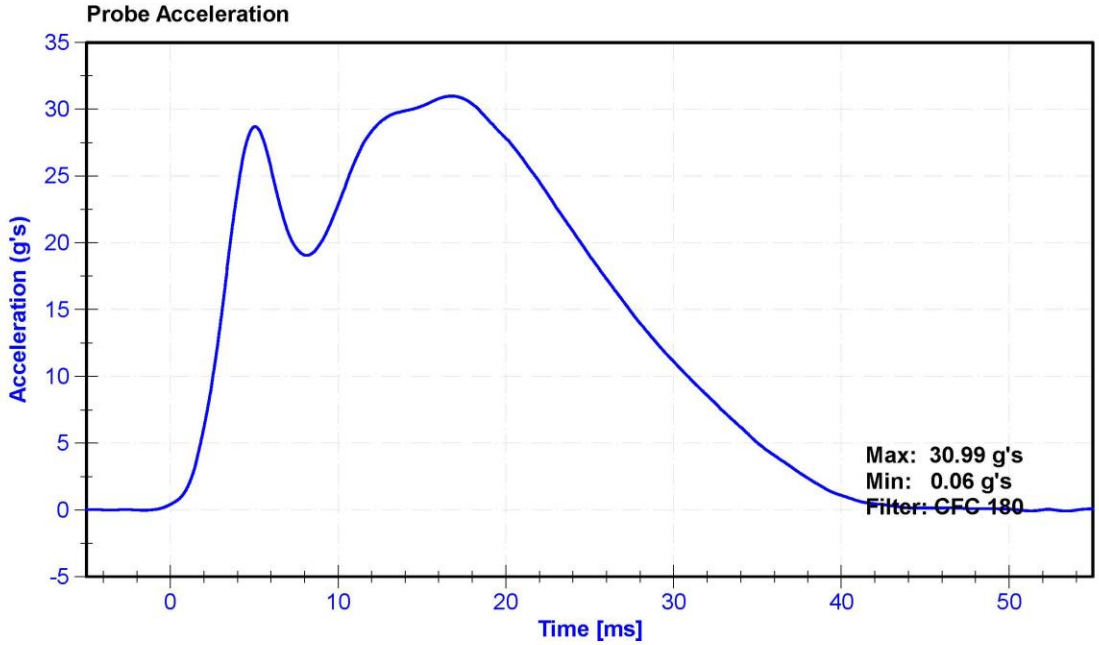
**Transducer Calibrations**

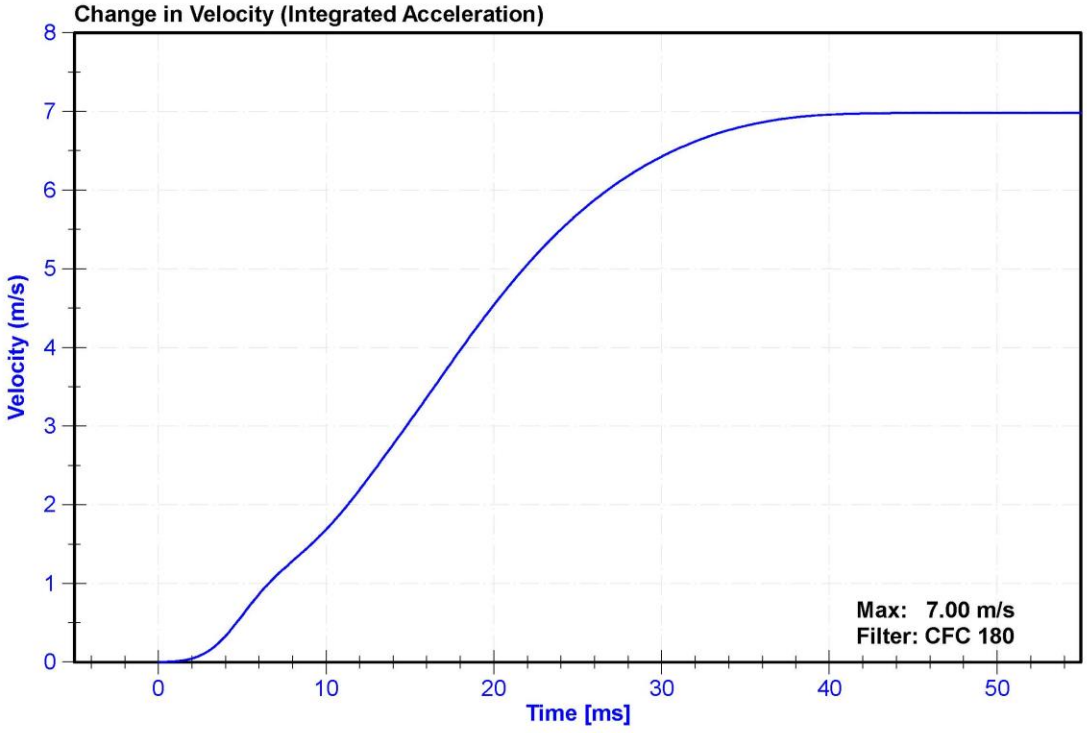
| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | MSI 64C-2000 | A278994 | 12/3/2020 | 12/3/2021 |
| Chest Potentiometer | SERVO 14CB1-2897 | DS-288GFE | 1/21/2021 | 7/22/2021 |




Resistive Force
Force (N)
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50
Time [ms]
Max: 4220.2 N
Min: -11.5 N
Filter: CFC 180


Chest Displacement
Displacement (mm)
10
0
-10
-20
-30
-40
-50
-60
0
10
20
30
40
50
Time [ms]
Max: -0.0 mm
Min: -51.4 mm
Filter: CFC 180


Probe Acceleration
Acceleration (g's)
35
30
25
20
15
10
5
0
-5
0
10
20
30
40
50
Time [ms]
Max: 30.99 g's
Min: 0.06 g's
Filter: CFC 180


Change in Velocity (Integrated Acceleration)
Velocity (m/s)
8
7
6
5
4
3
2
1
0
0
10
20
30
40
50
Time [ms]
Max: 7.00 m/s
Filter: CFC 180

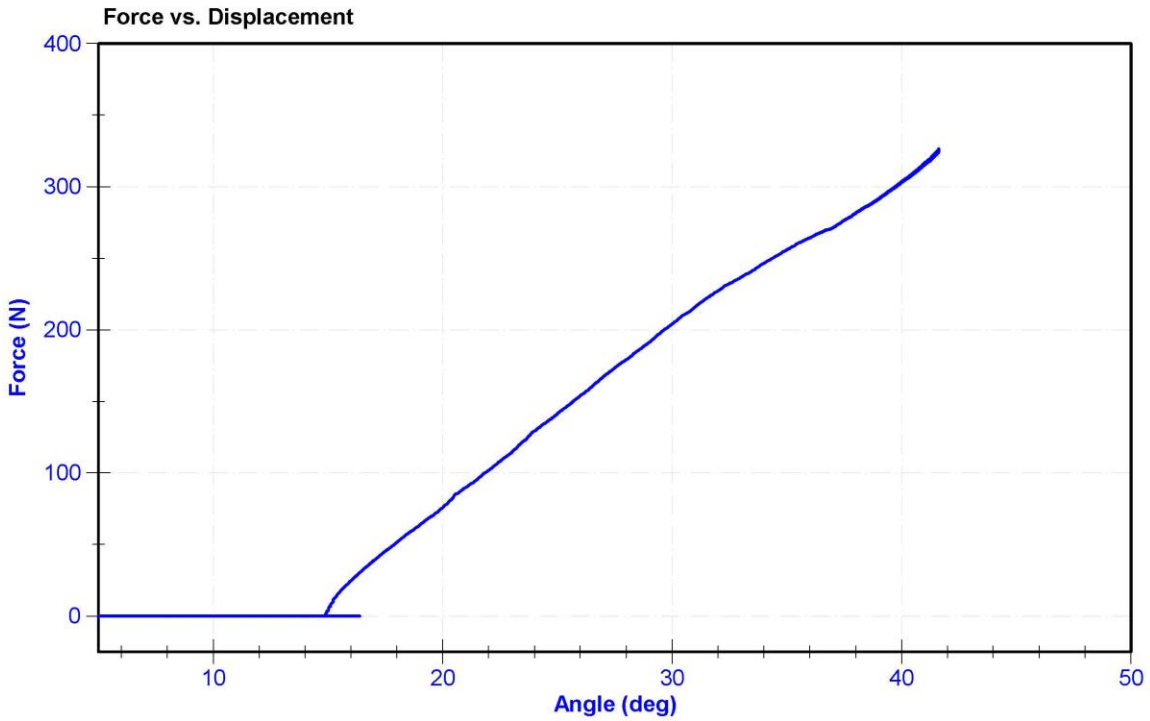
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | S. Vacanti |
| ATD Serial Number | 288 | Laboratory Supervisor | K. Brogan |

**Results**

| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 18.6 | 25.6 | ºC | 21.5 | Pass |
| Humidity | 10 | 70 | % | 32 | Pass |
| Initial Angle | 0 | 20 | deg | 14.8 | Pass |
| Force at 45 Degrees | 320 | 390 | N | 370.8 | Pass |
| Return Angle Relative to Initial | 0 | 8 | deg | 3.7 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Potentiometer | Seika.de N4C-1 | DS-1905226 | 2020-10-12 | 2021-10-12 |
| Load Cell | Interface SML-200 | LC-493319 | 2020-10-08 | 2021-10-08 |



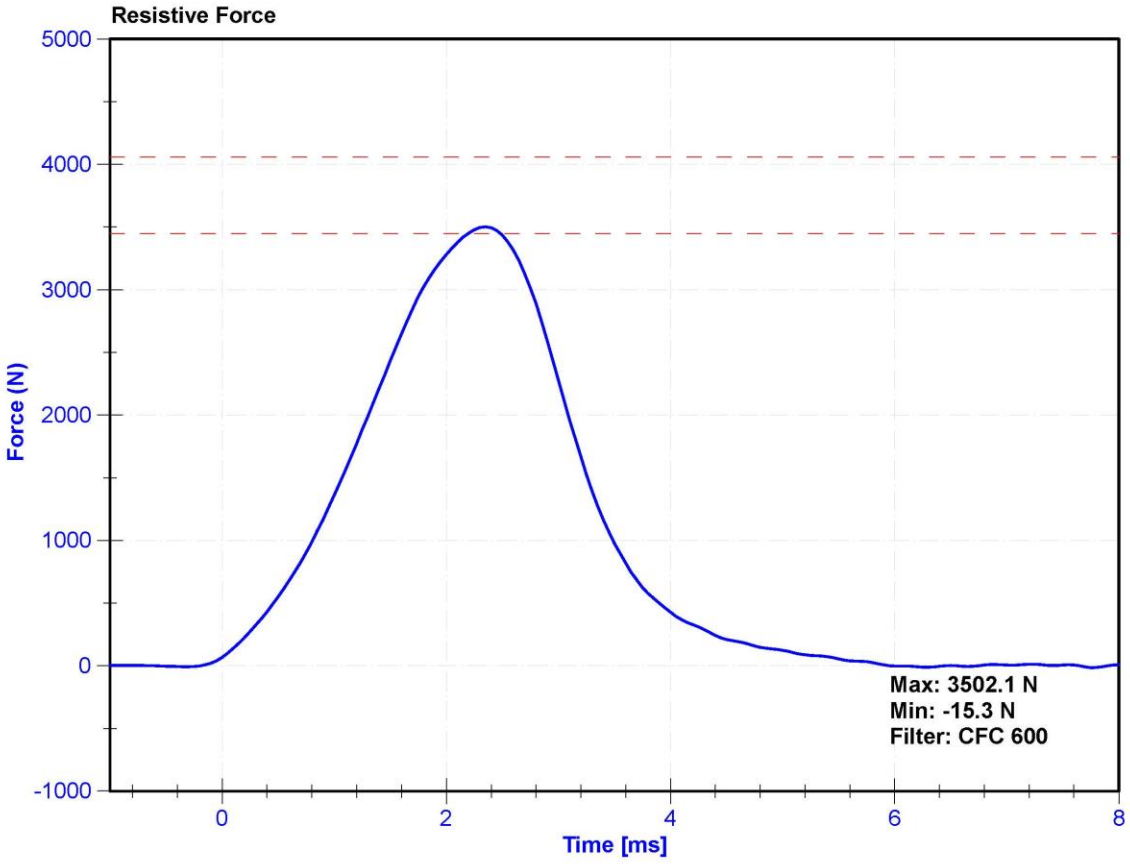
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | E. Helenbrook |
| ATD Serial Number | 288 | Laboratory Supervisor | K. Brogan |

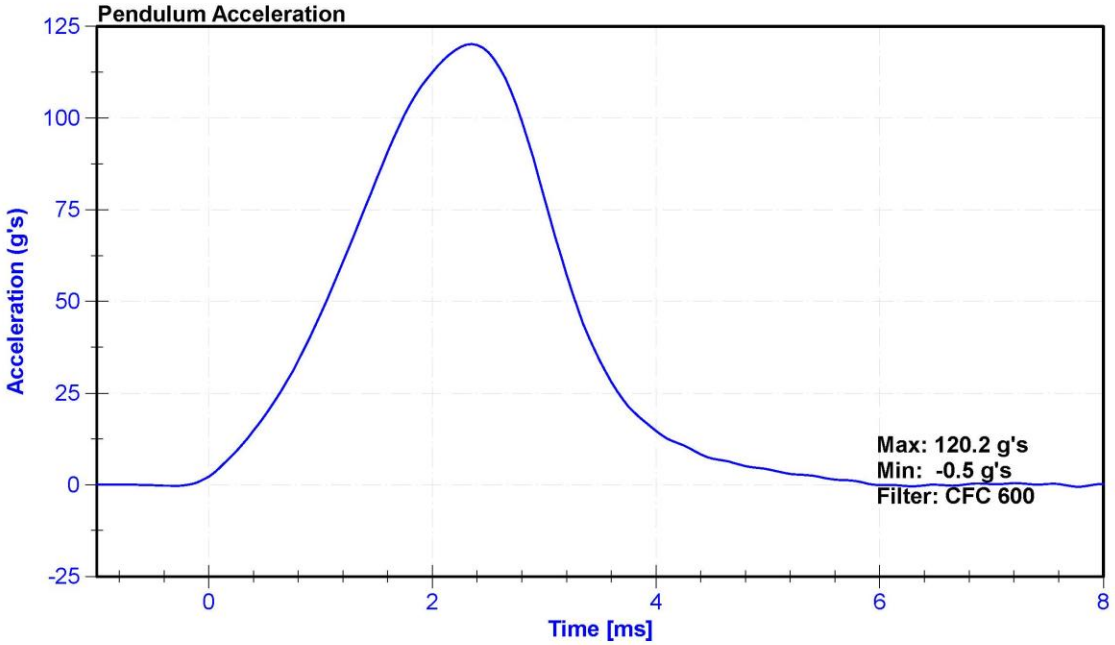
**Results**

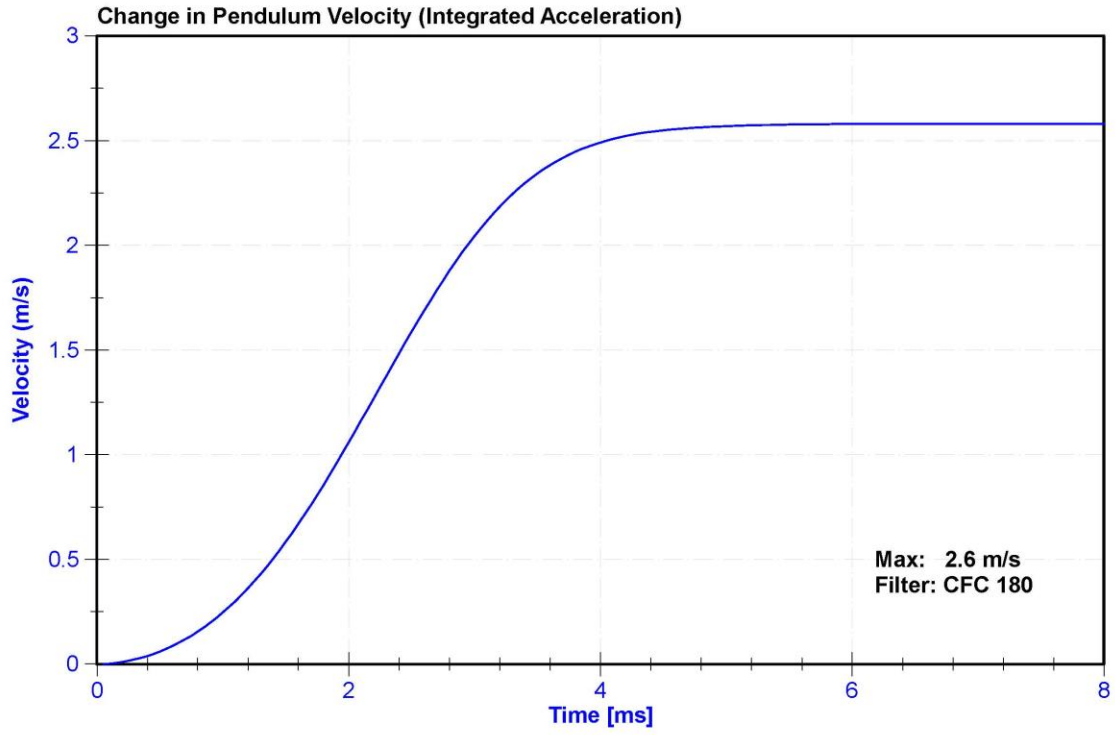
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 18.9 | 25.6 | ºC | 21.5 | Pass |
| Humidity | 10 | 70 | % | 34.4 | Pass |
| Velocity | 2.07 | 2.13 | m/s | 2.113 | Pass |
| Resistive Force | 3450 | 4060 | N | 3502.1 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7264C-2K-TZ2 | T25885 | 2/2/2021 | 2/2/2022 |




Pendulum Acceleration
Acceleration (g's)
125
100
75
50
25
0
-25
0
2
4
6
8
Time [ms]
Max: 120.2 g's
Min: -0.5 g's
Filter: CFC 600


Change in Pendulum Velocity (Integrated Acceleration)
Velocity (m/s)
3
2.5
2
1.5
1
0.5
0
0
2
4
6
8
Time [ms]
Max: 2.6 m/s
Filter: CFC 180

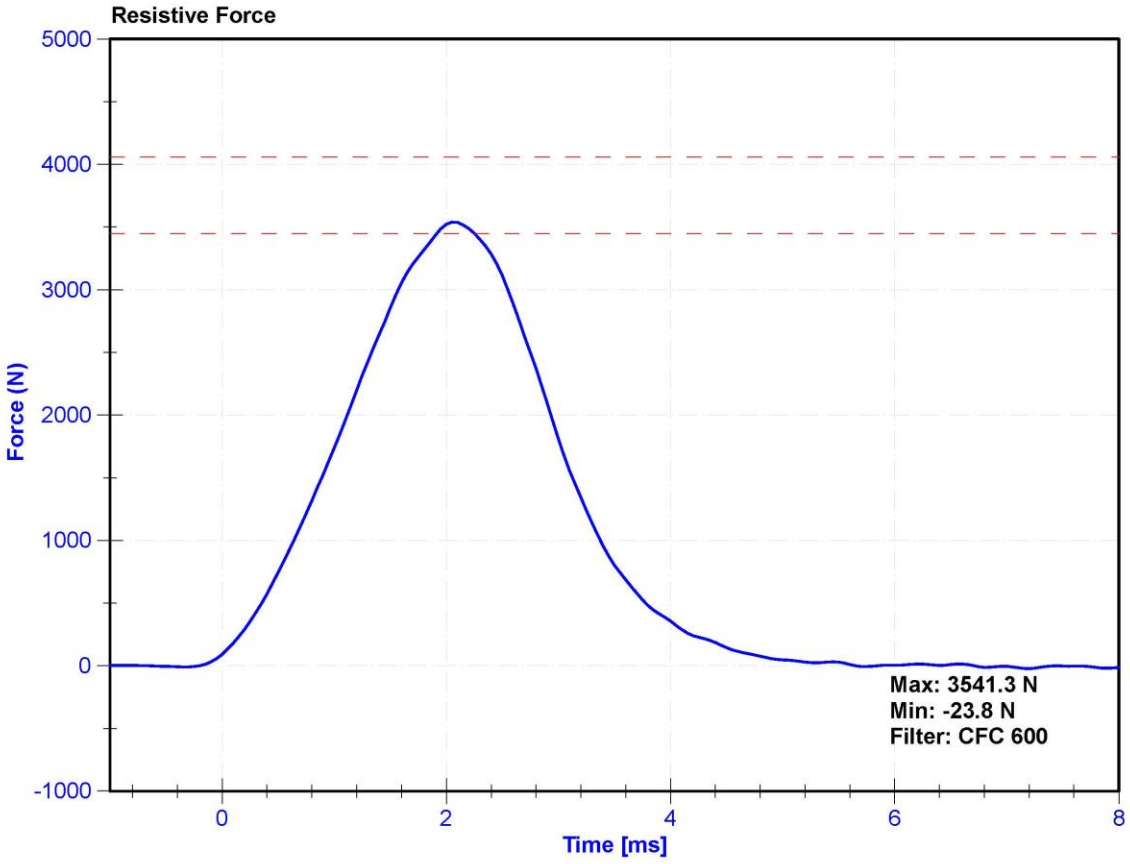
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | E. Helenbrook |
| ATD Serial Number | 288 | Laboratory Supervisor | K. Brogan |

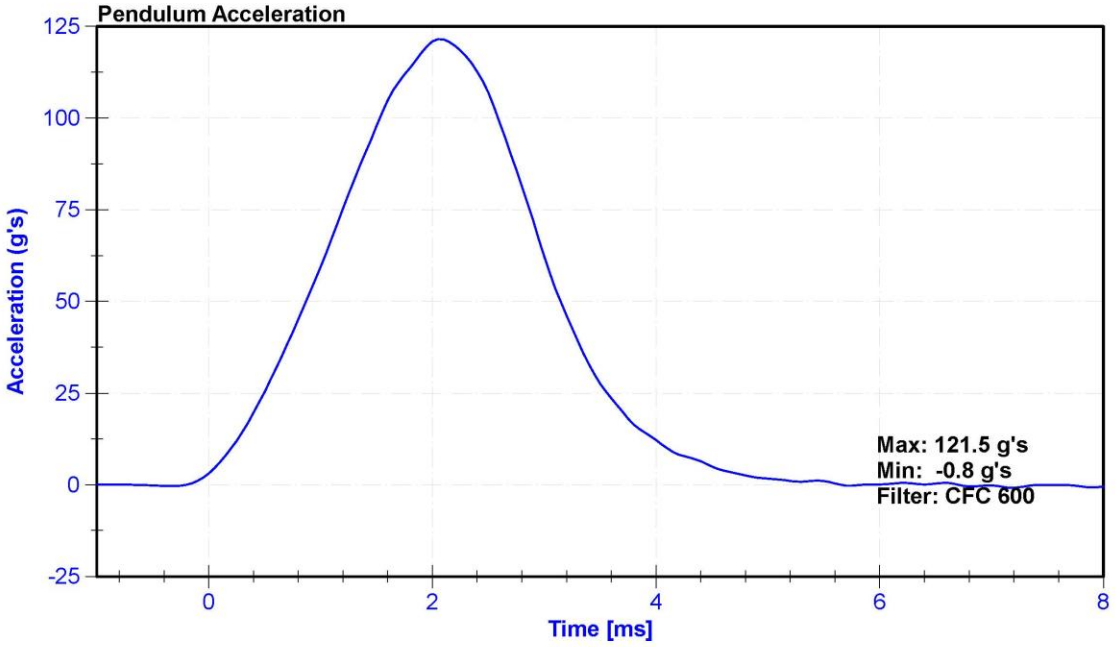
**Results**

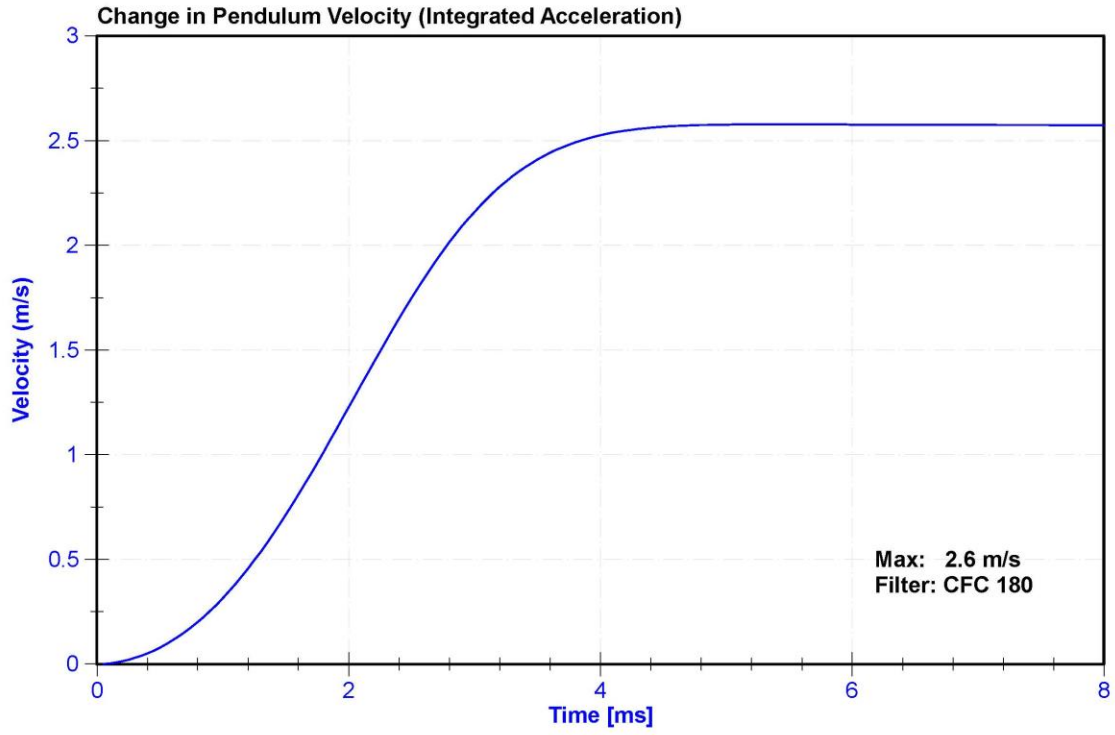
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 18.9 | 25.6 | ºC | 21.5 | Pass |
| Humidity | 10 | 70 | % | 34.3 | Pass |
| Velocity | 2.07 | 2.13 | m/s | 2.090 | Pass |
| Resistive Force | 3450 | 4060 | N | 3541.3 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7264C-2K-TZ2 | T25885 | 2/2/2021 | 2/2/2022 |




Pendulum Acceleration
Acceleration (g's)
125
100
75
50
25
0
-25
0
2
4
6
8
Time [ms]
Max: 121.5 g's
Min: -0.8 g's
Filter: CFC 600


Change in Pendulum Velocity (Integrated Acceleration)
Velocity (m/s)
3
2.5
2
1.5
1
0.5
0
0
2
4
6
8
Time [ms]
Max: 2.6 m/s
Filter: CFC 180

**CALIBRATION TEST RESULTS**

**POST-TEST**

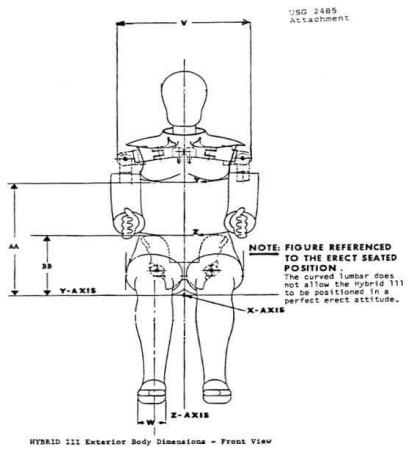
**HYBRID III 50$^{TH}$ PERCENTILE MALE - DRIVER ATD**

**SERIAL NO: 142**

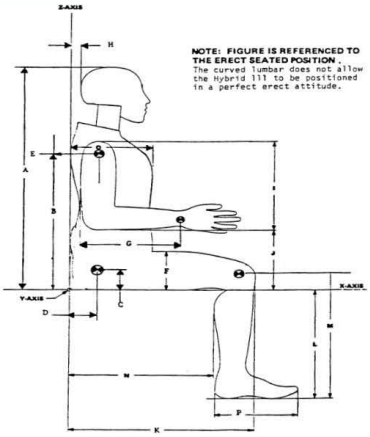
External Measurements - Hybrid 3 - 50th Male

Technician: K. Brogan  Date: 05/19/2021

Dummy Serial Number: 142



HYBRID III Exterior Body Dimensions - Front View



HYBRID III Exterior Body Dimensions - Side View

| Symbol | Description | Specification (in) | | Result (in) | Pass/Fail |
|---|---|---|---|---|---|
| A | Sitting Height | 34.6 | 35.0 | 34.7 | Pass |
| B | Shoulder Pivot Height | 19.9 | 20.5 | 20.3 | 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 | 8.6 | 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 | 38.8 | 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 |

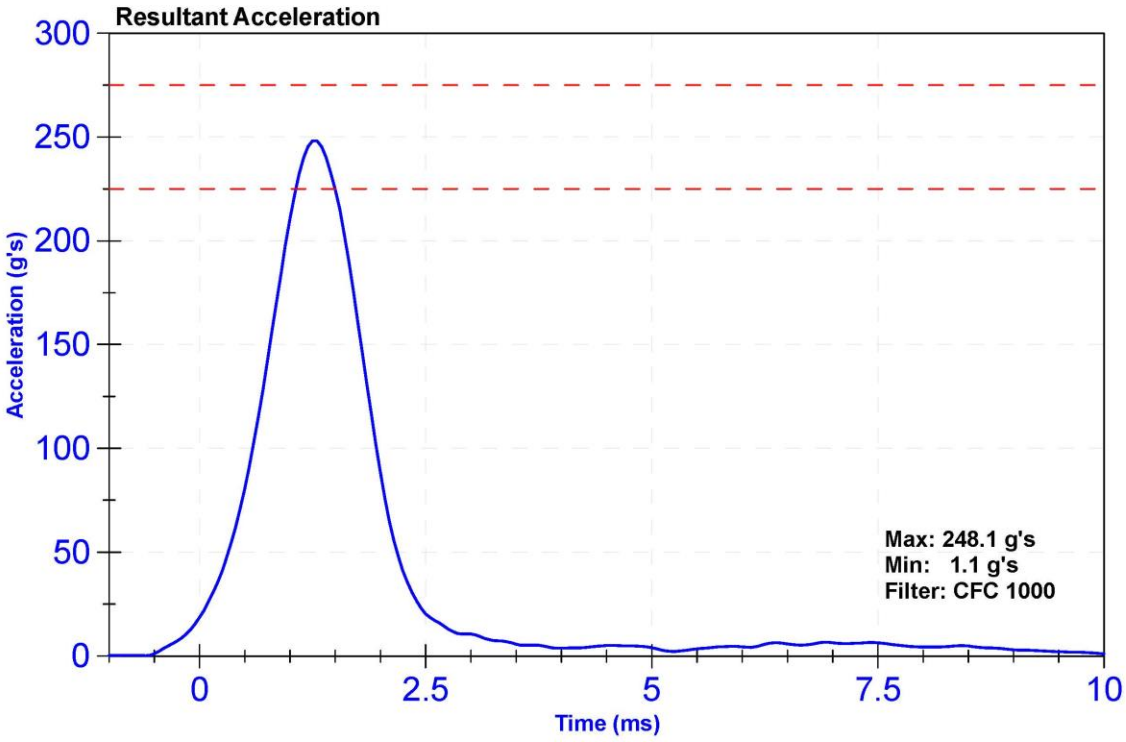
| | | | |
|---|---|---|---|
| ATD Manufacturer | Humanetics | Test Technician | C. Mantell |
| ATD Serial Number | 142 | Laboratory Supervisor | K. Brogan |

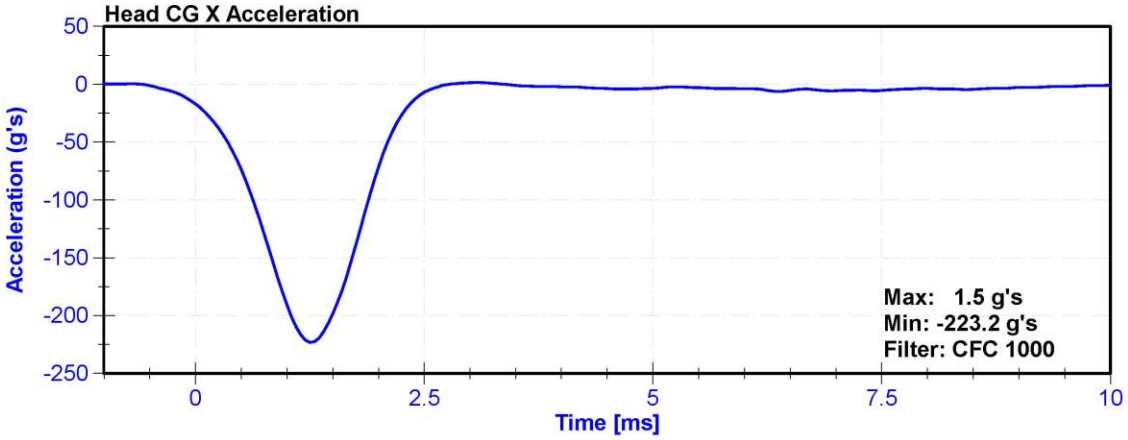
**Results**

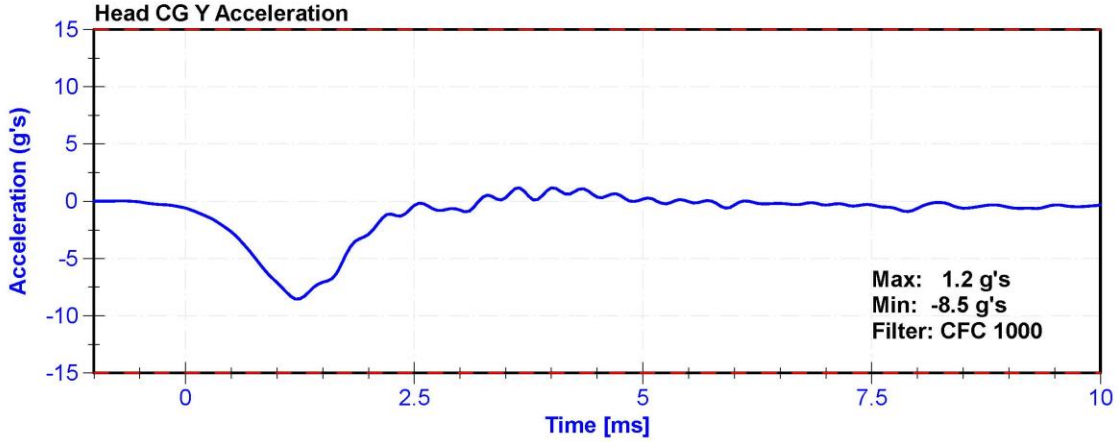
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 18.9 | 25.6 | ºC | 21.8 | Pass |
| Humidity | 10 | 70 | % | 40.1 | Pass |
| Resultant Acceleration | 225 | 275 | g's | 248.1 | Pass |
| Oscillation | 0 | 10 | % | 4.3 | Pass |
| Lateral Acceleration | -15 | 15 | g's | -8.5 | Pass |

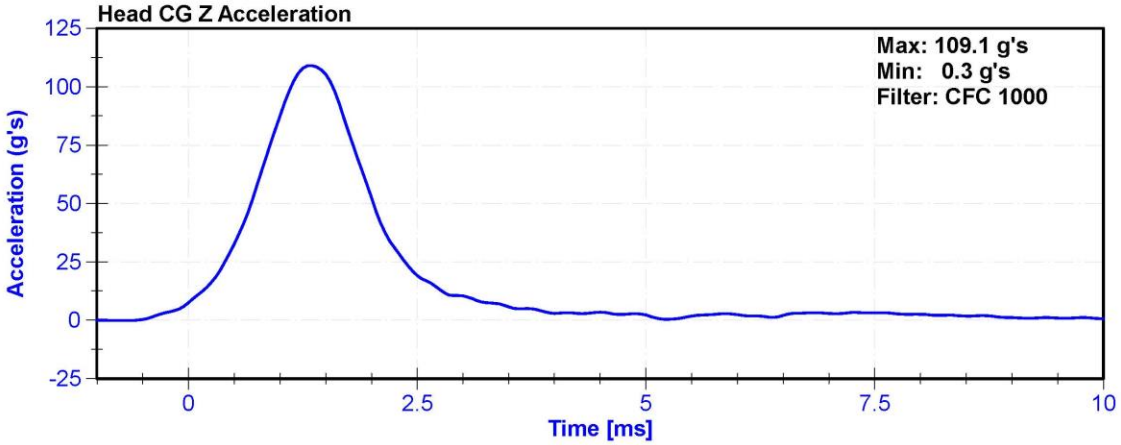
**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| X Accelerometer | ENDEVCO 7264 | P51681 | 5/11/2021 | 11/9/2021 |
| Y Accelerometer | ENDEVCO 7264 | P64151 | 5/11/2021 | 11/9/2021 |
| Z Accelerometer | ENDEVCO 7264 | P52114 | 5/11/2021 | 11/9/2021 |




Head CG X Acceleration
Acceleration (g's)
50
0
-50
-100
-150
-200
-250
0
2.5
5
7.5
10
Time [ms]
Max: 1.5 g's
Min: -223.2 g's
Filter: CFC 1000


Head CG Y Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]
Max: 1.2 g's
Min: -8.5 g's
Filter: CFC 1000


Head CG Z Acceleration
Acceleration (g's)
125
100
75
50
25
0
-25
0
2.5
5
7.5
10
Time [ms]
Max: 109.1 g's
Min: 0.3 g's
Filter: CFC 1000

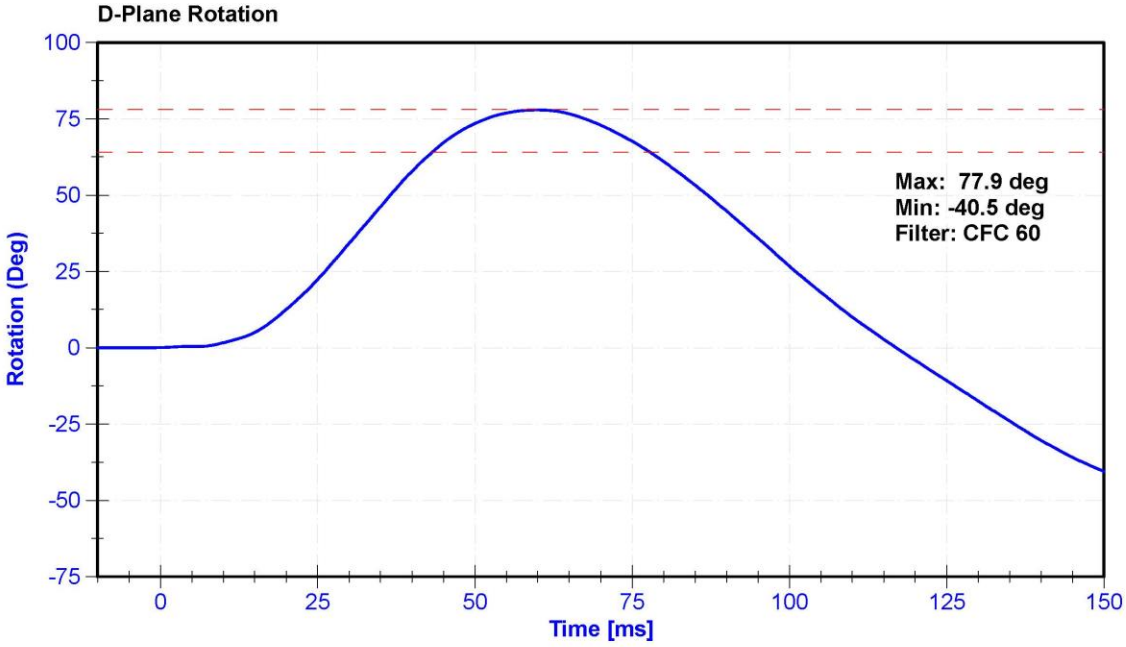
| | | | |
|---|---|---|---|
| ATD Manufacturer | Humanetics | Test Technician | C. Mantell |
| ATD Serial Number | 142 | Laboratory Supervisor | K. Brogan |

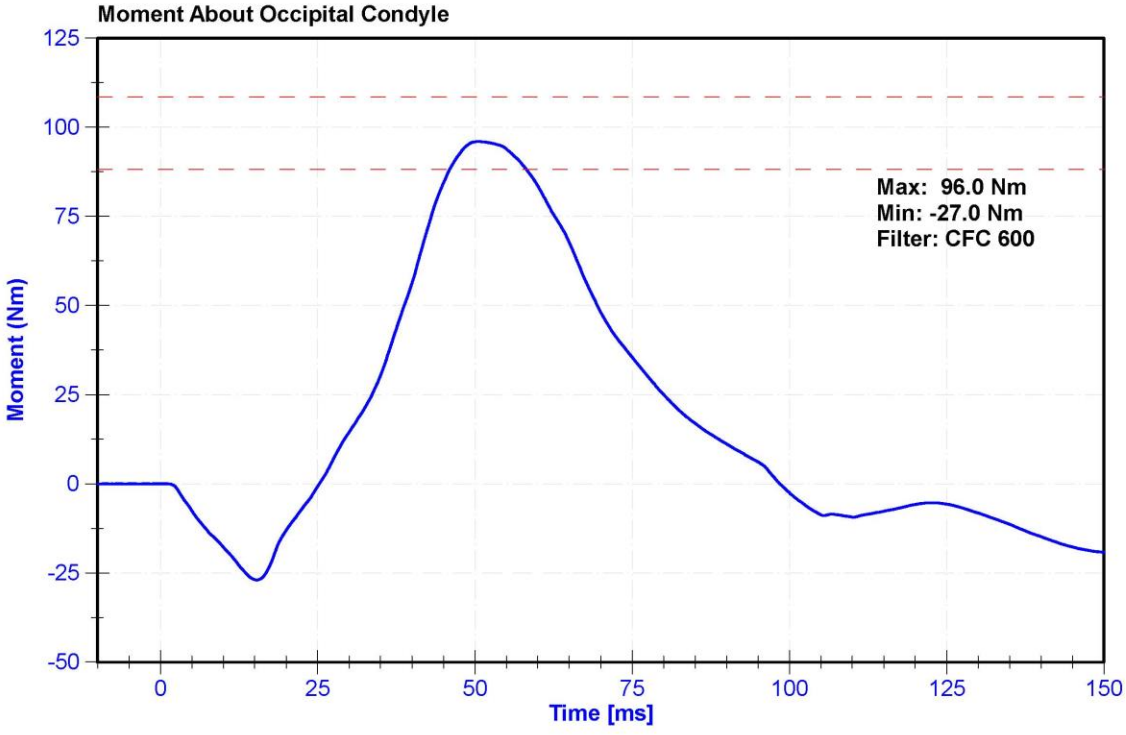
**Results**

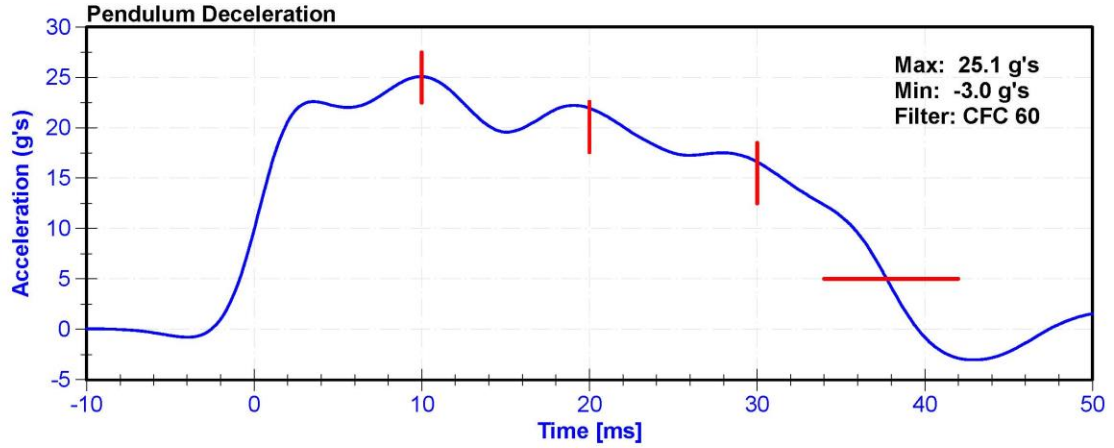
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | ºC | 21.4 | Pass |
| Humidity | 10 | 70 | % | 39.1 | Pass |
| Velocity | 6.89 | 7.13 | m/s | 6.922 | Pass |
| Pendulum Deceleration at 10ms | 22.5 | 27.5 | g's | 25.08 | Pass |
| Pendulum Deceleration at 20ms | 17.6 | 22.6 | g's | 21.94 | Pass |
| Pendulum Deceleration at 30ms | 12.5 | 18.5 | g's | 16.62 | Pass |
| Max. Pendulum Deceleration After 30ms | 0 | 29 | g's | 25.1 | Pass |
| Pendulum Deceleration Time to 5 g's | 34 | 42 | ms | 37.7 | Pass |
| Maximum D Plane Rotation | 64 | 78 | deg | 77.9 | Pass |
| Time to Maximum Rotation | 57 | 64 | ms | 59.8 | Pass |
| Rotation Decay to Zero | 113 | 127 | ms | 117.0 | Pass |
| Moment About Occipital Condyle | 88.1 | 108.4 | Nm | 95.97 | Pass |
| Time to Maximum Moment | 47 | 58 | ms | 50.5 | Pass |
| Moment Decay to Zero | 97 | 107 | ms | 98.5 | Pass |

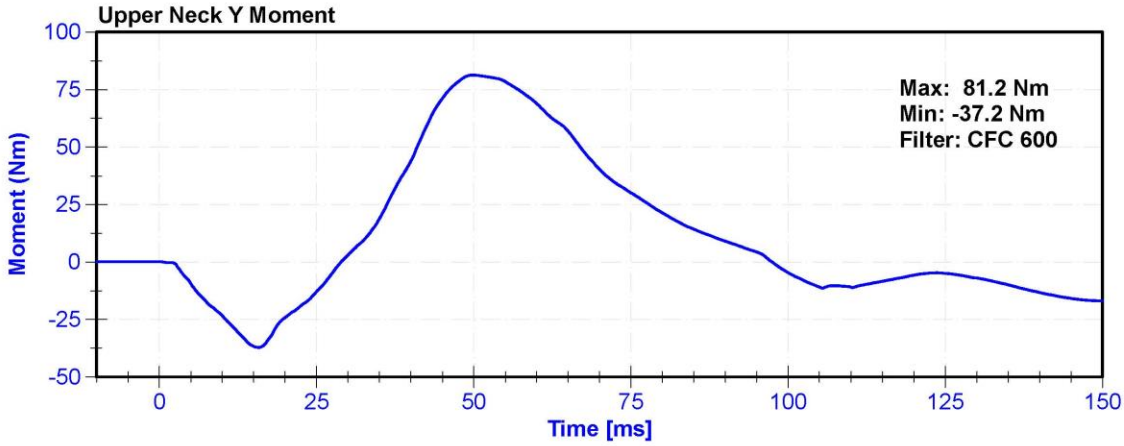
**Transducer Calibrations**

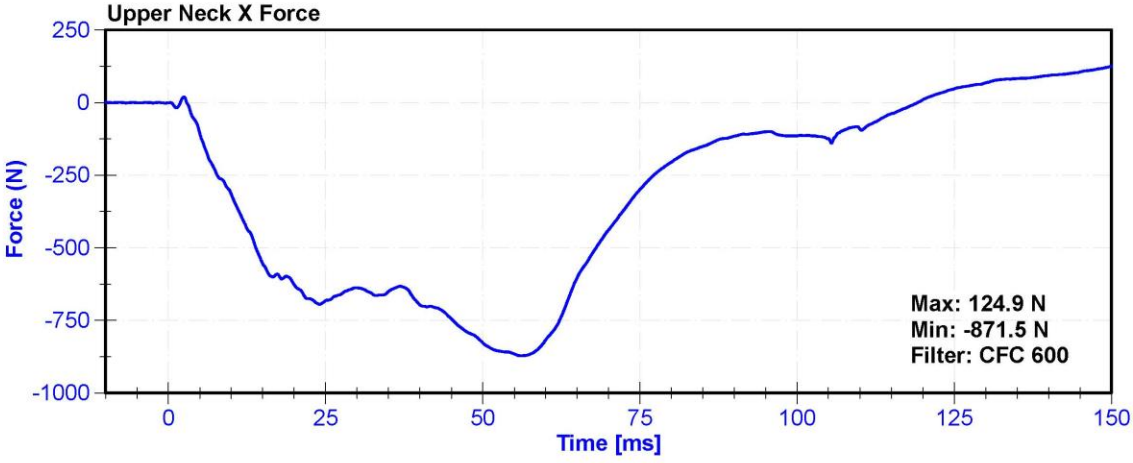
| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7231CT | AC-C16503 Striker | 2/5/2021 | 2/5/2022 |
| Pendulum Potentiometer | ETI SP22G | DS-LABPOT1 | 9/17/2020 | 9/17/2021 |
| Condyle Potentiometer | ETI SP22G | DS-LABPOT2 | 9/17/2020 | 9/17/2021 |
| Upper Neck Load Cell | DENTON 1716A | LC-2186Fx | 11/10/2020 | 11/10/2021 |


D-Plane Rotation
Rotation (Deg)
100
75
50
25
0
-25
-50
-75
0
25
50
75
100
125
150
Time [ms]
Max: 77.9 deg
Min: -40.5 deg
Filter: CFC 60


Moment About Occipital Condyle
Moment (Nm)
125
100
75
50
25
0
-25
-50
0
25
50
75
100
125
150
Time [ms]
Max: 96.0 Nm
Min: -27.0 Nm
Filter: CFC 600


Pendulum Deceleration
Max: 25.1 g's
Min: -3.0 g's
Filter: CFC 60
Acceleration (g's)
Time [ms]


Upper Neck Y Moment
Max: 81.2 Nm
Min: -37.2 Nm
Filter: CFC 600
Moment (Nm)
Time [ms]


Upper Neck X Force
Max: 124.9 N
Min: -871.5 N
Filter: CFC 600
Force (N)
Time [ms]

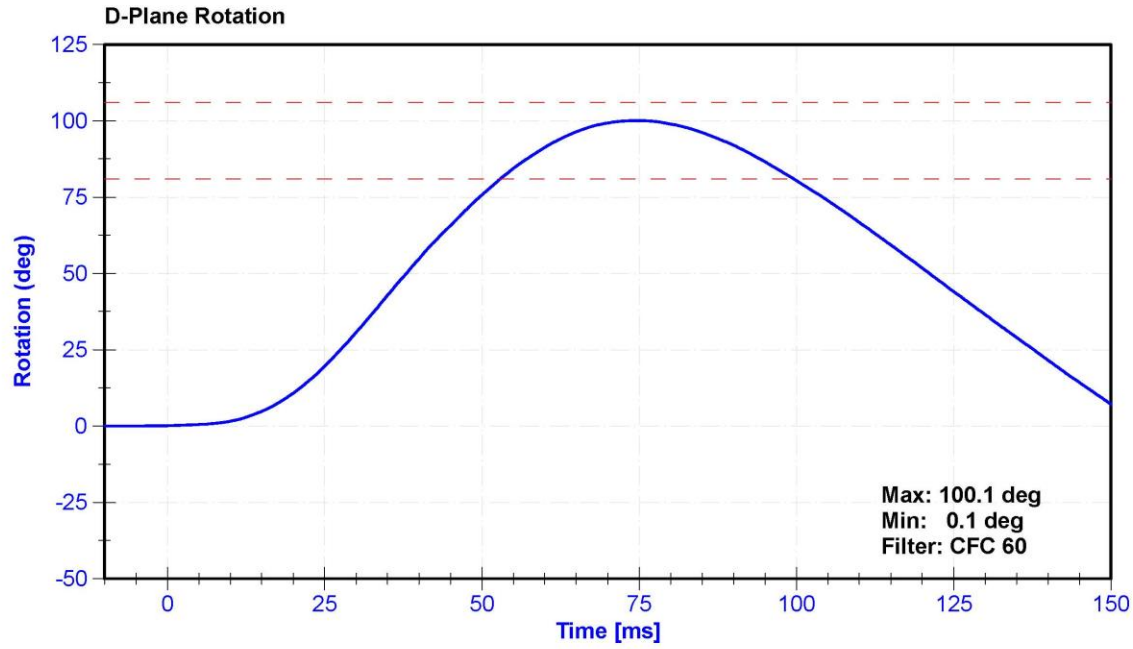
| | | | |
|---|---|---|---|
| ATD Manufacturer | Humanetics | Test Technician | C. Mantell |
| ATD Serial Number | 142 | Laboratory Supervisor | K. Brogan |

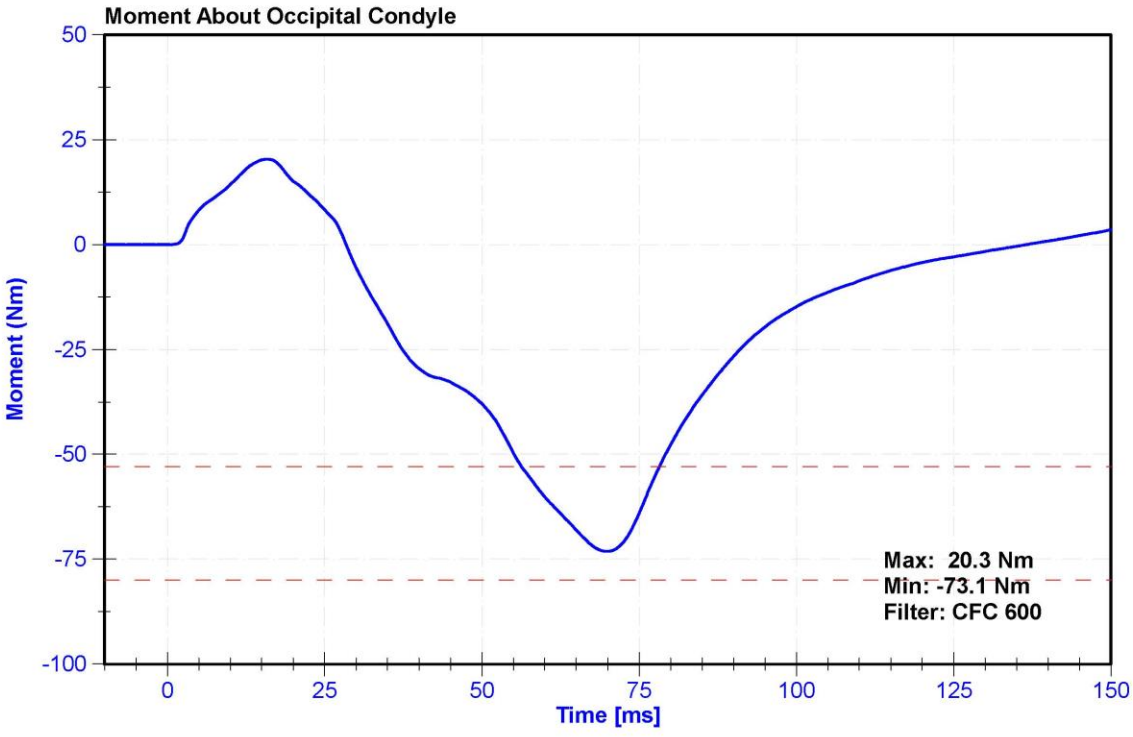
**Results**

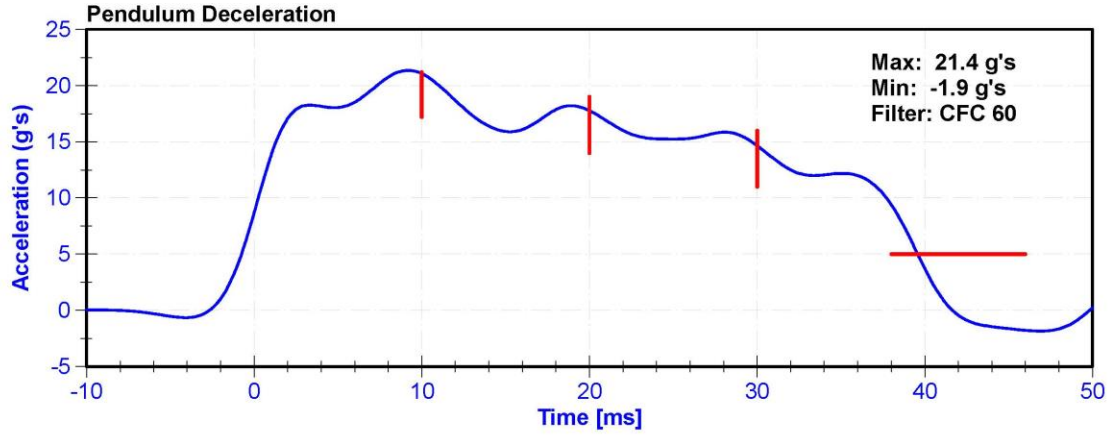
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | ºC | 21.6 | Pass |
| Humidity | 10 | 70 | % | 39.4 | Pass |
| Velocity | 5.94 | 6.19 | m/s | 6.007 | Pass |
| Pendulum Deceleration at 10ms | 17.2 | 21.2 | g's | 21.07 | Pass |
| Pendulum Deceleration at 20ms | 14 | 19 | g's | 17.8 | Pass |
| Pendulum Deceleration at 30ms | 11 | 16 | g's | 14.7 | Pass |
| Max. Pendulum Deceleration After 30ms | 0 | 22 | g's | 21.4 | Pass |
| Pendulum Deceleration Time to 5 g's | 38 | 46 | ms | 39.6 | Pass |
| Maximum D Plane Rotation | 81 | 106 | deg | 100.1 | Pass |
| Time to Maximum Rotation | 72 | 82 | ms | 74.7 | Pass |
| Rotation Decay to Zero | 147 | 174 | ms | 155.0 | Pass |
| Minimum Moment About OC | -80 | -52.9 | Nm | -73.09 | Pass |
| Time to Minimum Moment | 65 | 79 | ms | 70.1 | Pass |
| Moment Decay to Zero | 120 | 148 | ms | 136.7 | Pass |

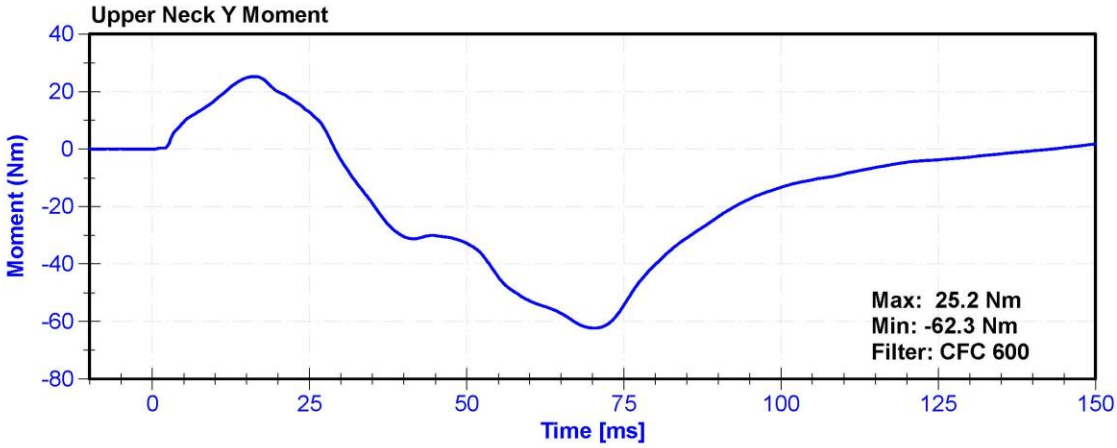
**Transducer Calibrations**

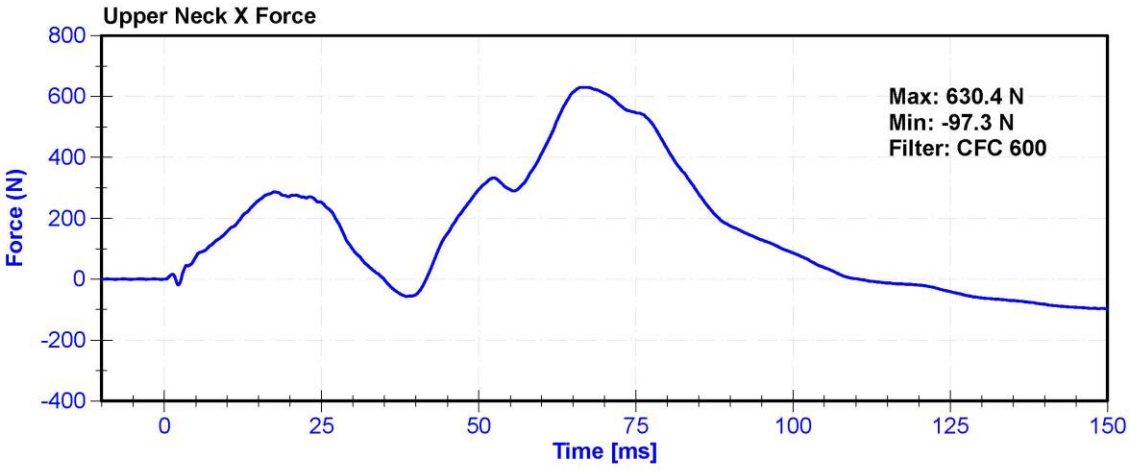
| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7231CT | AC-C16503 Striker | 2/5/2021 | 2/5/2022 |
| Pendulum Potentiometer | ETI SP22G | DS-LABPOT1 | 9/17/2020 | 9/17/2021 |
| Condyle Potentiometer | ETI SP22G | DS-LABPOT2 | 9/17/2020 | 9/17/2021 |
| Upper Neck Load Cell | DENTON 1716A | LC-2186Fx | 11/10/2020 | 11/10/2021 |


D-Plane Rotation
Rotation (deg)
125
100
75
50
25
0
-25
-50
0
25
50
75
100
125
150
Time [ms]
Max: 100.1 deg
Min: 0.1 deg
Filter: CFC 60


Moment About Occipital Condyle
Moment (Nm)
50
25
0
-25
-50
-75
-100
0
25
50
75
100
125
150
Time [ms]
Max: 20.3 Nm
Min: -73.1 Nm
Filter: CFC 600


Pendulum Deceleration
Max: 21.4 g's
Min: -1.9 g's
Filter: CFC 60
Acceleration (g's)
25
20
15
10
5
0
-5
-10
0
10
20
30
40
50
Time [ms]


Upper Neck Y Moment
Max: 25.2 Nm
Min: -62.3 Nm
Filter: CFC 600
Moment (Nm)
40
20
0
-20
-40
-60
-80
0
25
50
75
100
125
150
Time [ms]


Upper Neck X Force
Max: 630.4 N
Min: -97.3 N
Filter: CFC 600
Force (N)
800
600
400
200
0
-200
-400
0
25
50
75
100
125
150
Time [ms]

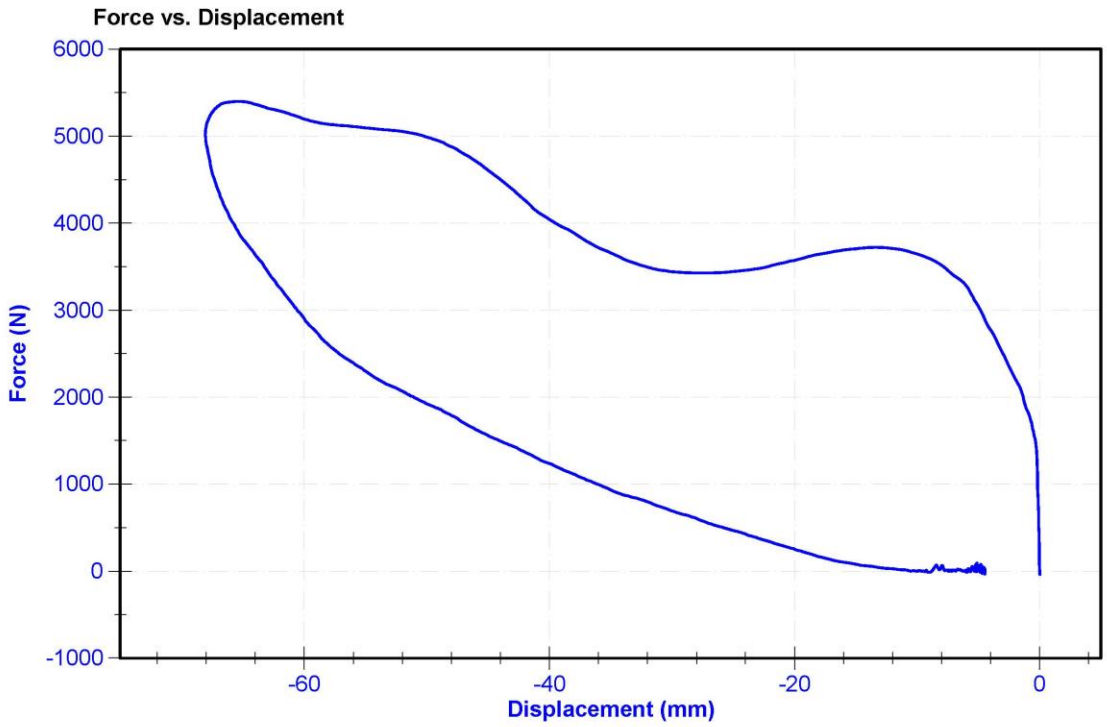
| | | | |
|---|---|---|---|
| ATD Manufacturer | Humanetics | Test Technician | C. Mantell |
| ATD Serial Number | 142 | Laboratory Supervisor | K. Brogan |

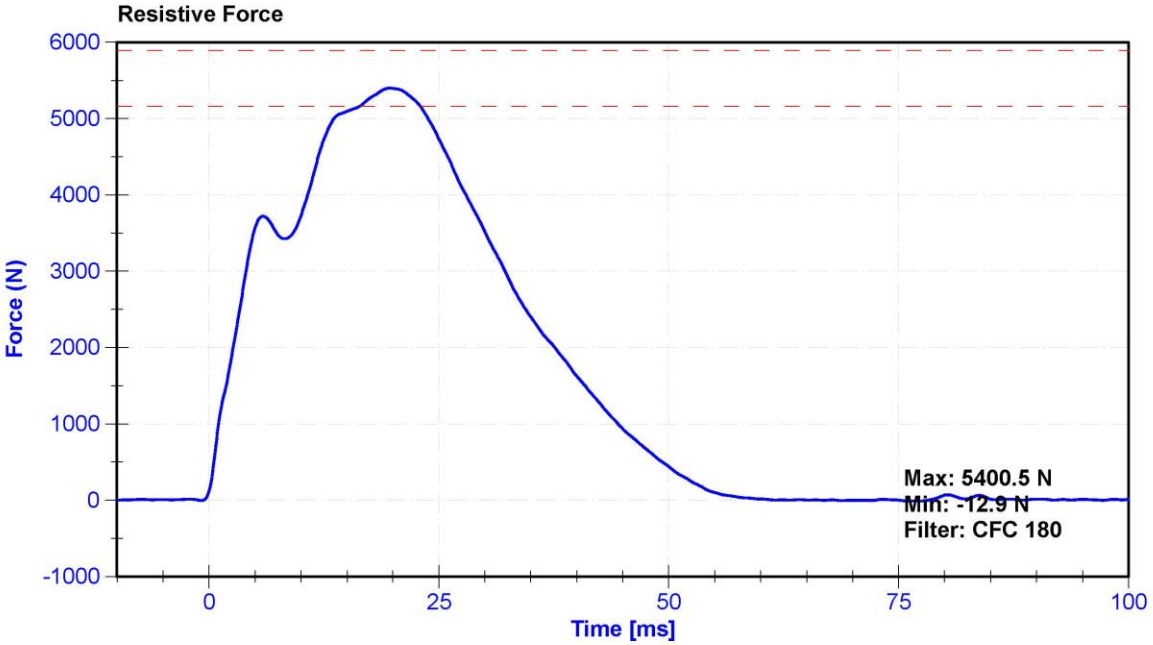
**Results**

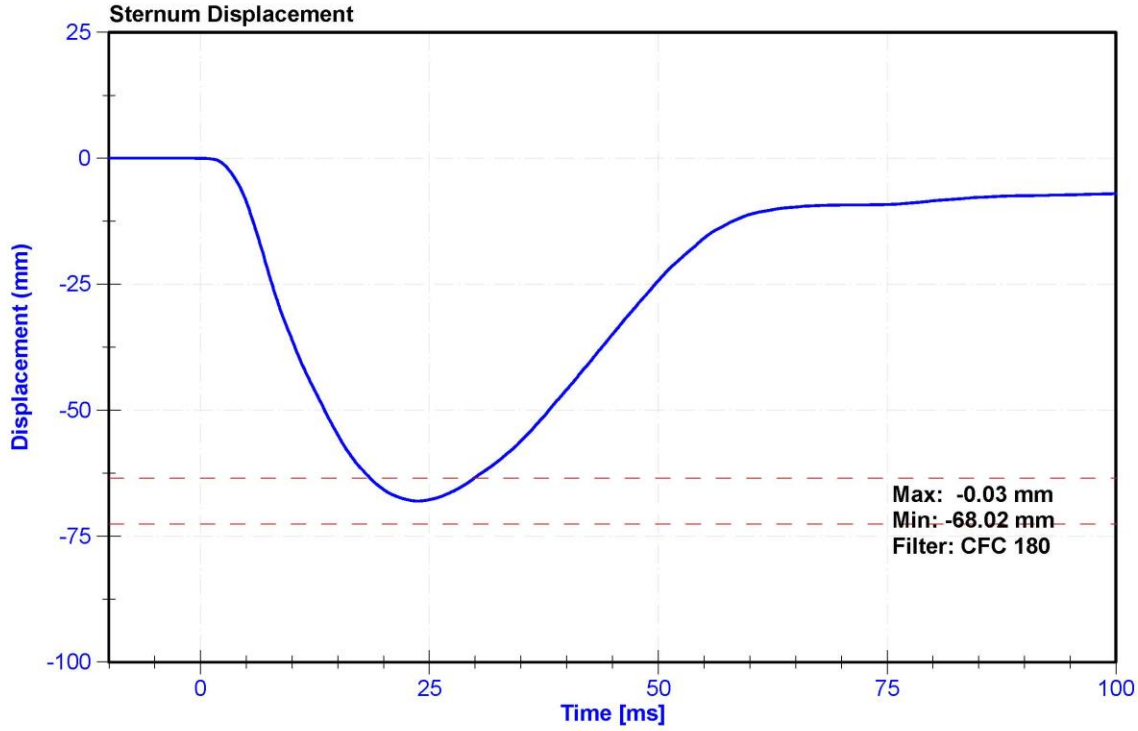
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | ºC | 21.7 | Pass |
| Humidity | 10 | 70 | % | 40.1 | Pass |
| Velocity | 6.59 | 6.83 | m/s | 6.644 | Pass |
| Chest Displacement | -72.6 | -63.5 | mm | -68.02 | Pass |
| Resistive Force | 5160 | 5894 | N | 5400.5 | Pass |
| Hysteresis | 65 | 85 | % | 69.6 | Pass |

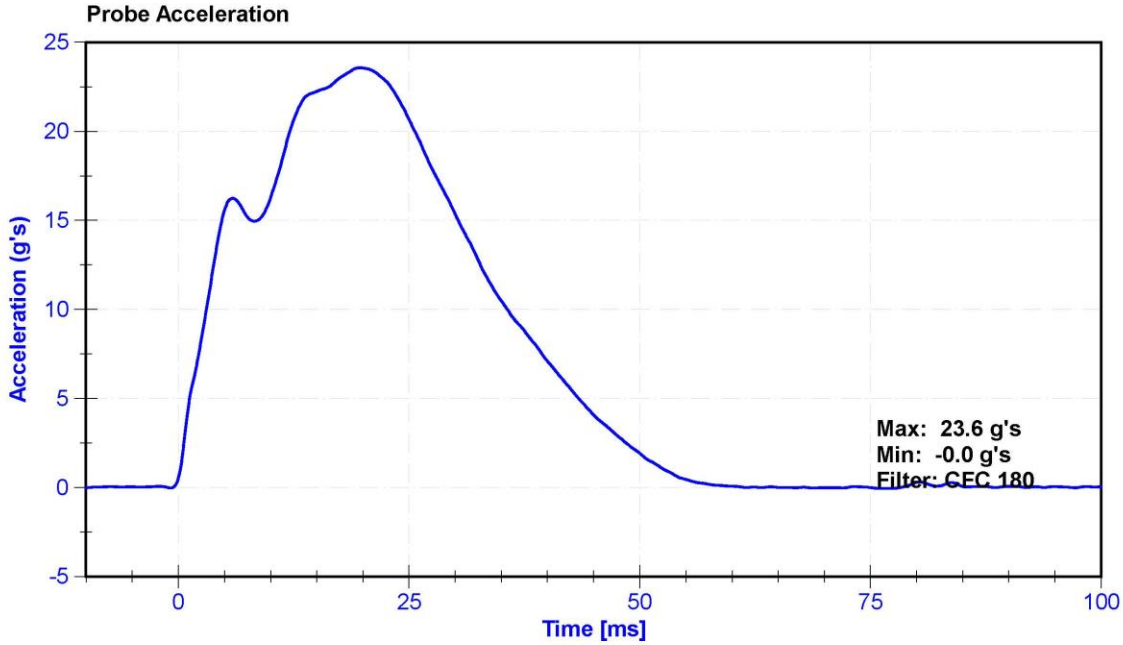
**Transducer Calibrations**

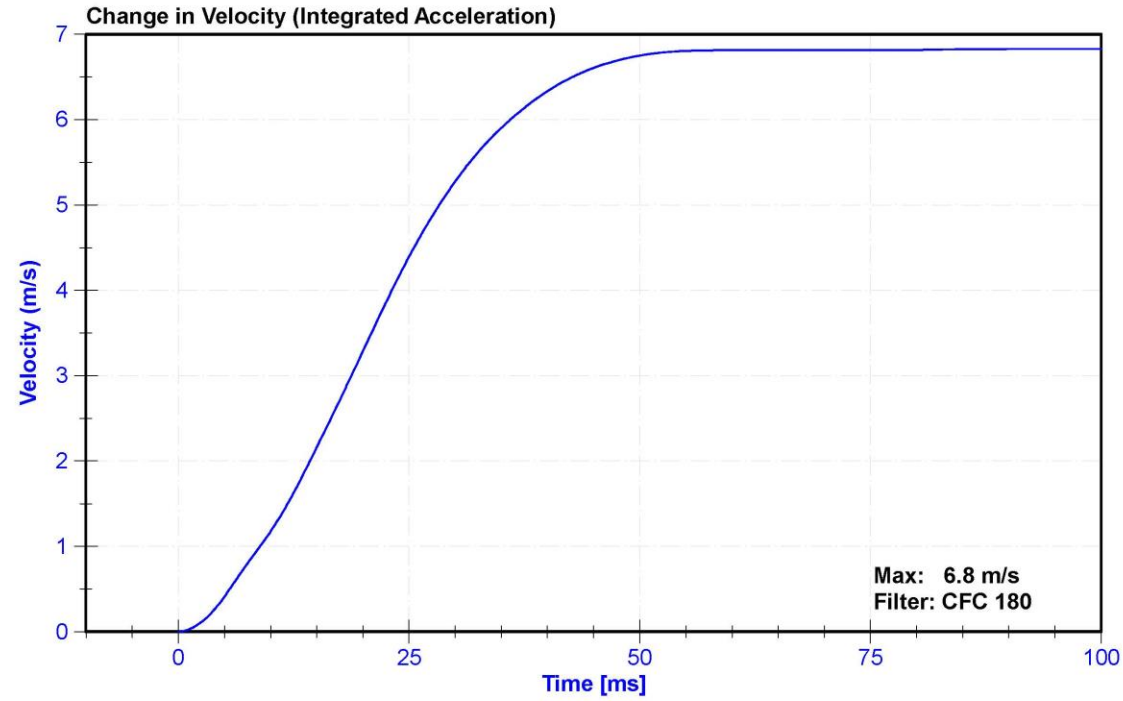
| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7264C | AC-P51736 | 5/14/2021 | 5/14/2022 |
| Chest Potentiometer | Servo 6209-2038 | DS-142 | 5/12/2021 | 11/10/2021 |




Resistive Force
Force (N)
6000
5000
4000
3000
2000
1000
0
-1000
0
25
50
75
100
Time [ms]
Max: 5400.5 N
Min: -12.9 N
Filter: CFC 180


Sternum Displacement
Displacement (mm)
25
0
-25
-50
-75
-100
0
25
50
75
100
Time [ms]
Max: -0.03 mm
Min: -68.02 mm
Filter: CFC 180


Probe Acceleration
Acceleration (g's)
25
20
15
10
5
0
-5
0
25
50
75
100
Time [ms]
Max: 23.6 g's
Min: -0.0 g's
Filter: CFC 180


Change in Velocity (Integrated Acceleration)
Velocity (m/s)
7
6
5
4
3
2
1
0
0
25
50
75
100
Time [ms]
Max: 6.8 m/s
Filter: CFC 180

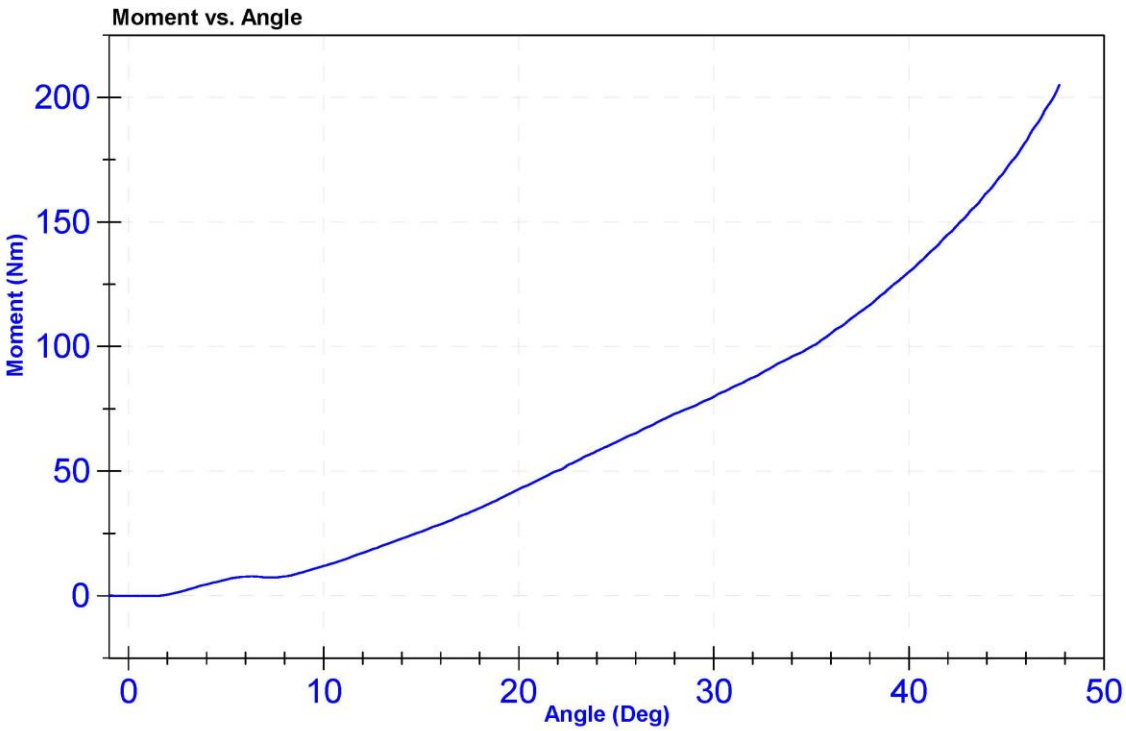
| | | | |
|---|---|---|---|
| ATD Manufacturer | Humanetics | Test Technician | C. Mantell |
| ATD Serial Number | 142 | Laboratory Supervisor | K. Brogan |

**Results**

| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 18.9 | 25.6 | ºC | 21.7 | Pass |
| Humidity | 10 | 70 | % | 40.5 | Pass |
| Average Velocity | 5 | 10 | deg/s | 7.2 | Pass |
| Angle at 203Nm | 40 | 50 | deg | 47.6 | Pass |
| Moment at 30 degrees | 0 | 94.9 | Nm | 79.9 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Potentiometer | ETI SP22 | DS-0008 | 9/18/2020 | 9/18/2021 |
| Load Cell | Key Trans 2301-02 | LC-115 My | 9/12/2020 | 9/12/2021 |



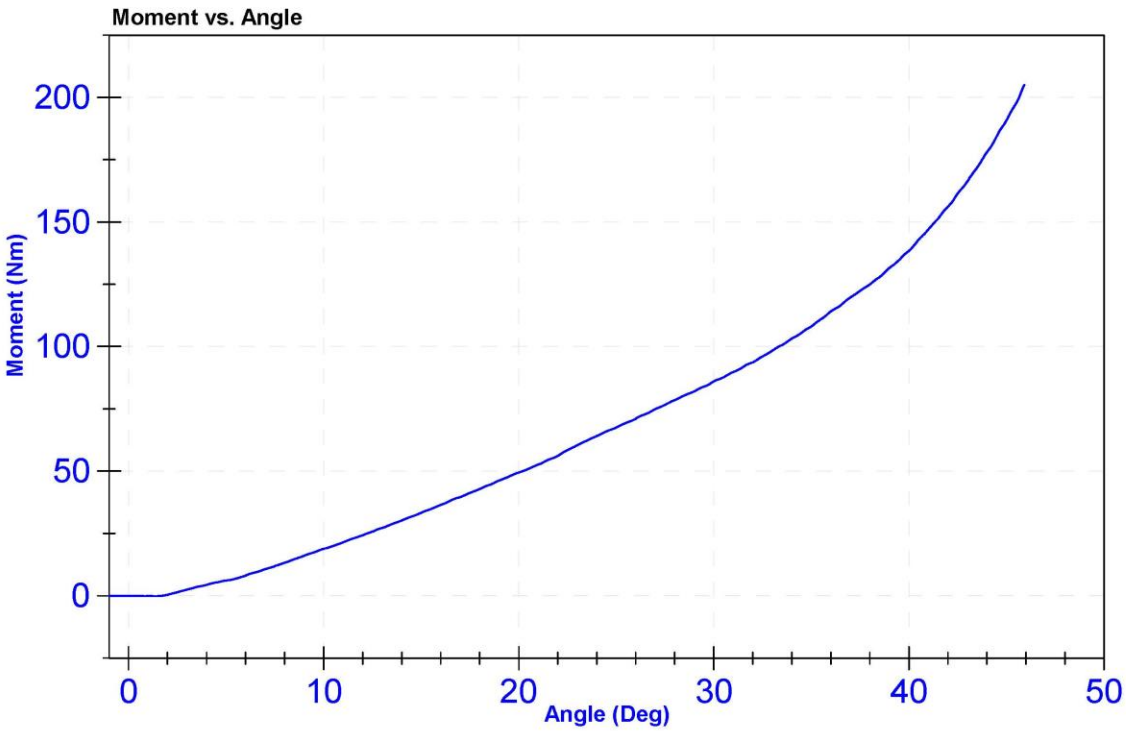
| | | | |
|---|---|---|---|
| ATD Manufacturer | Humanetics | Test Technician | C. Mantell |
| ATD Serial Number | 142 | Laboratory Supervisor | K. Brogan |

**Results**

| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 18.9 | 25.6 | ºC | 21.7 | Pass |
| Humidity | 10 | 70 | % | 40.5 | Pass |
| Average Velocity | 5 | 10 | deg/s | 7.1 | Pass |
| Angle at 203Nm | 40 | 50 | deg | 45.8 | Pass |
| Moment at 30 degrees | 0 | 94.9 | Nm | 86.1 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Potentiometer | ETI SP22 | DS-0008 | 9/18/2020 | 9/18/2021 |
| Load Cell | Key Trans 2301-02 | LC-115 My | 9/12/2020 | 9/12/2021 |



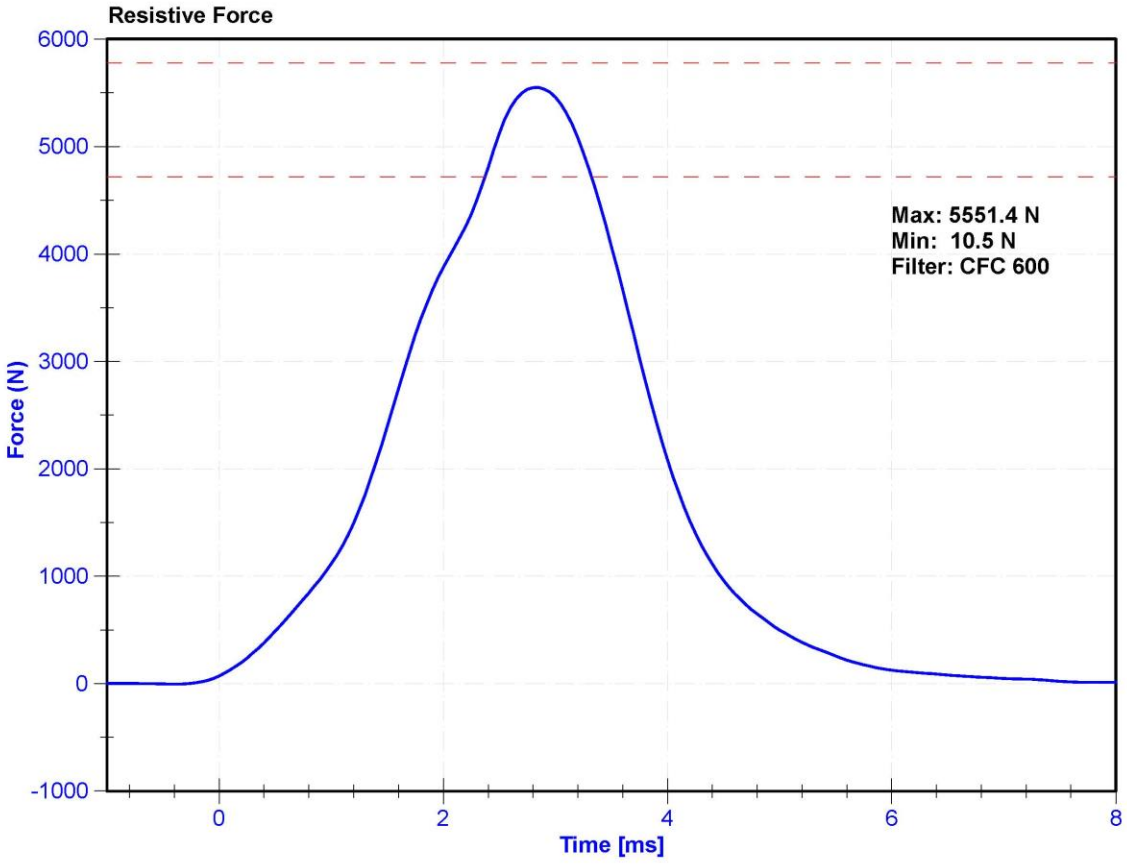
| | | | |
|---|---|---|---|
| ATD Manufacturer | Humanetics | Test Technician | C. Mantell |
| ATD Serial Number | 142 | Laboratory Supervisor | K. Brogan |

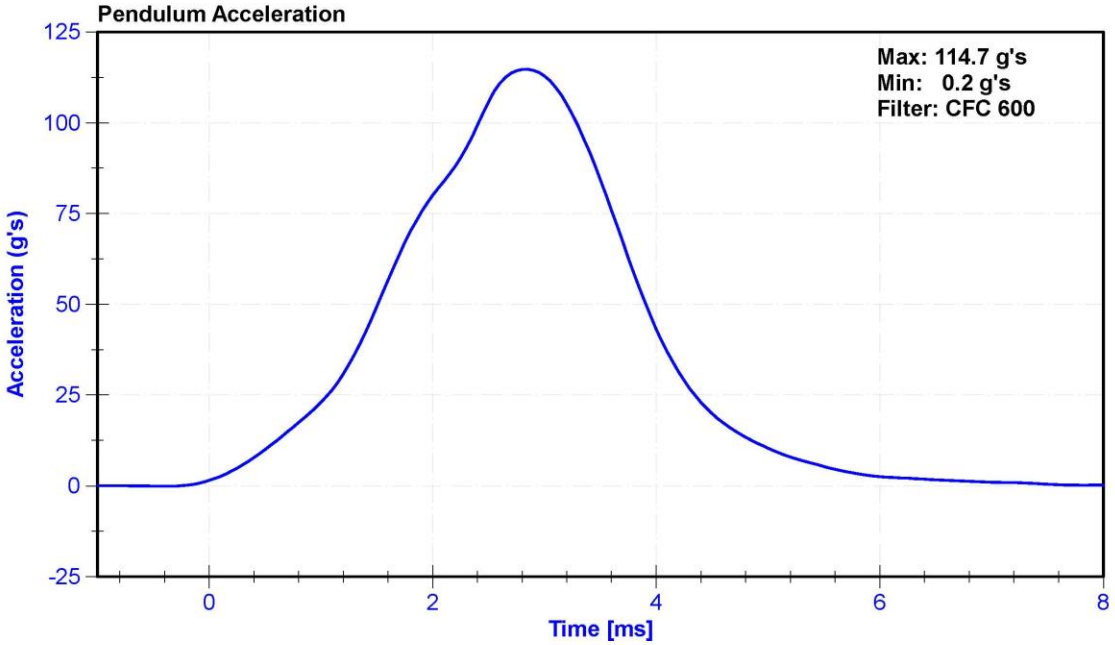
**Results**

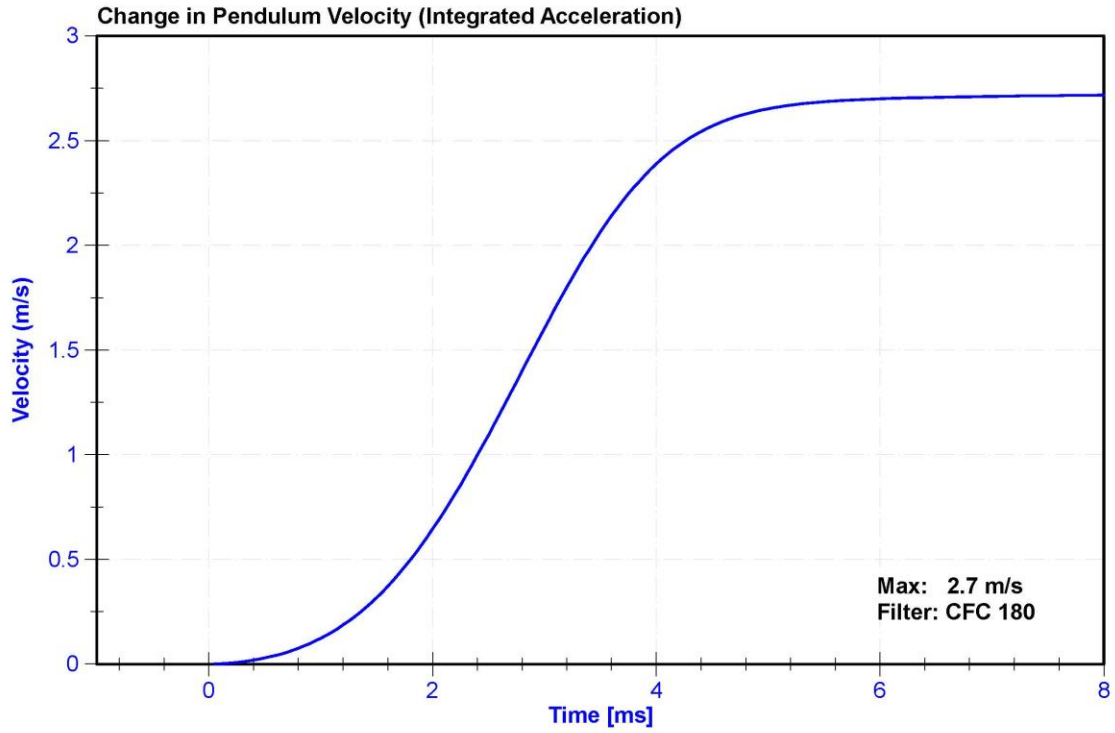
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 18.9 | 25.6 | ºC | 21.7 | Pass |
| Humidity | 10 | 70 | % | 40.1 | Pass |
| Velocity | 2.07 | 2.13 | m/s | 2.090 | Pass |
| Maximum Resistive Force | 4720 | 5780 | N | 5551.4 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | MSI 64C-2000 | A278994 | 12/3/2020 | 12/3/2021 |




Pendulum Acceleration
Max: 114.7 g's
Min: 0.2 g's
Filter: CFC 600
Acceleration (g's)
125
100
75
50
25
0
-25
0
2
4
6
8
Time [ms]


Change in Pendulum Velocity (Integrated Acceleration)
Max: 2.7 m/s
Filter: CFC 180
Velocity (m/s)
3
2.5
2
1.5
1
0.5
0
0
2
4
6
8
Time [ms]

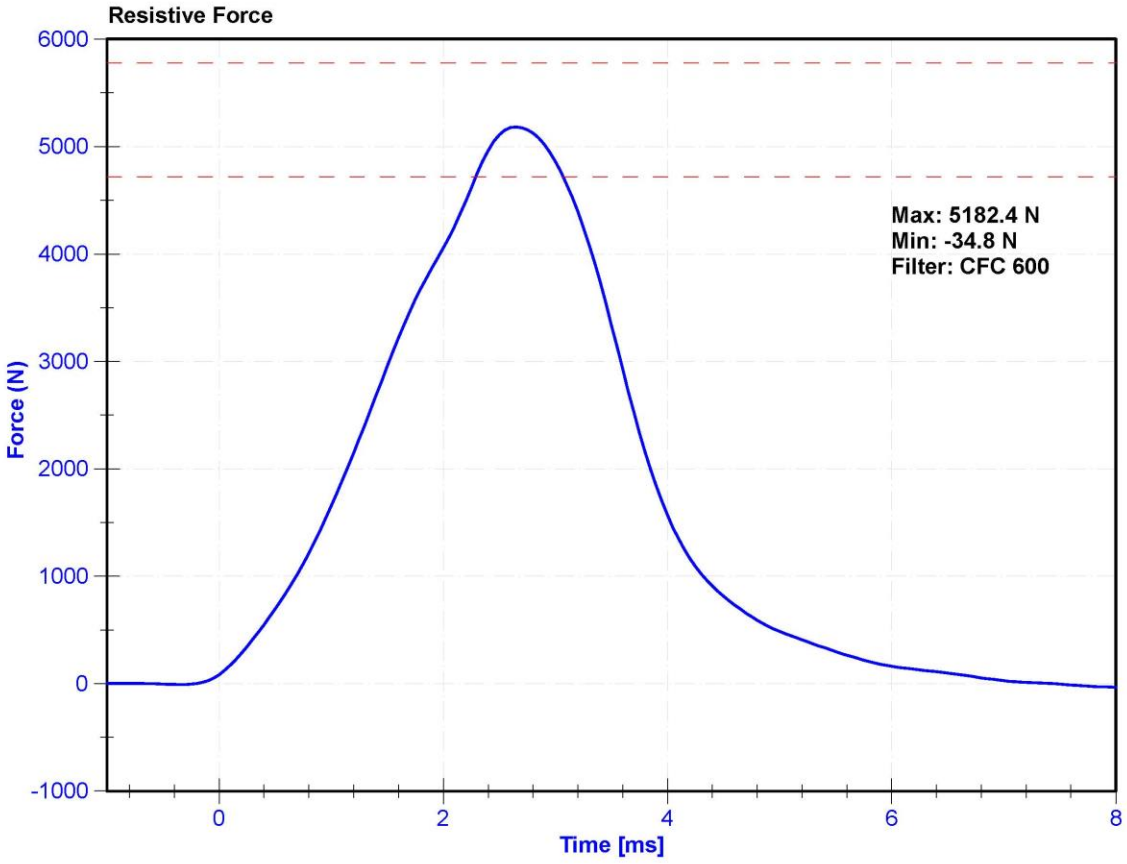
| | | | |
|---|---|---|---|
| ATD Manufacturer | Humanetics | Test Technician | C. Mantell |
| ATD Serial Number | 142 | Laboratory Supervisor | K. Brogan |

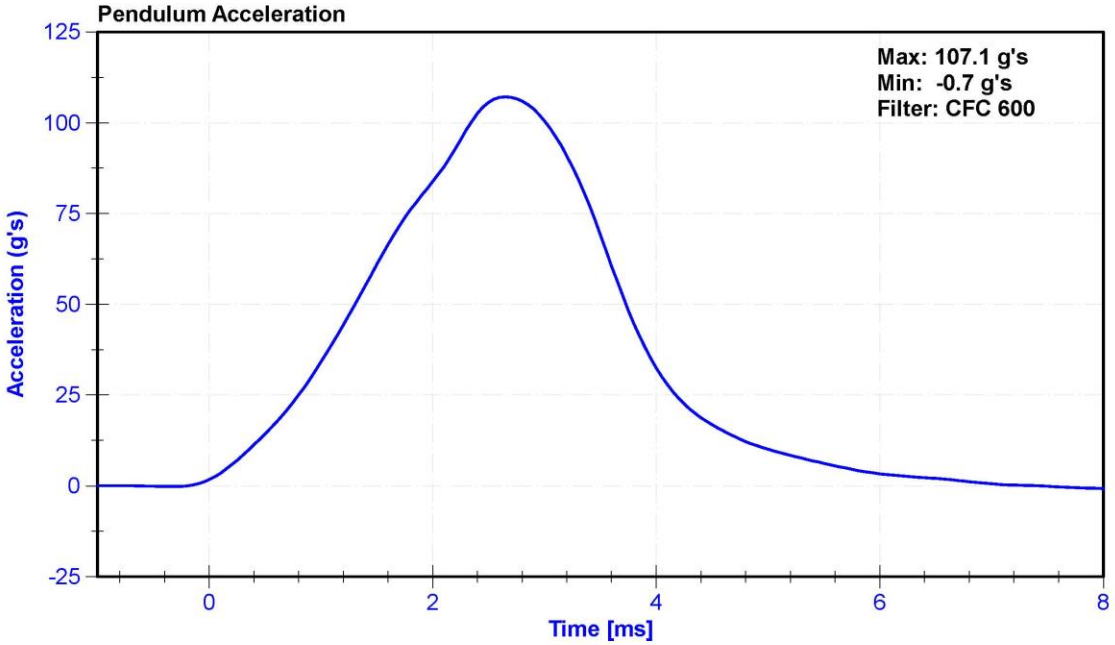
**Results**

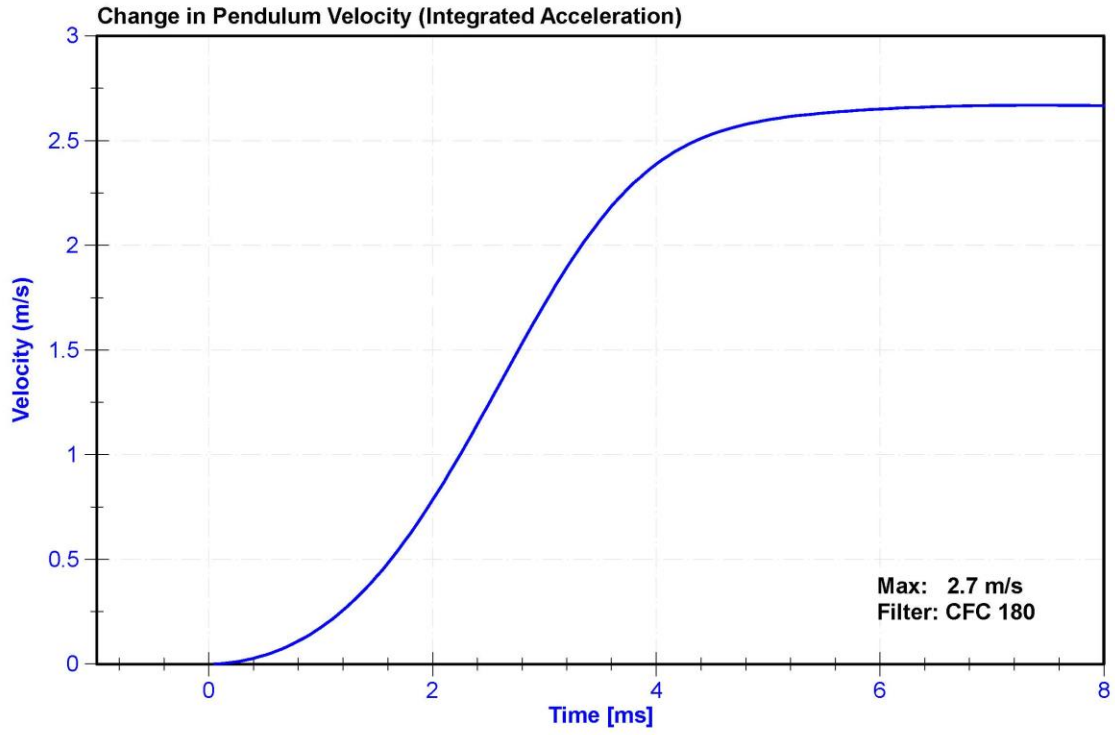
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 18.9 | 25.6 | ºC | 21.7 | Pass |
| Humidity | 10 | 70 | % | 40.1 | Pass |
| Velocity | 2.07 | 2.13 | m/s | 2.086 | Pass |
| Maximum Resistive Force | 4720 | 5780 | N | 5182.4 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | MSI 64C-2000 | A278994 | 12/3/2020 | 12/3/2021 |




Pendulum Acceleration
Max: 107.1 g's
Min: -0.7 g's
Filter: CFC 600
Acceleration (g's)
125
100
75
50
25
0
-25
0
2
4
6
8
Time [ms]


Change in Pendulum Velocity (Integrated Acceleration)
Velocity (m/s)
3
2.5
2
1.5
1
0.5
0
Max: 2.7 m/s
Filter: CFC 180
0
2
4
6
8
Time [ms]

**CALIBRATION TEST RESULTS**

**POST-TEST**

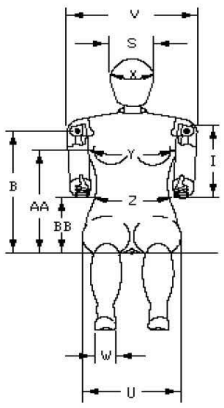
**HYBRID III 5TH PERCENTILE FEMALE - PASSENGER ATD**

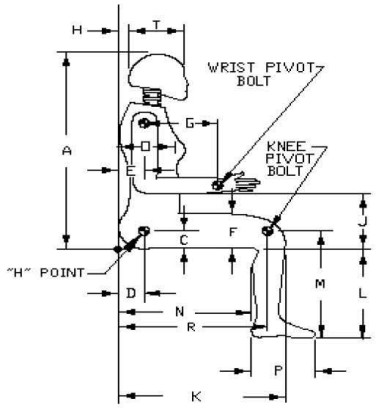
**SERIAL NO: 288**

External Measurements - Hybrid 3 - 5th Female

Technician: K. Brogan  Date: 05/18/2021

Dummy Serial Number: 288




| Symbol | Description | Specification (mm) | | Result (mm) | Pass/Fail |
|---|---|---|---|---|---|
| A | Sitting Height | 775 | 800 | 787 | Pass |
| B | Shoulder Pivot Height | 432 | 457 | 450 | Pass |
| C | H-Point Height | 81 | 86 | 85 | Pass |
| D | H-Point from Backline | 145 | 150 | 146 | Pass |
| E | Shoulder Pivot from Backline | 69 | 84 | 77 | Pass |
| F | Thigh Clearance | 119 | 135 | 129 | Pass |
| G | Back of Elbow to Wrist Pivot | 244 | 259 | 255 | Pass |
| H | Head Back to Backline | 43 | 48 | 45 | Pass |
| I | Shoulder to Elbow Length | 277 | 297 | 284 | Pass |
| J | Elbow Rest Height | 183 | 203 | 192 | Pass |
| K | Buttock to Knee Length | 521 | 546 | 539 | Pass |
| L | Popliteal Height | 356 | 376 | 365 | Pass |
| M | Knee Pivot Height | 394 | 419 | 410 | Pass |
| N | Buttock Popliteal Length | 414 | 439 | 429 | Pass |
| O | Chest Depth without Jacket | 175 | 191 | 182 | Pass |
| P | Foot Length (right) | 219 | 234 | 221 | Pass |
| R | Buttock To Knee Pivot Length | 457 | 483 | 465 | Pass |
| S | Head Breadth | 137 | 147 | 141 | Pass |
| T | Head Depth | 178 | 188 | 183 | Pass |
| U | Hip Breadth | 300 | 315 | 310 | Pass |
| V | Shoulder Breadth | 351 | 366 | 361 | Pass |
| W | Foot Breadth | 79 | 94 | 85 | Pass |
| X | Head Circumference | 528 | 549 | 537 | Pass |
| Y | Chest Circumference with Jacket | 851 | 881 | 865 | Pass |
| Z | Waist Circumference | 460 | 790 | 777 | Pass |
| AA | Reference Location (Chest Circumference) | 333 | 358 | 345 | Pass |
| BB | Reference Location (Waist Circumference) | 160 | 170 | 164 | Pass |

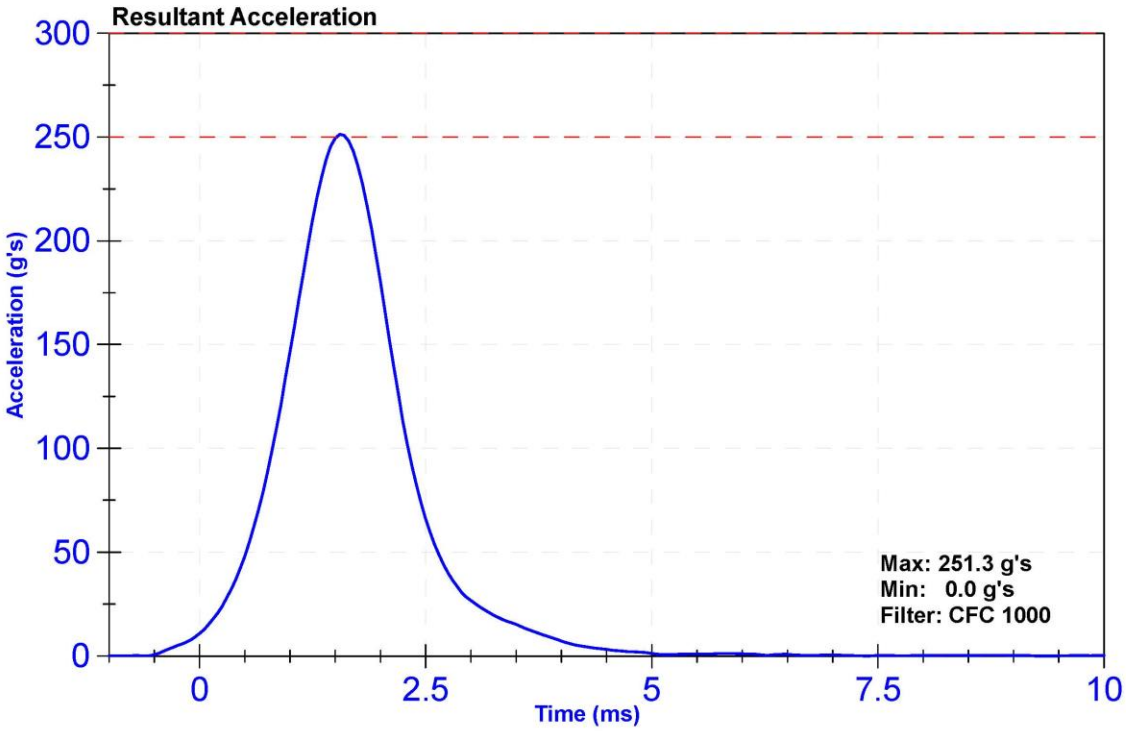
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | C. Mantell |
| ATD Serial Number | 288 | Laboratory Supervisor | K. Brogan |

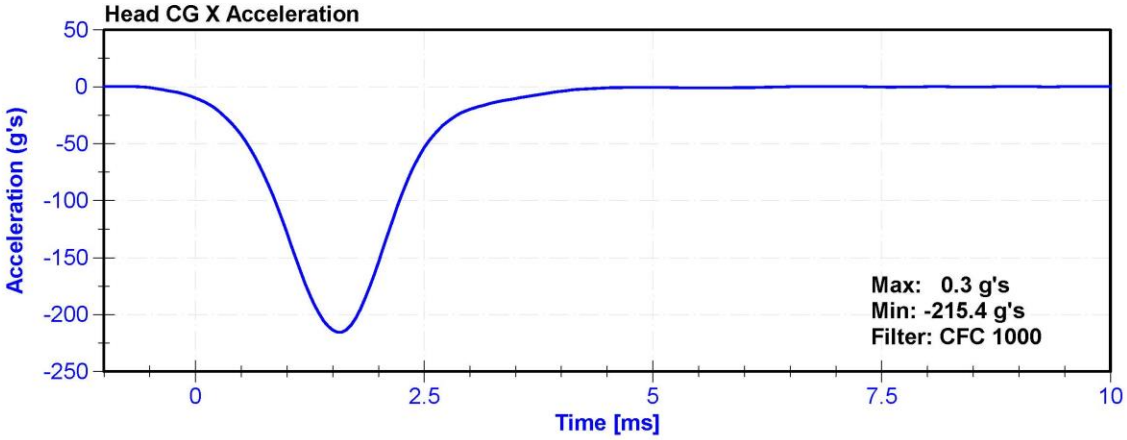
**Results**

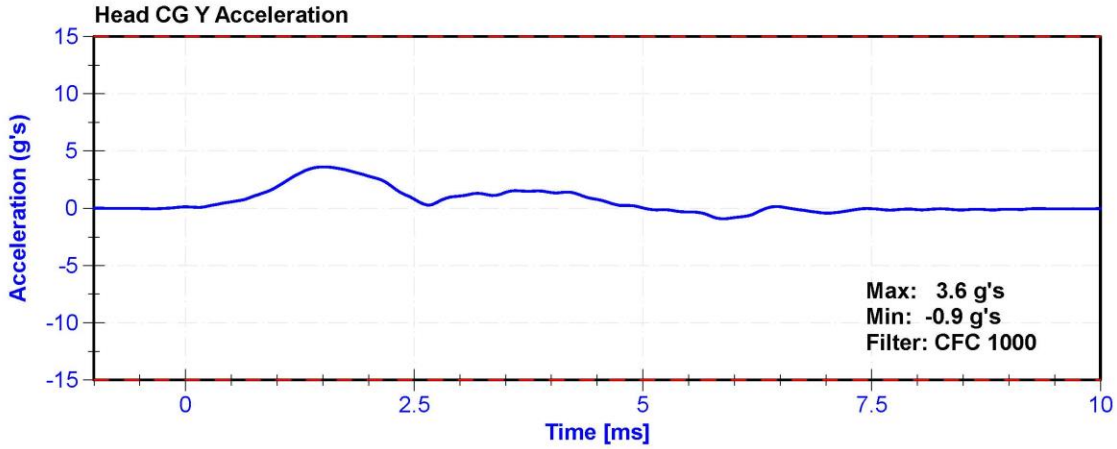
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 18.9 | 25.6 | ºC | 21.7 | Pass |
| Humidity | 10 | 70 | % | 40.2 | Pass |
| Resultant Acceleration | 250 | 300 | g's | 251.3 | Pass |
| Oscillation | 0 | 10 | % | 0.5 | Pass |
| Lateral Acceleration | -15 | 15 | g's | 3.6 | Pass |

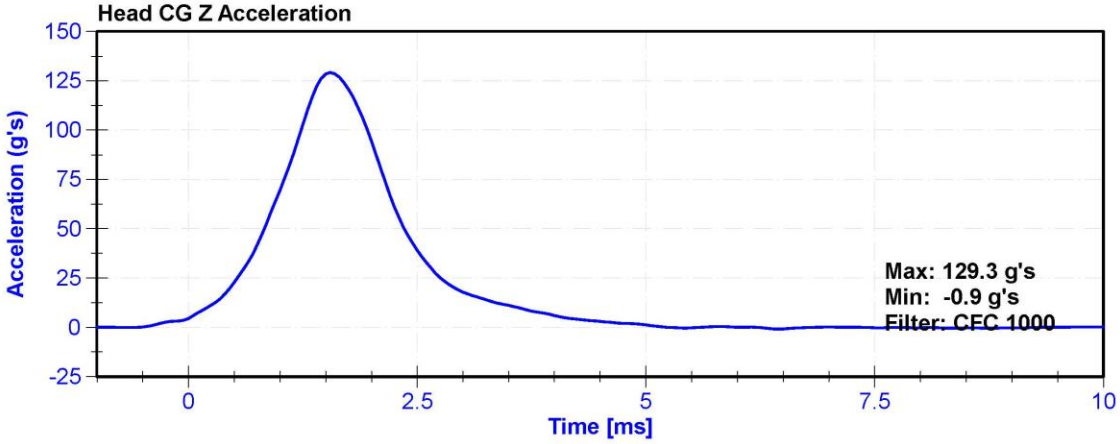
**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| X Accelerometer | ENDEVCO 7264CT | AC-P58780 | 4/5/2021 | 10/4/2021 |
| Y Accelerometer | ENDEVCO 7264 | AC-P83320 | 4/5/2021 | 10/4/2021 |
| Z Accelerometer | ENDEVCO 7264CT | AC-P58997 | 4/5/2021 | 10/4/2021 |




Head CG X Acceleration
Acceleration (g's)
50
0
-50
-100
-150
-200
-250
0
2.5
5
7.5
10
Time [ms]
Max: 0.3 g's
Min: -215.4 g's
Filter: CFC 1000


Head CG Y Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]
Max: 3.6 g's
Min: -0.9 g's
Filter: CFC 1000


Head CG Z Acceleration
Acceleration (g's)
150
125
100
75
50
25
0
-25
0
2.5
5
7.5
10
Time [ms]
Max: 129.3 g's
Min: -0.9 g's
Filter: CFC 1000

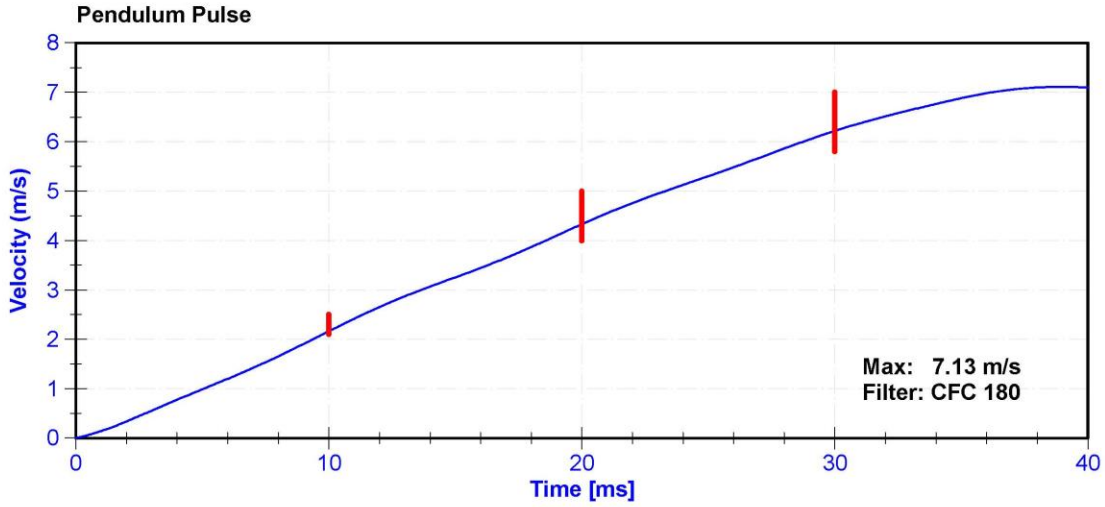
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | C. Mantell |
| ATD Serial Number | 288 | Laboratory Supervisor | K. Brogan |

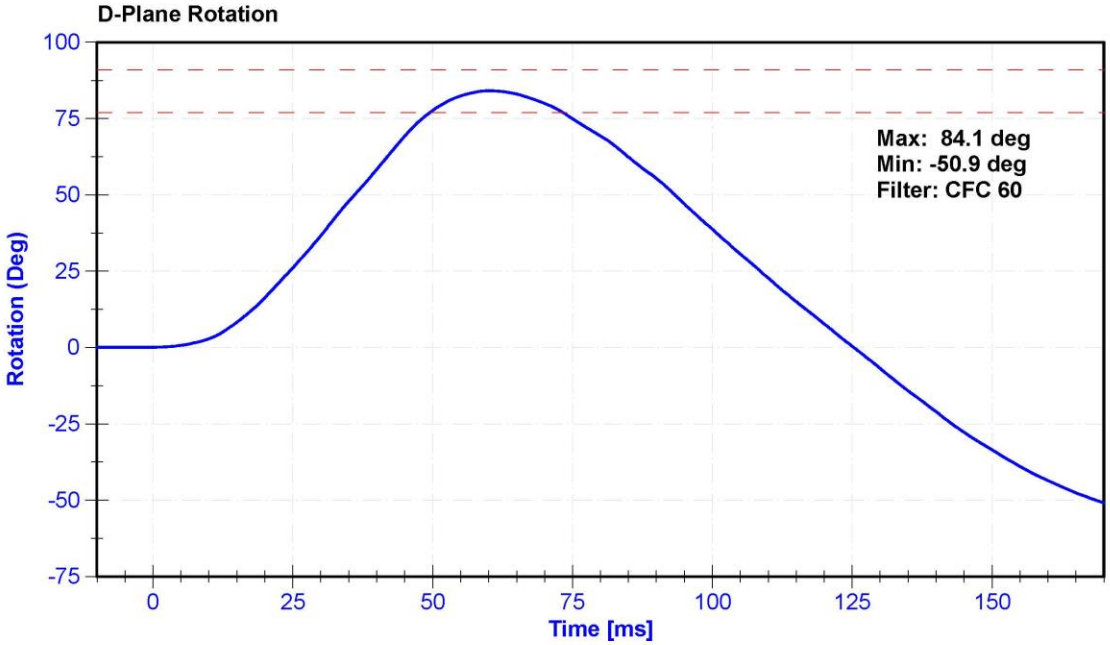
**Results**

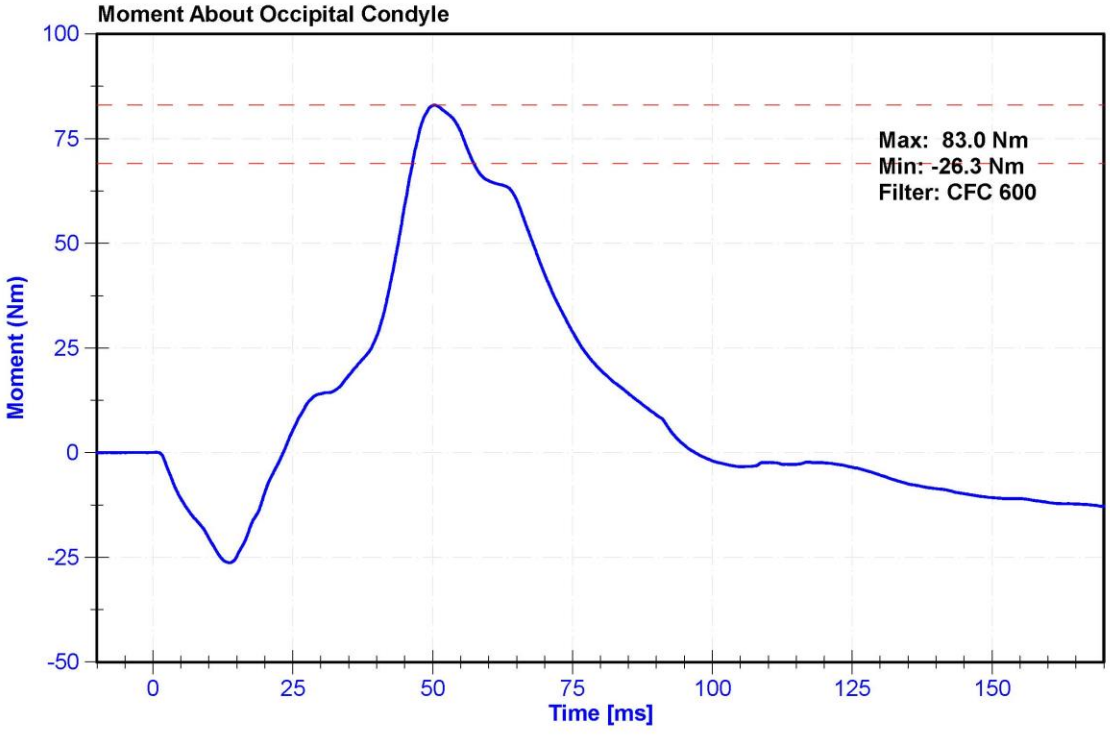
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | ºC | 21.2 | Pass |
| Humidity | 10 | 70 | % | 39.1 | Pass |
| Velocity | 6.89 | 7.13 | m/s | 6.971 | Pass |
| Pendulum Impulse at 10ms | 2.1 | 2.5 | m/s | 2.16 | Pass |
| Pendulum Impulse at 20ms | 4.0 | 5.0 | m/s | 4.33 | Pass |
| Pendulum Impulse at 30ms | 5.8 | 7.0 | m/s | 6.22 | Pass |
| Max D Plane Rotation | 77 | 91 | deg | 84.1 | Pass |
| Max Moment During Rotation Interval | 69 | 83 | Nm | 83.0 | Pass |
| Moment Decay to 10.0 Nm | 80 | 100 | ms | 89.0 | Pass |

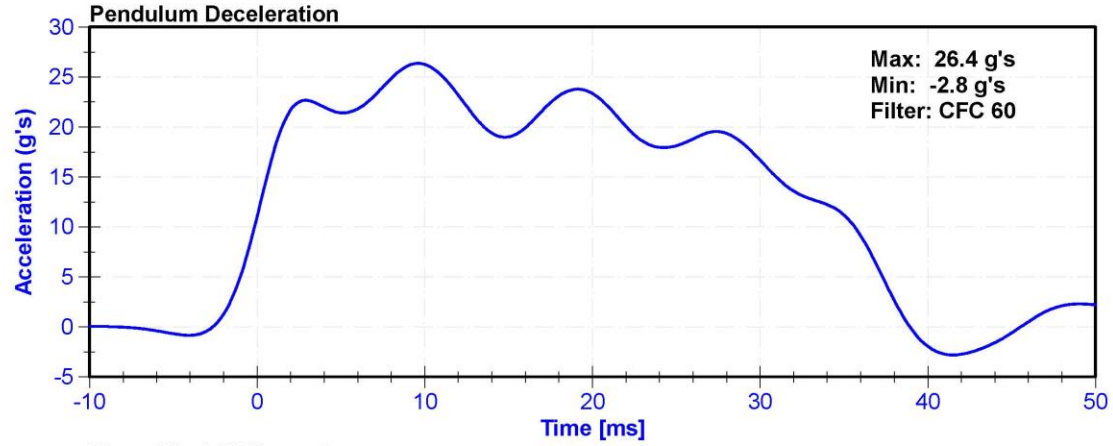
**Transducer Calibrations**

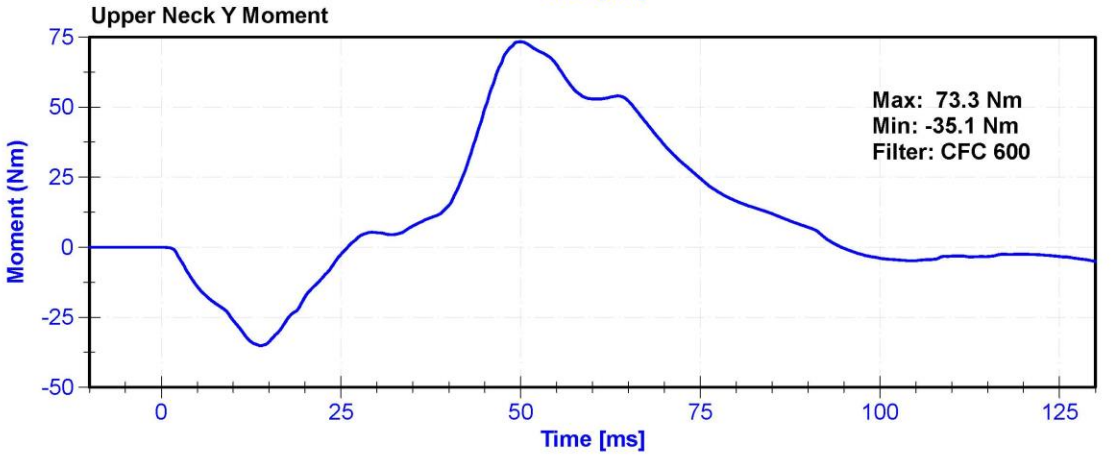
| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7231CT | AC-C16503 Striker | 2/5/2021 | 2/5/2022 |
| Pendulum Potentiometer | ETI SP22G | DS-LABPOT1 | 9/17/2020 | 9/17/2021 |
| Condyle Potentiometer | ETI SP22G | DS-LABPOT2 | 9/17/2020 | 9/17/2021 |
| Upper Neck Load Cell | FTSS 1716 | LC-851 Fx | 7/9/2020 | 7/9/2021 |

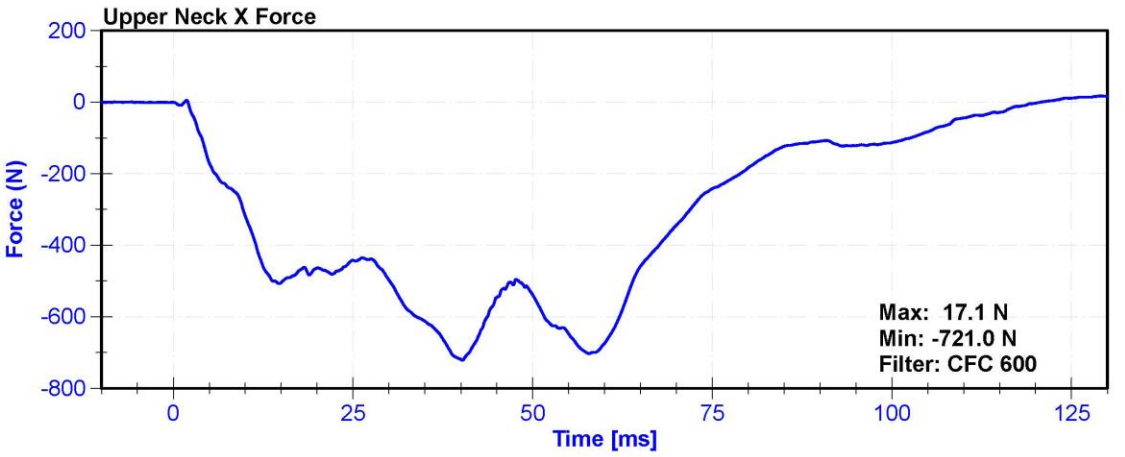



D-Plane Rotation
Rotation (Deg)
Time [ms]
Max: 84.1 deg
Min: -50.9 deg
Filter: CFC 60
100
75
50
25
0
-25
-50
-75
0
25
50
75
100
125
150


Moment About Occipital Condyle
Moment (Nm)
Time [ms]
Max: 83.0 Nm
Min: -26.3 Nm
Filter: CFC 600
100
75
50
25
0
-25
-50
0
25
50
75
100
125
150


Pendulum Deceleration
Max: 26.4 g's
Min: -2.8 g's
Filter: CFC 60
Acceleration (g's)
30
25
20
15
10
5
0
-5
-10
0
10
20
30
40
50
Time [ms]


Upper Neck Y Moment
Max: 73.3 Nm
Min: -35.1 Nm
Filter: CFC 600
Moment (Nm)
75
50
25
0
-25
-50
0
25
50
75
100
125
Time [ms]


Upper Neck X Force
Max: 17.1 N
Min: -721.0 N
Filter: CFC 600
Force (N)
200
0
-200
-400
-600
-800
0
25
50
75
100
125
Time [ms]

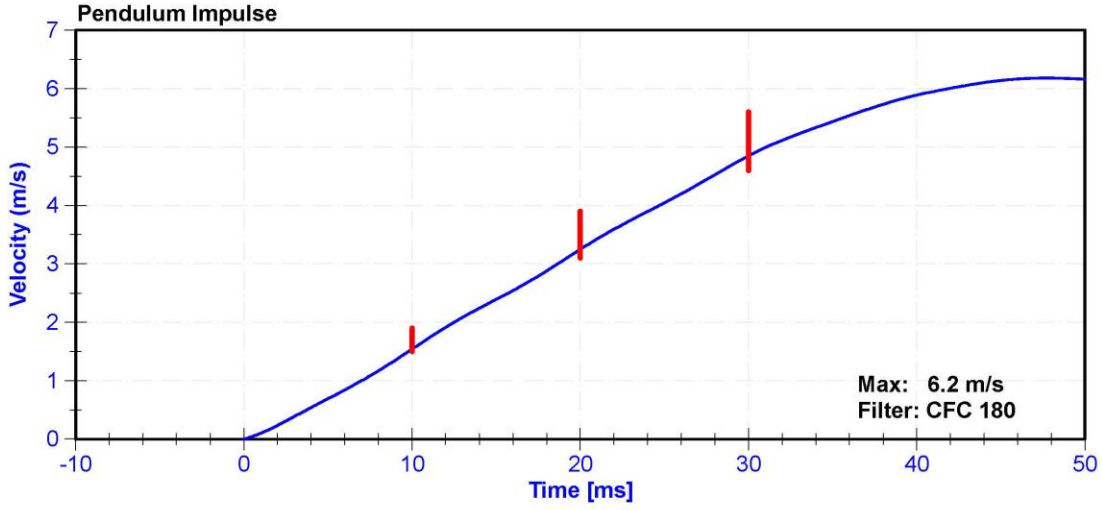
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | C. Mantell |
| ATD Serial Number | 288 | Laboratory Supervisor | K. Brogan |

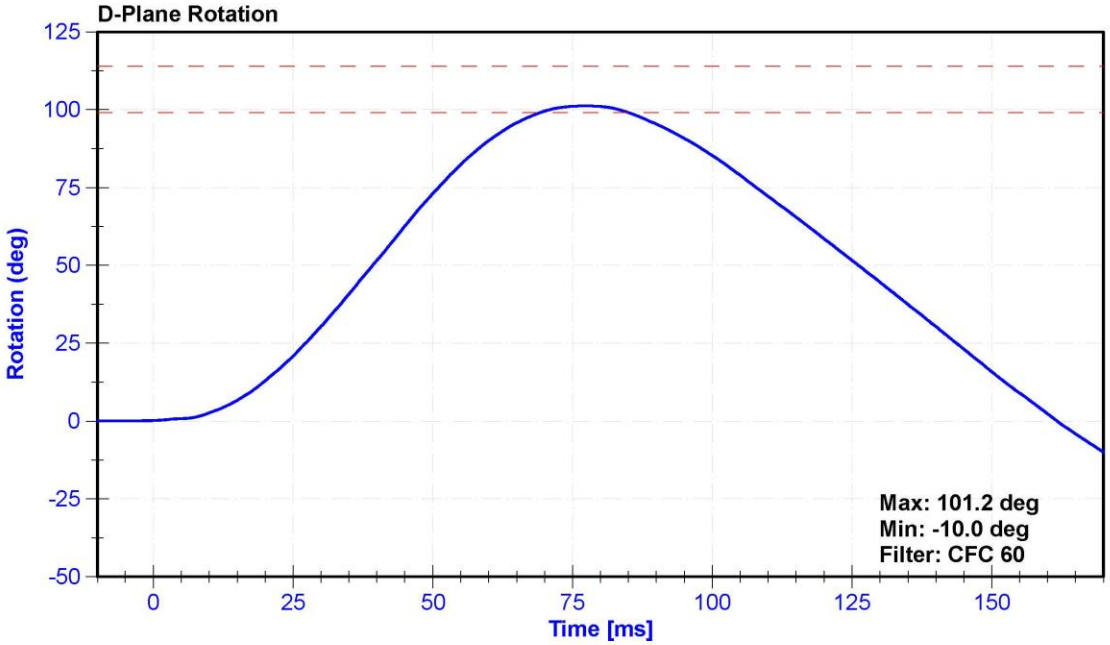
**Results**

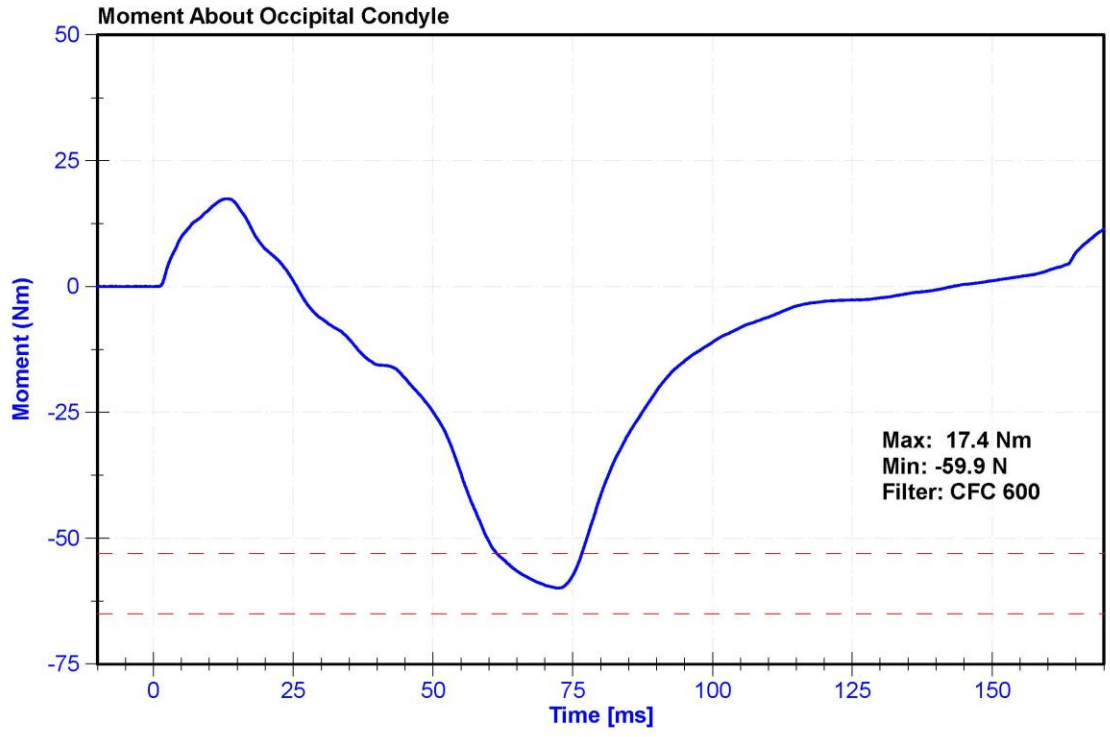
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | ºC | 21.6 | Pass |
| Humidity | 10 | 70 | % | 39.7 | Pass |
| Velocity | 5.95 | 6.19 | m/s | 6.035 | Pass |
| Pendulum Impulse at 10ms | 1.5 | 1.9 | m/s | 1.54 | Pass |
| Pendulum Impulse at 20ms | 3.1 | 3.9 | m/s | 3.25 | Pass |
| Pendulum Impulse at 30ms | 4.6 | 5.6 | m/s | 4.85 | Pass |
| D Plane Rotation | 99 | 114 | deg | 101.2 | Pass |
| Moment During Rotation Interval | -65 | -53 | Nm | -59.9 | Pass |
| Moment Decay to -10Nm | 94 | 114 | ms | 101.6 | Pass |

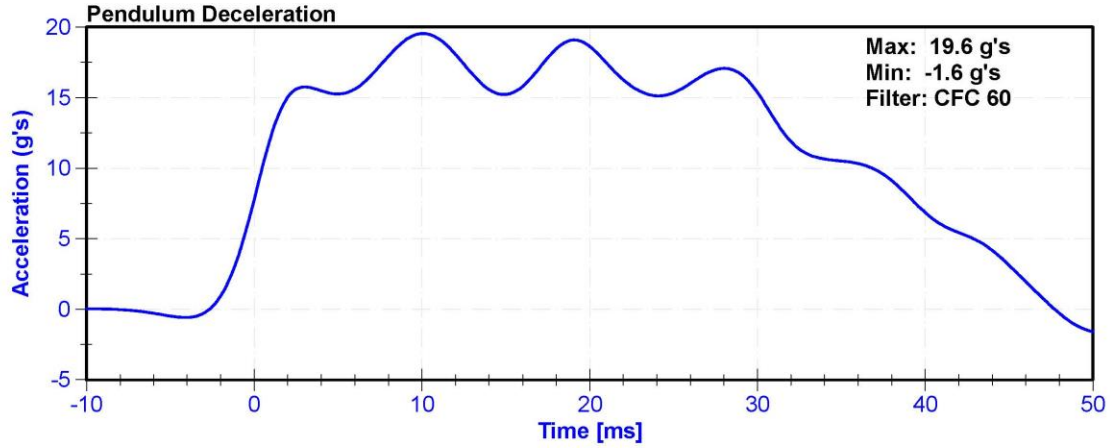
**Transducer Calibrations**

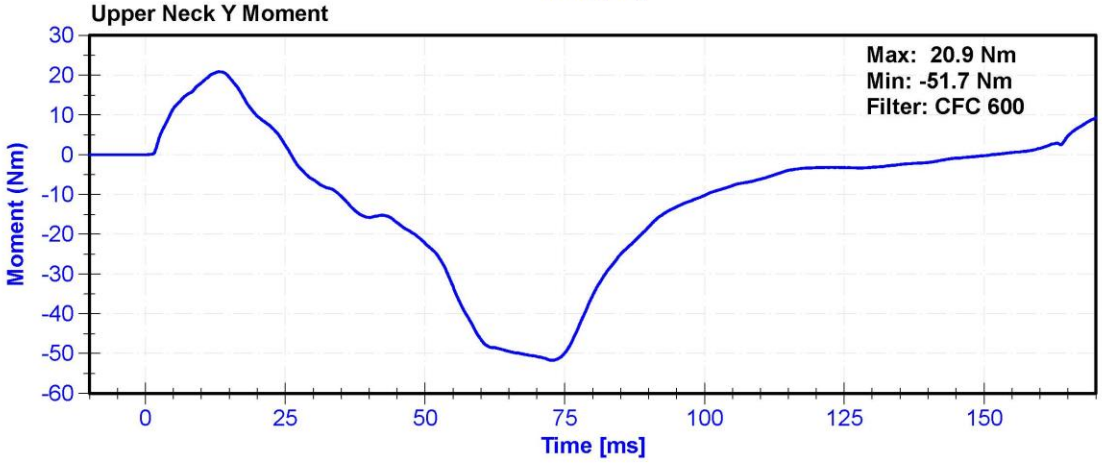
| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7231CT | AC-C16503 Striker | 2/5/2021 | 2/5/2022 |
| Pendulum Potentiometer | ETI SP22G | DS-LABPOT1 | 9/17/2020 | 9/17/2021 |
| Condyle Potentiometer | ETI SP22G | DS-LABPOT2 | 9/17/2020 | 9/17/2021 |
| Upper Neck Load Cell | FTSS 1716 | LC-851 Fx | 7/9/2020 | 7/9/2021 |

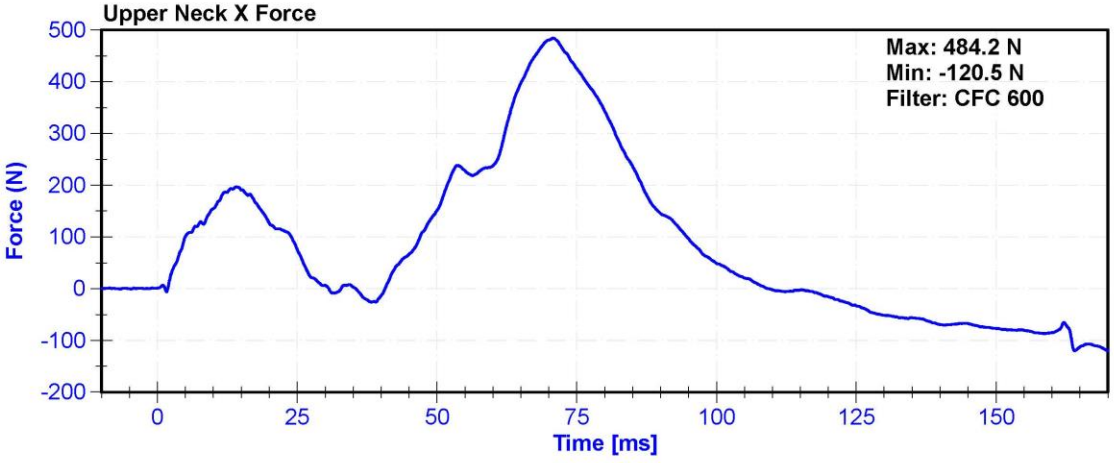



D-Plane Rotation
Rotation (deg)
125
100
75
50
25
0
-25
-50
0
25
50
75
100
125
150
Time [ms]
Max: 101.2 deg
Min: -10.0 deg
Filter: CFC 60


Moment About Occipital Condyle
Moment (Nm)
50
25
0
-25
-50
-75
0
25
50
75
100
125
150
Time [ms]
Max: 17.4 Nm
Min: -59.9 N
Filter: CFC 600


Pendulum Deceleration
Max: 19.6 g's
Min: -1.6 g's
Filter: CFC 60
Acceleration (g's)
Time [ms]


Upper Neck Y Moment
Max: 20.9 Nm
Min: -51.7 Nm
Filter: CFC 600
Moment (Nm)
Time [ms]


Upper Neck X Force
Max: 484.2 N
Min: -120.5 N
Filter: CFC 600
Force (N)
Time [ms]

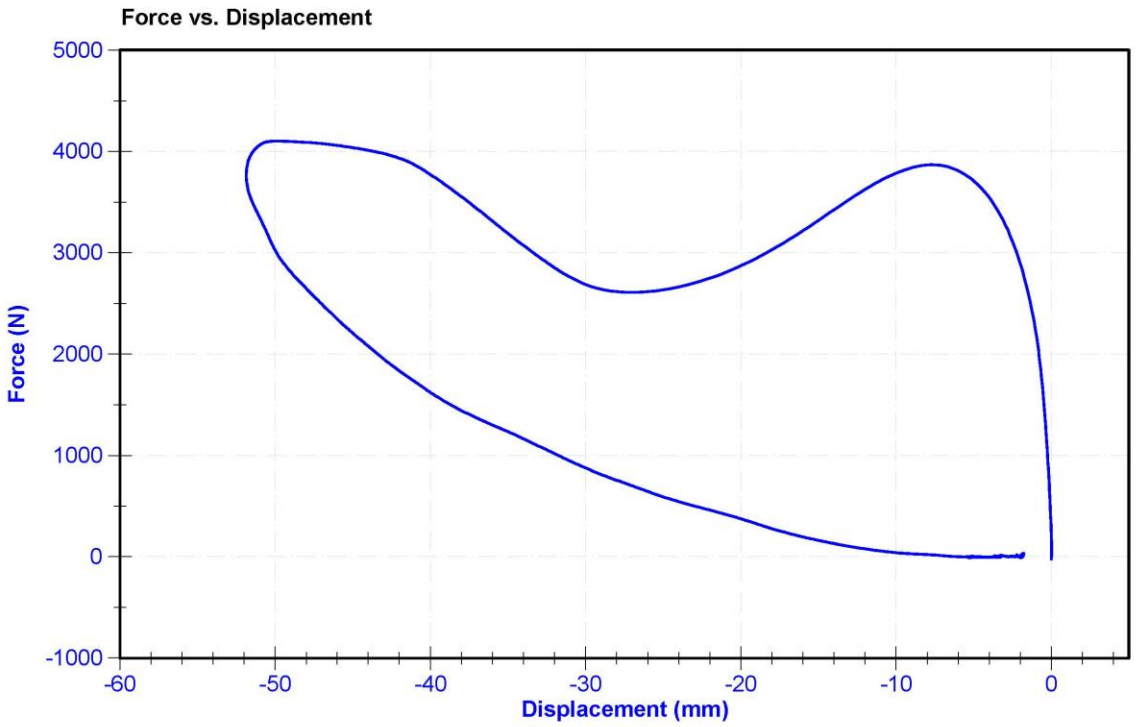
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | D.Reinhard |
| ATD Serial Number | 288 | Laboratory Supervisor | K. Brogan |

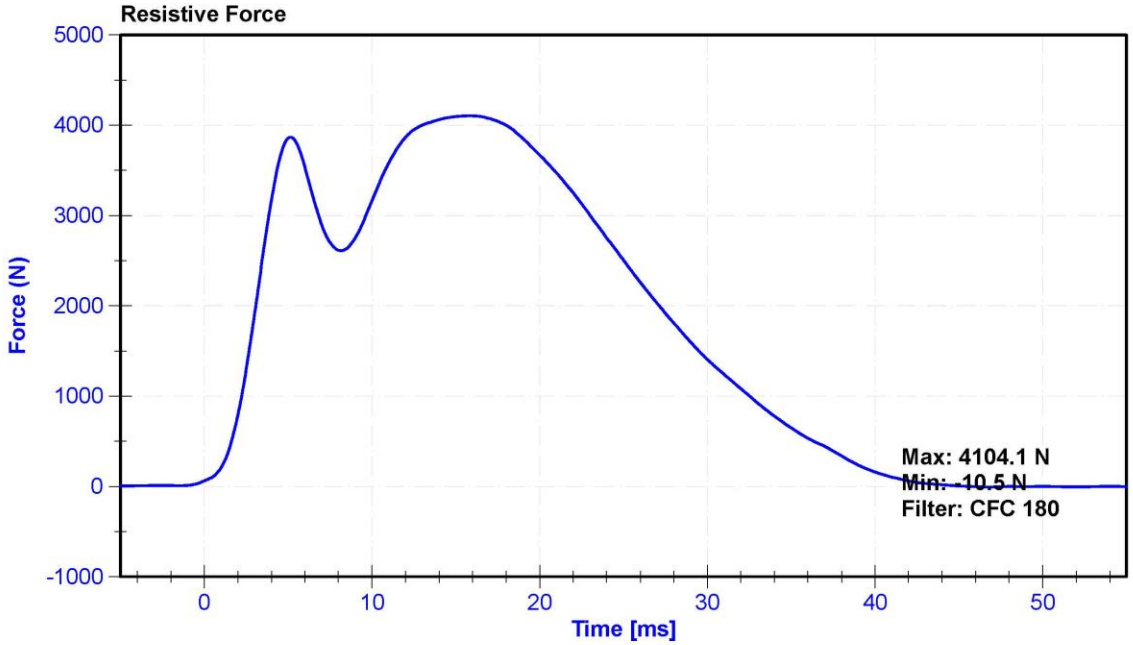
**Results**

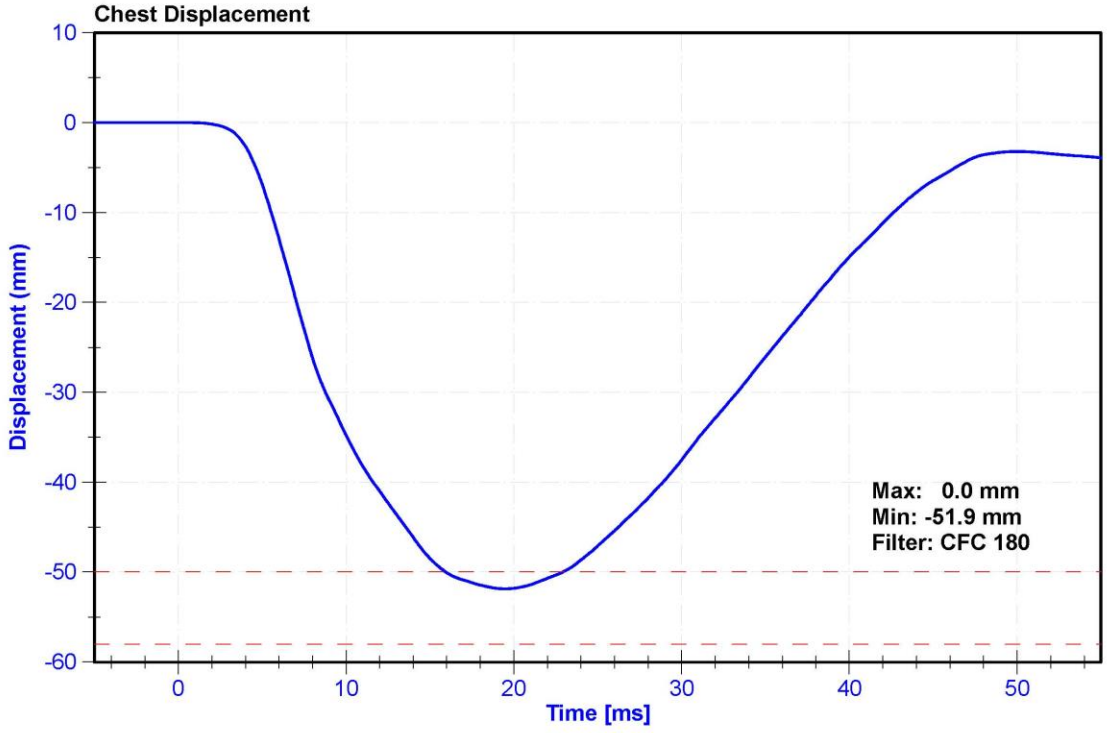
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | ºC | 20.7 | Pass |
| Humidity | 10 | 70 | % | 35 | Pass |
| Velocity | 6.59 | 6.83 | m/s | 6.704 | Pass |
| Chest Deflection | -58 | -50 | mm | -51.9 | Pass |
| Maximum Resistive Force (50 to 58mm) | 3900 | 4400 | N | 4104.0 | Pass |
| Maximum Resistive Force (18 to 50mm) | 0 | 4600 | N | 4104.1 | Pass |
| Hysteresis | 69 | 85 | % | 71.8 | Pass |

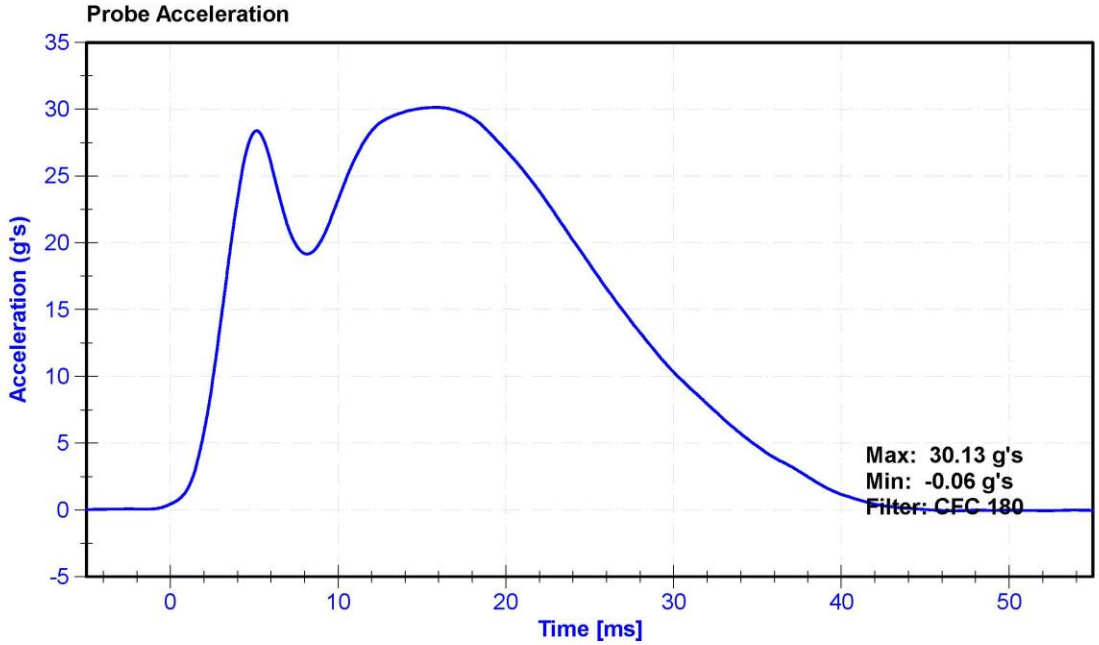
**Transducer Calibrations**

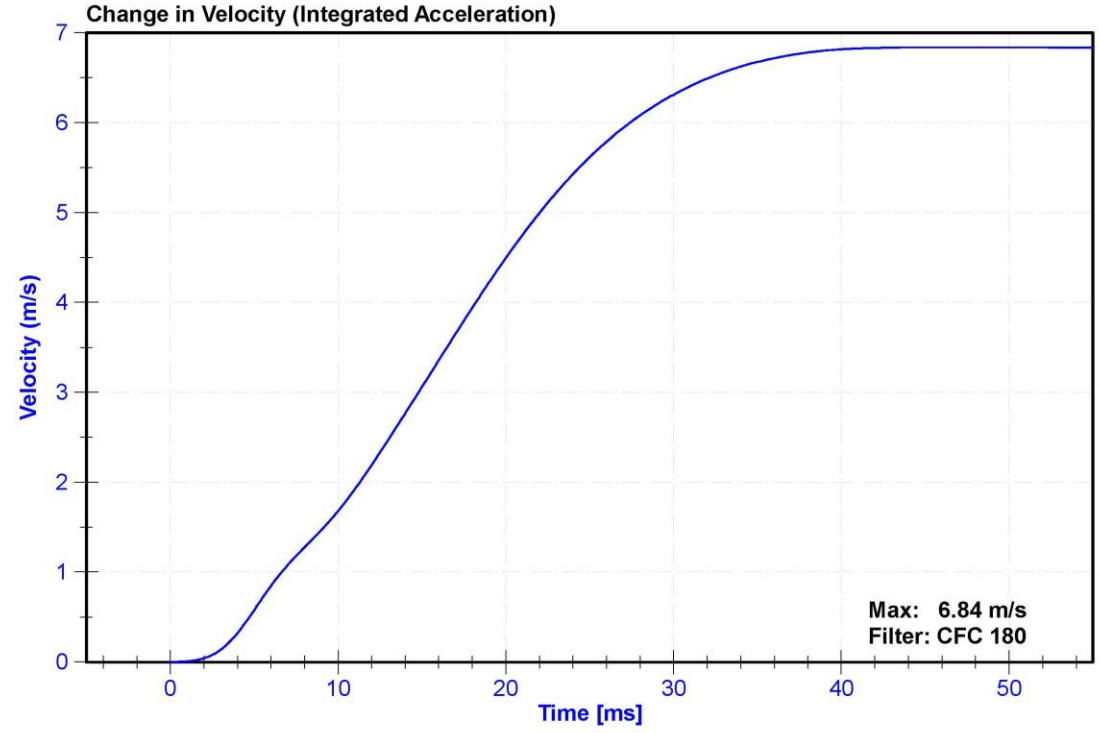
| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7264C-2K-TZ2 | AC-P51736 | 5/14/2021 | 5/14/2022 |
| Chest Potentiometer | SERVO 14CB1-2897 | DS-288GFE | 1/21/2021 | 7/22/2021 |




Resistive Force
Force (N)
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50
Time [ms]
Max: 4104.1 N
Min: -10.5 N
Filter: CFC 180


Chest Displacement
Displacement (mm)
10
0
-10
-20
-30
-40
-50
-60
0
10
20
30
40
50
Time [ms]
Max: 0.0 mm
Min: -51.9 mm
Filter: CFC 180


Probe Acceleration
Acceleration (g's)
35
30
25
20
15
10
5
0
-5
0
10
20
30
40
50
Time [ms]
Max: 30.13 g's
Min: -0.06 g's
Filter: CFC 180


Change in Velocity (Integrated Acceleration)
Velocity (m/s)
7
6
5
4
3
2
1
0
0
10
20
30
40
50
Time [ms]
Max: 6.84 m/s
Filter: CFC 180

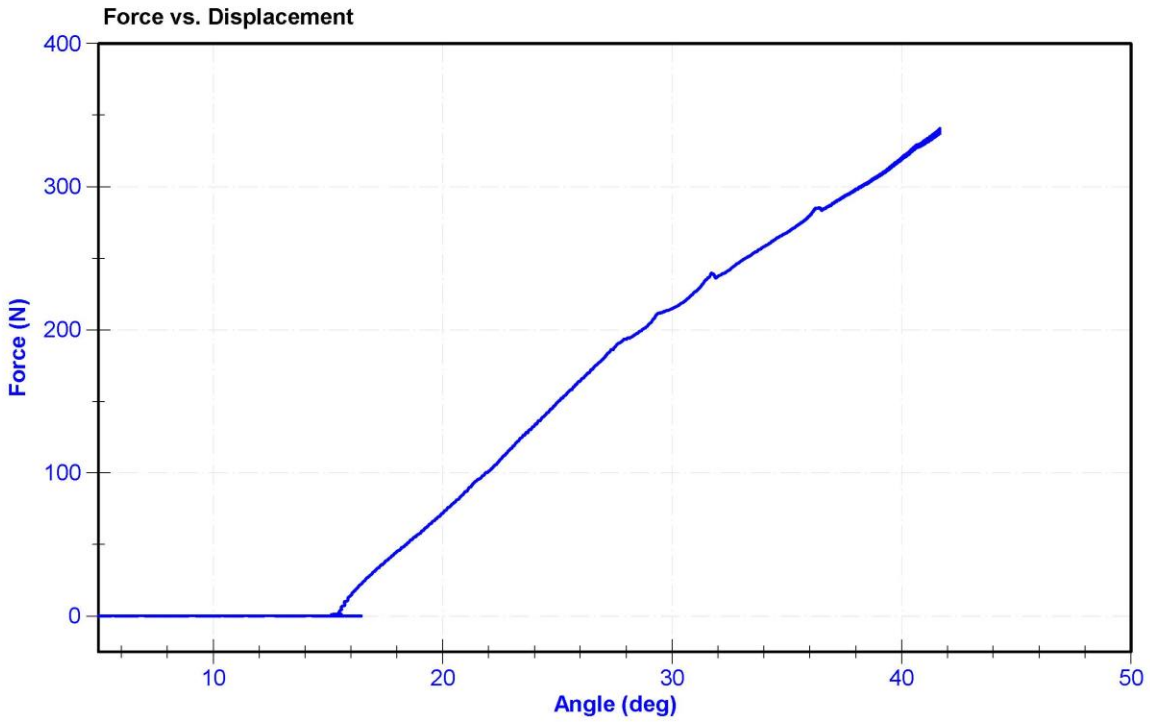
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | D. Reinhard |
| ATD Serial Number | 288 | Laboratory Supervisor | K. Brogan |

**Results**

| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 18.6 | 25.6 | ºC | 20.9 | Pass |
| Humidity | 10 | 70 | % | 24 | Pass |
| Initial Angle | 0 | 20 | deg | 15.2 | Pass |
| Force at 45 Degrees | 320 | 390 | N | 386.0 | Pass |
| Return Angle Relative to Initial | 0 | 8 | deg | 0.7 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Potentiometer | Seika.de N4C-1 | DS-1905226 | 10/12/2020 | 10/12/2021 |
| Load Cell | Interface SML-200 | LC-493319 | 10/8/2020 | 10/8/2021 |



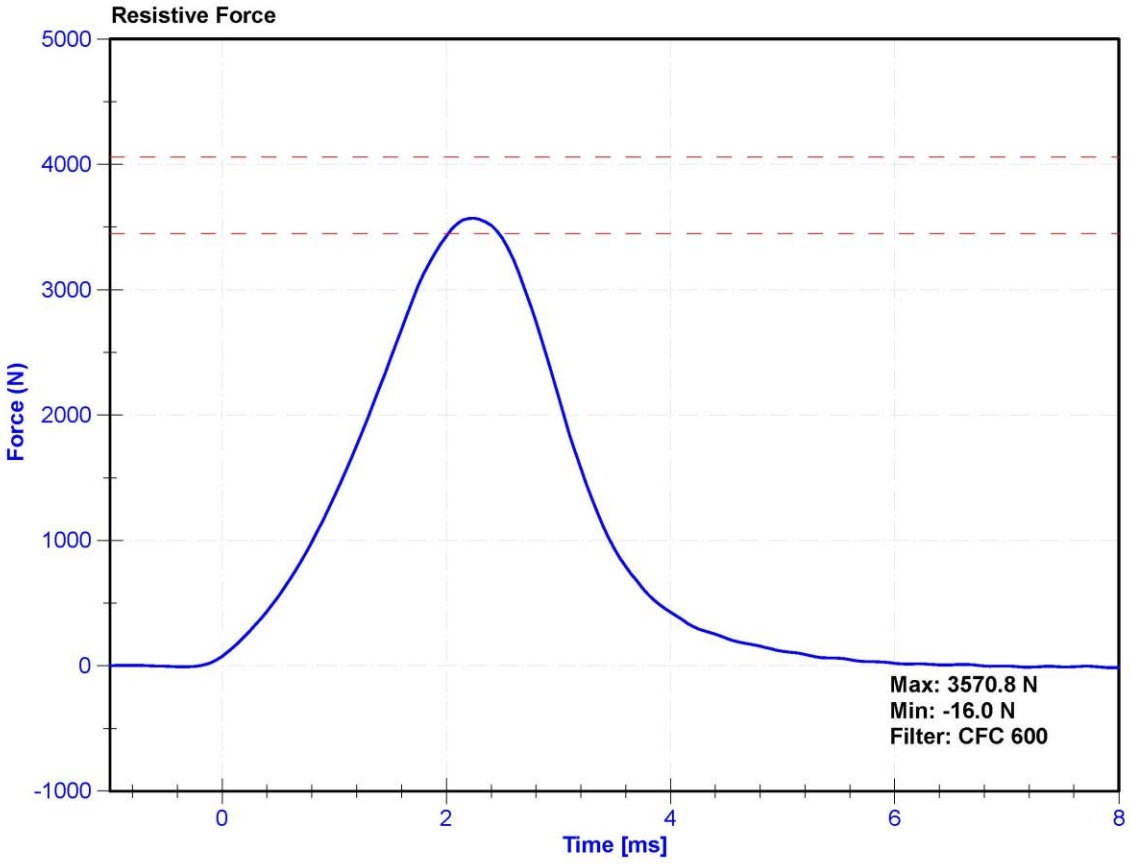
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | E. Helenbrook |
| ATD Serial Number | 288 | Laboratory Supervisor | K. Brogan |

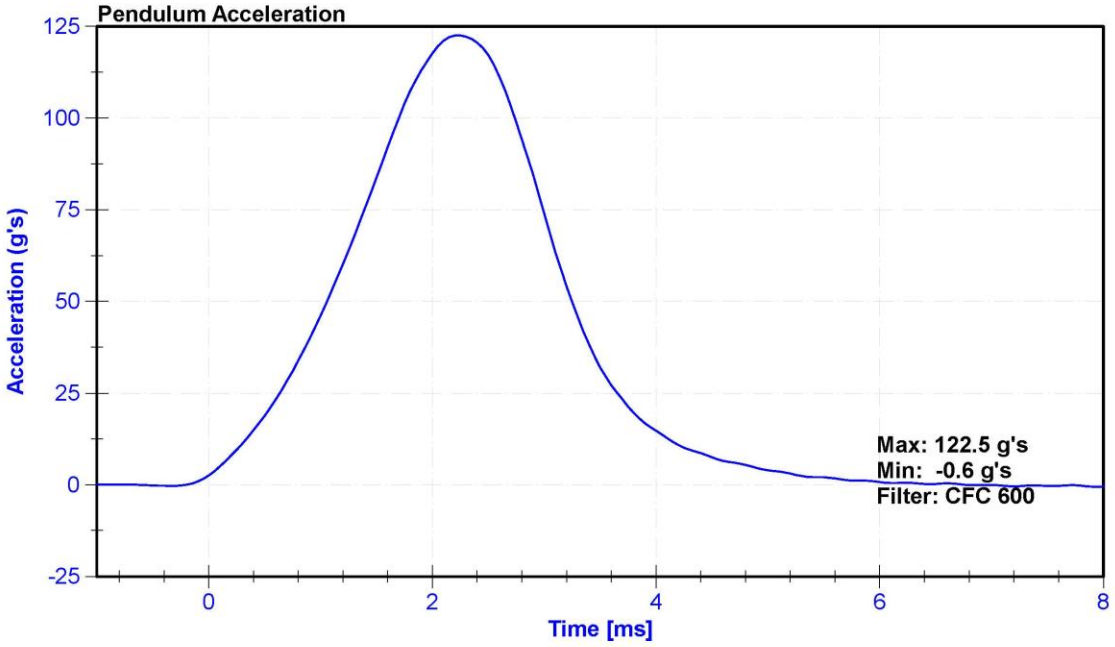
**Results**

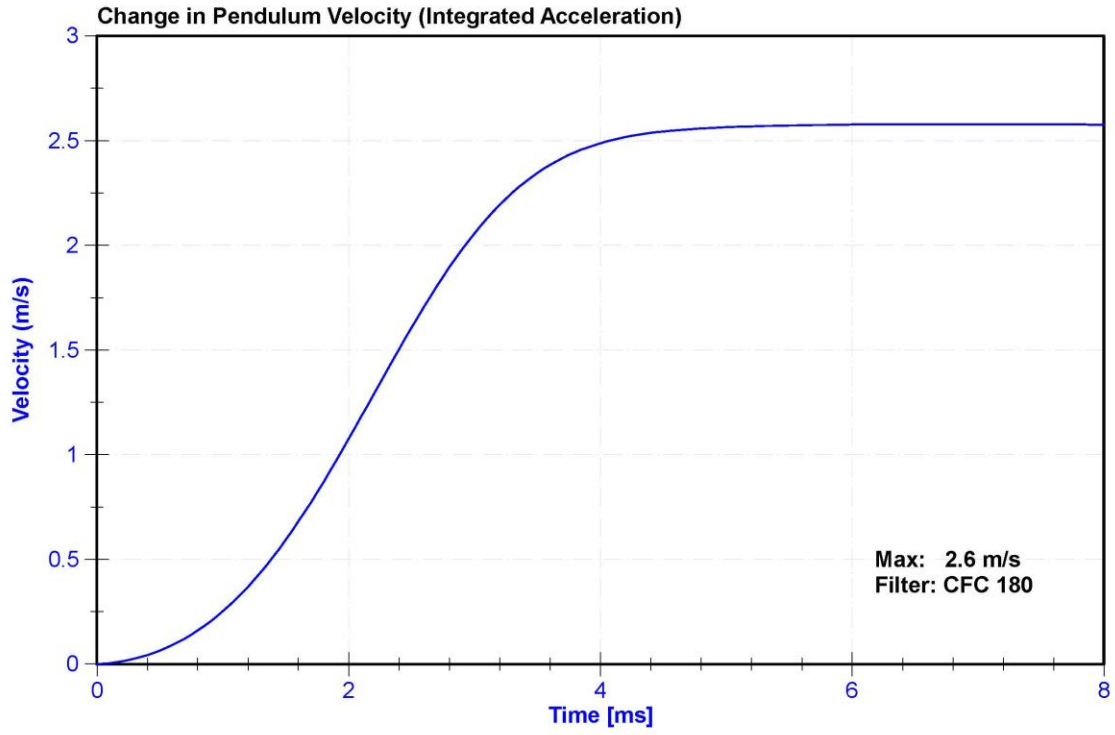
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 18.9 | 25.6 | ºC | 21.5 | Pass |
| Humidity | 10 | 70 | % | 36.0 | Pass |
| Velocity | 2.07 | 2.13 | m/s | 2.078 | Pass |
| Resistive Force | 3450 | 4060 | N | 3570.8 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7264C-2K-TZ2 | AC-P51736 | 5/14/2021 | 5/14/2022 |




Pendulum Acceleration
Acceleration (g's)
125
100
75
50
25
0
-25
0
2
4
6
8
Time [ms]
Max: 122.5 g's
Min: -0.6 g's
Filter: CFC 600


Change in Pendulum Velocity (Integrated Acceleration)
Velocity (m/s)
3
2.5
2
1.5
1
0.5
0
0
2
4
6
8
Time [ms]
Max: 2.6 m/s
Filter: CFC 180

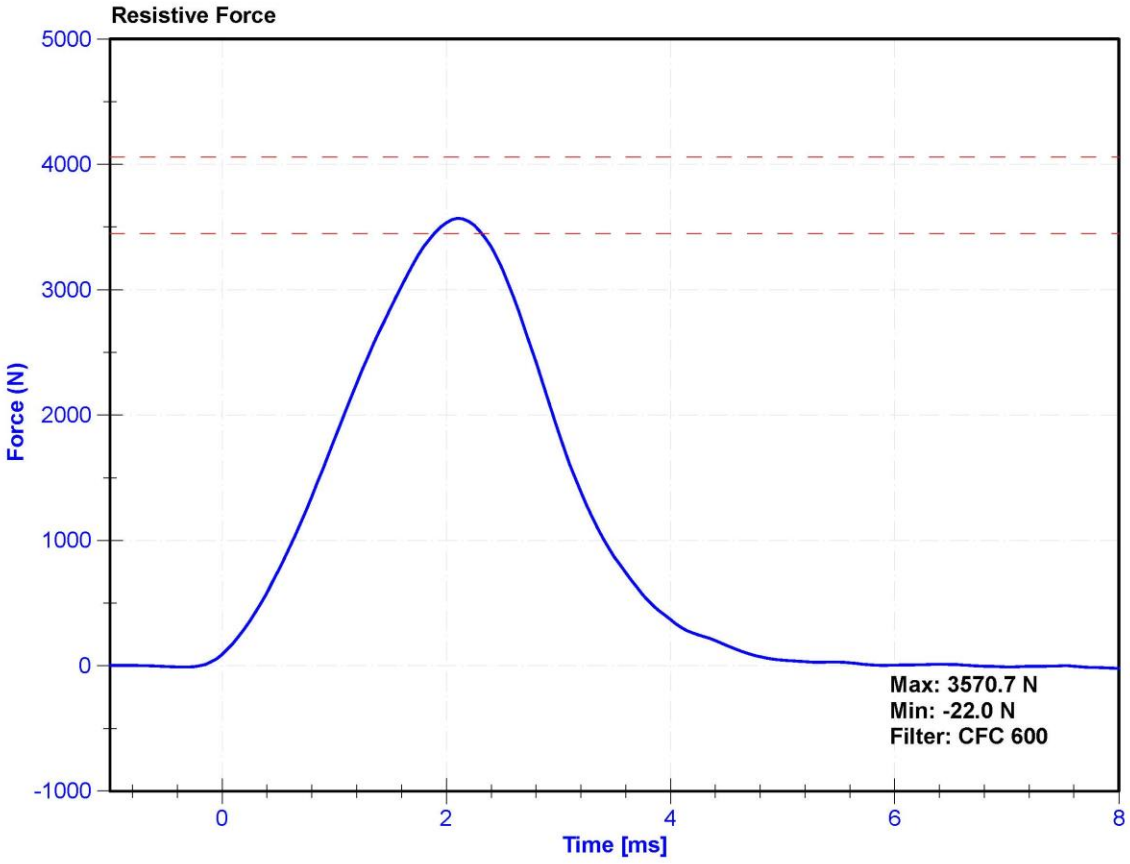
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | E. Helenbrook |
| ATD Serial Number | 288 | Laboratory Supervisor | K. Brogan |

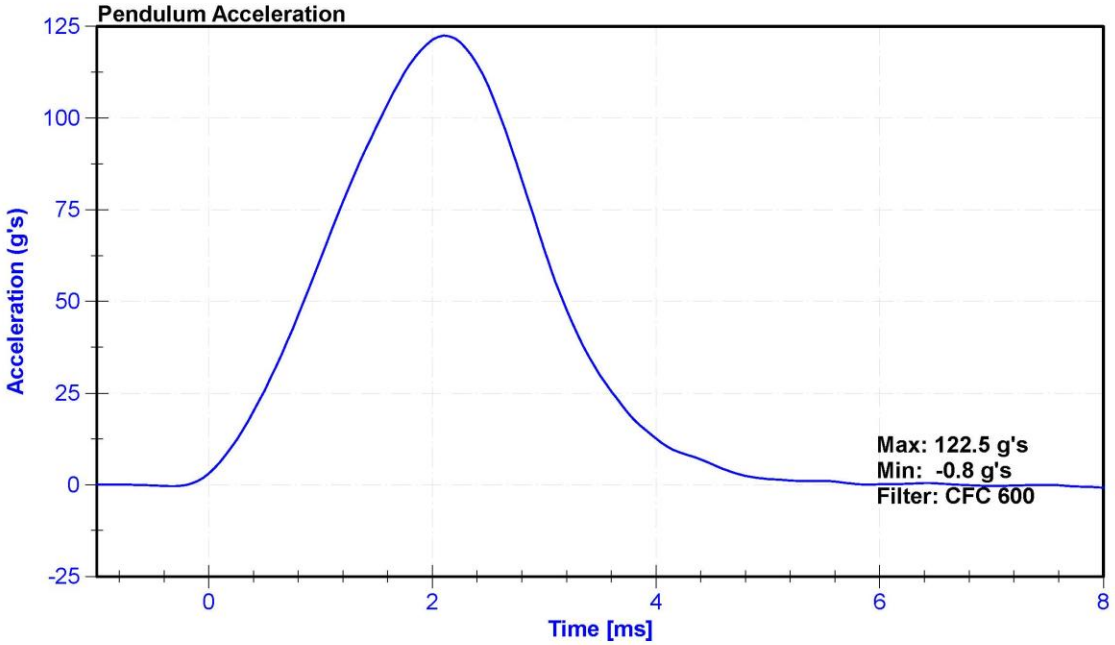
**Results**

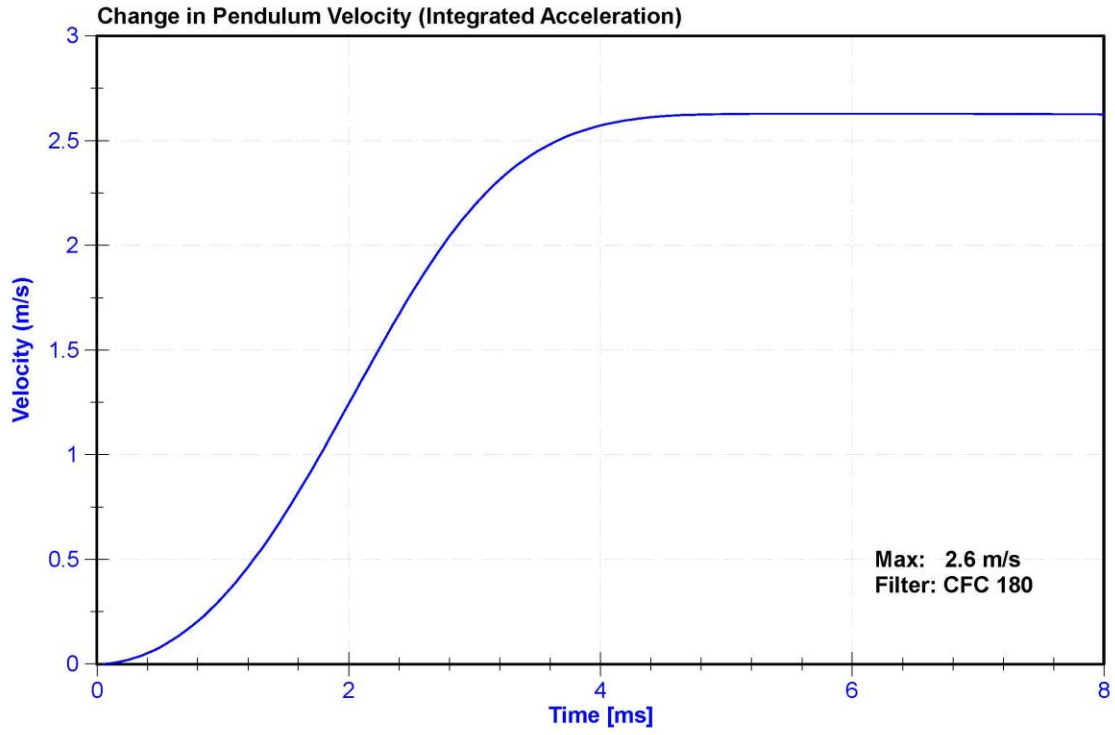
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 18.9 | 25.6 | ºC | 21.5 | Pass |
| Humidity | 10 | 70 | % | 36.3 | Pass |
| Velocity | 2.07 | 2.13 | m/s | 2.118 | Pass |
| Resistive Force | 3450 | 4060 | N | 3570.7 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7264C-2K-TZ2 | AC-P51736 | 5/14/2021 | 5/14/2022 |




Pendulum Acceleration
Acceleration (g's)
125
100
75
50
25
0
-25
0
2
4
6
8
Time [ms]
Max: 122.5 g's
Min: -0.8 g's
Filter: CFC 600


Change in Pendulum Velocity (Integrated Acceleration)
Velocity (m/s)
3
2.5
2
1.5
1
0.5
0
0
2
4
6
8
Time [ms]
Max: 2.6 m/s
Filter: CFC 180

# APPENDIX D

# DUMMY CALIBRATION AND PERFORMANCE VERIFICATION DATA

**Table 1 – Driver Dummy Instrumentation**

| Instrumentation | | Axis/Location | Hybrid III 50th S/N: 142 | | |
|---|---|---|---|---|---|
| | | | Serial Number | Manufacturer | Calibration Date |
| Head Accelerometers | Primary | X | P51681 | ENDEVCO | 5/11/2021 |
| | | Y | P64151 | ENDEVCO | 5/11/2021 |
| | | Z | P52114 | ENDEVCO | 5/11/2021 |
| | Redundant | X | P58833 | ENDEVCO | 5/11/2021 |
| | | Y | P58905 | ENDEVCO | 5/11/2021 |
| | | Z | P63996 | ENDEVCO | 5/11/2021 |
| Head Angular Rate Sensors | | X | ARS-7603 GFE | DTS ARS-PRO-8K | 8/4/2020 |
| | | Y | ARS-4718 GFE | DTS ARS-PRO-8K | 8/4/2020 |
| | | Z | ARS-7521 GFE | DTS ARS-PRO-8K | 8/4/2020 |
| Upper Neck Load Cell | | FX, Fy, Fz MX,MY, MZ | LC-2186Fx | DENTON | 11/10/2020 |
| Chest Accelerometers | Primary | X | AC-P51994 | ENDEVCO | 5/12/2021 |
| | | Y | AC-P51991 | ENDEVCO | 5/12/2021 |
| | | Z | AC-P49185 | ENDEVCO | 5/12/2021 |
| | Redundant | X | AC-P51713 | ENDEVCO | 5/12/2021 |
| | | Y | AC-P68059 | ENDEVCO | 5/12/2021 |
| | | Z | AC-P78824 | ENDEVCO | 5/12/2021 |
| Chest Potentiometer | | X | DS-142 | Servo | 5/12/2021 |
| Pelvis Accelerometer | | X | AC-P58800 | ENDEVCO | 5/12/2021 |
| | | Y | AC-P52157 | ENDEVCO | 5/12/2021 |
| | | Z | AC-P52156 | ENDEVCO | 5/12/2021 |
| Femur Load Cells - Left | Primary | Z | LC-136Fz1 | DENTON | 11/10/2020 |
| | Redundant | Z | LC-136Fz2 | DENTON | 11/10/2020 |
| Femur Load Cells - Right | Primary | Z | LC-DI4211FZ1 | DENTON | 11/10/2020 |
| | Redundant | Z | LC-DI4211FZ2 | DENTON | 11/10/2020 |
| Tibia Load Cells - Left | Upper | MX, MY, FZ | 3643-93 Fz | DENTON | 11/20/2020 |
| | Lower | MX, MY, FZ | 36440495-FZ | DENTON | 11/20/2020 |
| Tibia Load Cells – Right | Upper | MX, MY, FZ | 36430362-FZ | DENTON | 11/20/2020 |
| | Lower | MX, MY, FZ | LC-672 FZ | DENTON | 7/8/2020 |
| Foot Accelerometers - Left | Rear | X | AC-P50084 | ENDEVCO | 5/11/2021 |
| | Front | Z | AC-P58779 | ENDEVCO | 5/11/2021 |
| Foot Accelerometers - Right | Rear | X | AC-P51872 | ENDEVCO | 5/11/2021 |
| | Front | Z | AC-P58893 | ENDEVCO | 5/11/2021 |
| Seat belt Load Cells | Lap | | LC-292 | GFE IF-964 | 5/4/2021 |
| | Shoulder | | NA | NA | NA |

**Table 2 – Front Passenger Dummy Instrumentation**

| Instrumentation | | Axis/Location | Hybrid III 5th S/N: 288 | | |
|---|---|---|---|---|---|
| | | | Serial Number | Manufacturer | Calibration Date |
| Head Accelerometers | Primary | X | AC-P58780 | ENDEVCO | 4/5/2021 |
| | | Y | AC-P83320 | ENDEVCO | 4/5/2021 |
| | | Z | AC-P58997 | ENDEVCO | 4/5/2021 |
| | Redundant | X | AC-P58998 | ENDEVCO | 4/5/2021 |
| | | Y | AC-P58749 | ENDEVCO | 4/5/2021 |
| | | Z | AC-P49226 | ENDEVCO | 4/6/2021 |
| Head Angular Rate Sensors | | X | ARS14934GFE | DTS ARS PRO-18K | 3/2/2021 |
| | | Y | ARS11059GFE | DTS ARS PRO-8K | 3/2/2021 |
| | | Z | ARS11335GFE | DTS PRO-18K 2KHz | 3/2/2021 |
| Upper Neck Load Cell | | FX, Fy, Fz MX,MY, MZ | LC-851 Fx | FTSS 1716 | 7/9/2020 |
| Chest Accelerometers | Primary | X | AC-P52064 | ENDEVCO | 11/12/2020 |
| | | Y | T20868 | ENDEVCO | 11/12/2020 |
| | | Z | AC-P83317 | ENDEVCO | 11/12/2020 |
| | Redundant | X | T20887 | ENDEVCO | 5/13/2021 |
| | | Y | P80268 | ENDEVCO | 5/13/2021 |
| | | Z | AC-P59020 | ENDEVCO | 11/12/2020 |
| Chest Potentiometer | | X | DS-288GFE | SERVO | 1/21/2021 |
| Pelvis Accelerometer | | X | AC-P58895 | ENDEVCO | 4/6/2021 |
| | | Y | AC-P51220 | ENDEVCO | 4/5/2021 |
| | | Z | AC-P82759 | ENDEVCO | 4/5/2021 |
| Femur Load Cells - Left | Primary | Z | LC-115-1 Fz | Denton | 11/23/2020 |
| | Redundant | Z | LC-115-2 Fz | Denton | 11/23/2020 |
| Femur Load Cells - Right | Primary | Z | LC-135Fz1 | Denton | 11/23/2020 |
| | Redundant | Z | LC-135Fz2 | Denton | 11/23/2020 |
| Tibia Load Cells - Left | Upper | MX, MY, FZ | 36430407-FZ | Denton | 7/9/2020 |
| | Lower | MX, MY, FZ | 36440674-FZ | Denton | 11/20/2020 |
| Tibia Load Cells – Right | Upper | MX, MY, FZ | 36430486-FZ | Denton | 11/20/2020 |
| | Lower | MX, MY, FZ | LC-490Fz | Denton | 11/20/2020 |
| Foot Accelerometers - Left | Rear | X | AC-P82750 | ENDEVCO | 4/5/2021 |
| | Front | Z | AC-P52040 | ENDEVCO | 4/6/2021 |
| Foot Accelerometers - Right | Rear | X | AC-P49182 | ENDEVCO | 4/5/2021 |
| | Front | Z | AC-P52054 | ENDEVCO | 4/5/2021 |
| Seat belt Load Cells | Lap | | LC-174 | GFE IF-964 | 5/4/2021 |
| | Shoulder | | NA | NA | NA |

**Table 3 – Vehicle Instrumentation**

| Instrumentation | | | Axis | Serial Number | Manufacturer | Calibration Date |
|---|---|---|---|---|---|---|
| Crossmember/Rear Seat Accelerometers | Left | Primary | X | 1201-1000_A335428 | Measurement Specialties | 4/1/2021 |
| | | | Z | 1201-1000_A374352 | Measurement Specialties | 11/28/2020 |
| | | Redundant | X | 1201-1000_A373221 | Measurement Specialties | 3/25/2021 |
| | Right | Primary | X | 1201-1000_A373216 | Measurement Specialties | 3/24/2021 |
| | | | Z | 1201-1000_A374337 | Measurement Specialties | 11/30/2020 |
| | | Redundant | X | 1201-1000_A374217 | Measurement Specialties | 11/30/2020 |
| Engine Accelerometers | Top | | X | 1201-1000_A335439 | Measurement Specialties | 4/16/2021 |
| | Bottom | | X | 1201-1000_A374348 | Measurement Specialties | 3/25/2021 |