

REPORT NUMBER: SideNCAPMDB-KAR-23-004

**NEW CAR ASSESSMENT PROGRAM (NCAP)
MOVING DEFORMABLE BARRIER SIDE IMPACT TEST**

**HYUNDAI MOTOR MANUFACTURING ALABAMA, LLC
2023 HYUNDAI SANTA CRUZ 4-DOOR TRUCK**

NHTSA No: M20234202

**PREPARED BY:
APPLUS+ IDIADA KARCO ENGINEERING, LLC.
9270 HOLLY ROAD
ADELANTO, CA 92301**



MARCH 8, 2023

FINAL REPORT

**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF CRASHWORTHINESS STANDARDS
MAIL CODE: NRM-100
1200 NEW JERSEY AVE, SE
WASHINGTON, D.C. 20590**

TECHNICAL REPORT DOCUMENTATION PAGE

| 1. Report No. SideNCAPMDB-KAR-23-004 | 2. Government Accession No. | 3. Recipient's Catalog No. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|--|------------------|-------------------------|-------------------------|--|--|-------|------|--------|---|--|------|---------|------------------------------------|----|----|--------|---|---|------|----------|---------------------------------|----|------|----------|----------------------------------|----|-----|--------|
| 4. Title and Subtitle Final Report of New Car Assessment Program Side Impact MDB Testing of a 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202 | | 5. Report Date March 8, 2023 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 6. Performing Organization Code KAR | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7. Authors Mr. Matthew J. Angeles, Project Engineer, Applus+ IDIADA KARCO Engineering, LLC Mr. Alex Beltran, Engineering Manager, Applus+ IDIADA KARCO Engineer, LLC | | 8. Performing Organization Report No. TR-P43028-01-NC | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 10. Work Unit No. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9. Performing Organization Name and Address Applus+ IDIADA KARCO Engineering, LLC. 9270 Holly Rd. Adelanto, CA 92301 | | 11. Contract or Grant No. 693JJ920D000015 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 13. Type of Report and Period Covered Final Test Report, February 22 - March 8, 2023 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12. Sponsoring Agency Name and Address U. S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NRM-100) 1200 New Jersey Ave., SE Washington, D.C. 20590 | | 14. Sponsoring Agency Code NRM-100 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 15. Supplementary Notes | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16. Abstract A 61.9 km/h 90° Moving Deformable Barrier NCAP Side Impact Test was conducted on the subject 2023 Hyundai Santa Cruz Tundra 4-Door Truck in accordance with the specifications of the Office of Crashworthiness Standards Test Procedure for the generation of consumer information on vehicle side crash protection. The test was conducted at the Applus IDIADA KARCO Engineering, LLC. facility in Adelanto, California on February 22, 2023. The impact velocity of the Moving Deformable Barrier was 61.79 km/h and the outside ambient temperature at the struck (driver's) side of the vehicle was 4.0°C. The target vehicle's maximum post-test static crush was 223 mm located at level 2. The test vehicle's occupant performance data is as follows: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="width: 35%;">Measurement Description</th> <th colspan="3">Driver ATD (ES-2re)</th> </tr> <tr> <th style="width: 15%;">Units</th> <th style="width: 15%;">IARV</th> <th style="width: 35%;">Result</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC₃₆)</td> <td></td> <td>1000</td> <td>54.404</td> </tr> <tr> <td>Maximum Thoracic Rib Deflection</td> <td>mm</td> <td>44</td> <td>17.617</td> </tr> <tr> <td>Total Abdominal Force</td> <td>N</td> <td>2500</td> <td>950.625</td> </tr> <tr> <td>Pubic Symphysis Force</td> <td>N</td> <td>6000</td> <td>1415.226</td> </tr> </tbody> </table> | | | | Measurement Description | Driver ATD (ES-2re) | | | Units | IARV | Result | Head Injury Criteria (HIC ₃₆) | | 1000 | 54.404 | Maximum Thoracic Rib Deflection | mm | 44 | 17.617 | Total Abdominal Force | N | 2500 | 950.625 | Pubic Symphysis Force | N | 6000 | 1415.226 | | | | |
| Measurement Description | Driver ATD (ES-2re) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Units | IARV | Result | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Head Injury Criteria (HIC ₃₆) | | 1000 | 54.404 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum Thoracic Rib Deflection | mm | 44 | 17.617 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Total Abdominal Force | N | 2500 | 950.625 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pubic Symphysis Force | N | 6000 | 1415.226 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="width: 35%;">Measurement Description</th> <th colspan="3">Passenger ATD (SID-IIs)</th> </tr> <tr> <th style="width: 15%;">Units</th> <th style="width: 15%;">IARV</th> <th style="width: 35%;">Result</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC₃₆)</td> <td></td> <td>1000</td> <td>171.566</td> </tr> <tr> <td>Resultant Lower Spine Acceleration</td> <td>g</td> <td>82</td> <td>43.063</td> </tr> <tr> <td>Total Pelvic Force (Sum of Acetubular and Iliac Forces)</td> <td>N</td> <td>5525</td> <td>2203.304</td> </tr> <tr> <td>Maximum Thoracic Rib Deflection</td> <td>mm</td> <td>38*</td> <td>8.458</td> </tr> <tr> <td>Maximum Abdominal Rib Deflection</td> <td>mm</td> <td>45*</td> <td>35.551</td> </tr> </tbody> </table> | | | | Measurement Description | Passenger ATD (SID-IIs) | | | Units | IARV | Result | Head Injury Criteria (HIC ₃₆) | | 1000 | 171.566 | Resultant Lower Spine Acceleration | g | 82 | 43.063 | Total Pelvic Force (Sum of Acetubular and Iliac Forces) | N | 5525 | 2203.304 | Maximum Thoracic Rib Deflection | mm | 38* | 8.458 | Maximum Abdominal Rib Deflection | mm | 45* | 35.551 |
| Measurement Description | Passenger ATD (SID-IIs) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Units | IARV | Result | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Head Injury Criteria (HIC ₃₆) | | 1000 | 171.566 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Resultant Lower Spine Acceleration | g | 82 | 43.063 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Total Pelvic Force (Sum of Acetubular and Iliac Forces) | N | 5525 | 2203.304 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum Thoracic Rib Deflection | mm | 38* | 8.458 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maximum Abdominal Rib Deflection | mm | 45* | 35.551 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Both struck side doors were jammed shut and did not separate from the body at the hinges or latches. The opposite side doors did not open during the side impact event. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 17. Key Words New Car Assessment Program (NCAP) Side Impact Moving Deformable Barrier (MDB) ES-2re SID-IIs | | 18. Distribution Statement Copies of this report are available from: National Highway Traffic Safety Admin. Technical Reference Division 1200 New Jersey Ave., SE Washington, DC 20590 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 19. Security Classification of this report UNCLASSIFIED | 20. Security Classification of this page UNCLASSIFIED | 21. No. of Pages 152 | 22. Price | | | | | | | | | | | | | | | | | | | | | | | | | | | |

*Proposed IARV

TABLE OF CONTENTS

| <u>Section</u> | | <u>Page</u> |
|-------------------|--|-------------|
| 1 | Test Purpose and Procedure | 1 |
| 2 | Summary of Test Results | 2 |
| 3 | Occupant and Vehicle Information/Data Sheets | 4 |
| | | |
| <u>Data Sheet</u> | | <u>Page</u> |
| 1 | General Test and Vehicle Parameter Data | 5 |
| 2 | Seat, Seat Belt, Steering Wheel Adjustment, and Fuel System Data | 9 |
| 3 | Dummy Longitudinal Clearance Dimensions | 13 |
| 4 | Dummy Lateral Clearance Dimensions | 14 |
| 5 | Camera and Instrumentation Data | 15 |
| 6 | Test Vehicle Accelerometer Locations | 16 |
| 7 | MDB Accelerometer Locations | 17 |
| 8 | Post-Test Observations | 18 |
| 9 | MDB Summary of Results | 21 |
| 10 | Test Vehicle Profile Measurements | 22 |
| 11 | Test Vehicle Exterior Crush Measurements | 23 |
| 12 | MDB Exterior Static Crush Measurements | 26 |
| 13 | Vehicle and MDB Damage Profile Distances | 27 |
| 14 | FMVSS No. 301 Static Rollover Results | 28 |
| 15 | Dummy/Vehicle Temperature and Humidity Stabilization | 29 |
| | | |
| <u>Appendix</u> | | <u>Page</u> |
| A | Photographs | A |
| B | Vehicle and Dummy Response Data Plots | B |
| C | ATD Configuration and Performance Verification Data | C |
| D | Test Equipment and Instrumentation Calibration Data | D |

SECTION 1
TEST PURPOSE AND PROCEDURE

This moving deformable barrier side impact test is part of the MY 2023 New Car Assessment Program Side Impact Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under contract number 693JJ920D000015. The purpose of this test is to generate comparative side impact performance in a 2023 Hyundai Santa Cruz 4-door truck. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Laboratory Test Procedure dated March 2020.

SECTION 2

SUMMARY OF TEST RESULTS

A 2023 Hyundai Santa Cruz 4-door truck was impacted on the left (driver's) side by a Moving Deformable Barrier (MDB) which was moving forward in a 27° crabbed position to the tow road guidance system at a velocity of 61.79 km/h (38.39 mph). The target vehicle was stationary and was positioned at an angle of 63° to the line of forward motion. The side impact test was conducted by Applus IDIADA KARCO Engineering, LLC. in Adelanto, California, on February 22, 2023. Pre- and post-test photographs of the test vehicle, the MDB and the dummy (ES-2re and SID-IIs) are included in Appendix A of this report.

The dummies were placed in the driver and left rear designated seating position according to instructions specified in the OCWS Side Impact Laboratory Test Procedure, dated March 2020. The side impact event was documented by 11 cameras. Camera locations are included in Data Sheet No. 5 of this report.

The dummies were instrumented in the following manner:

DRIVER ATD (ES-2re)

Primary and redundant head CG tri-axial accelerometers

Chest upper rib, middle rib and lower rib y-axis displacement potentiometers

Abdomen forward, middle, and rear y-axis load cells

Lower spine (12) tri-axial accelerometers

Pubic symphysis y-axis load cell

PASSENGER ATD (SID-IIs)

Primary and redundant head CG tri-axial accelerometers

Chest upper rib, middle rib and lower rib y-axis displacement potentiometers

Abdomen upper rib and lower rib y-axis displacement potentiometers

Lower spine (12) tri-axial accelerometers

Acetabulum and iliac wing y-axis load cells

Appendix B contains the vehicle and dummy response data. Dummy configuration and performance verification data can be found in Appendix C of this report. Appendix D of this report contains the test equipment and instrumentation calibration data.

Dummy injury readings were recorded as follows:

| Measurement Description | Units | Driver ATD (ES-2re) | |
|---|-------|---------------------|----------|
| | | Threshold | Result |
| Head Injury Criteria (HIC ₃₆) | | 1000 | 54.404 |
| Maximum Thoracic Rib Deflection | mm | 44 | 17.617 |
| Combined Abdominal Force | N | 2500 | 950.625 |
| Pubic Symphysis Force | N | 6000 | 1415.226 |

| Measurement Description | Units | Passenger ATD (SID-IIs) | |
|---|-------|-------------------------|----------|
| | | Threshold | Result |
| Head Injury Criteria (HIC ₃₆) | | 1000 | 171.566 |
| Lower Spine (T12) Resultant Acceleration | g | 82 | 43.063 |
| Total Pelvic Force (sum of acetabular and iliac forces) | N | 5525 | 2203.304 |
| Maximum Thoracic Rib Deflection | mm | 38* | 8.458 |
| Maximum Abdominal Rib Deflection | mm | 45* | 35.551 |

*Proposed IARV

Supplemental restraint information is given below:

| Restraint Type | Left Front (Driver) Occupant Location 1 | | Left Rear (Passenger) Occupant Location 4 | |
|------------------------------|--|----------|--|----------|
| | Mounted | Deployed | Mounted | Deployed |
| Frontal Airbag | Yes | No | | |
| Knee Airbag | No | | | |
| Side Airbag 1 (Curtain) | Yes | Yes | Yes | Yes |
| Side Airbag 2 (Torso/Pelvis) | Yes | Yes | No | |
| Seat Belt Pretensioner | Yes | Yes | No | |
| Seat Belt Load Limiter | Yes | Yes | No | |

GENERAL COMMENTS:

- None

SECTION 3

OCCUPANT AND VEHICLE INFORMATION/DATA SHEETS

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202

Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23

CONVERSION FACTORS

| Quantity | Typical Application | Std Units | Metric Unit | Multiply By |
|--------------------|---------------------|---------------------|-------------|-------------------|
| Mass | Vehicle Weight | lb | kg | 0.4536 |
| Linear Velocity | Impact Velocity | miles/hr | km/hr | 1.609344 |
| Length or Distance | Measurements | in | mm | 25.4 |
| Volume | Fuel Systems | gal | liter | 3.785 |
| Volume | Small Fluids | oz | mL | 29.574 |
| Pressure | Tire Pressures | lbf/in ² | kPa | 6.895 |
| Temperature | General Use | °F | °C | $=(T_f - 32)/1.8$ |
| Force | Dynamic Forces | lbf | N | 4.448 |
| Moment | Torque | lbf-ft | N•m | 1.355 |

DATA SHEET NO. 1S

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202
 Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23

TEST VEHICLE INFORMATION AND OPTIONS

| | |
|----------------------------|-------------------|
| NHTSA Number | M20234202 |
| Model Year | 2023 |
| Make | Hyundai |
| Model | Santa Cruz |
| Body Style | 4-Door Truck |
| VIN | 5NTJC4AE1PH055228 |
| Body Color | Blue Stone |
| Odometer Reading (km / mi) | 203 / 126 |
| Engine Displacement (L) | 2.5 |
| Type / No. of Cylinders | Inline |
| Engine Placement | Longitudinal |
| Transmission Type | Automatic |
| Transmission Speeds | 8 |
| Overdrive | Yes |
| Final Drive | FWD |
| Roof Rack | Yes |
| Sunroof / T-Top | Yes |
| Running Boards | No |
| Tilt Steering Wheel | Yes |
| Power Seats | Yes |
| Anti-Lock Brakes (ABS) | Yes |

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

Does Owner's Manual provide instructions to turn off automatic door locks? Yes

DATA FROM CERTIFICATION LABEL

| | |
|---------------------|--|
| Manufactured By | Hyundai Motor Manufacturing Alabama, LLC |
| Date of Manufacture | 22-Dec |
| Vehicle Type | Truck |

| | |
|------------------|------|
| GVWR (lbs) | 5456 |
| GAWR Front (lbs) | 2645 |
| GAWR Rear (lbs) | 3196 |

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

| Measured Parameter | Front | Rear | Third | Total | |
|-----------------------------|-------|------|-------|-------|------|
| Designated Seating Capacity | 2 | 3 | | 5 | |
| Capacity Weight (VCW) (kg) | | | | 640.0 | A |
| DSC x 68.04 (kg) | | | | 340.2 | B |
| Cargo Weight (RCLW) (kg) | | | | 136.0 | A-B* |

**For trucks or MPVs, if A-B>136, RCLW=136 kg

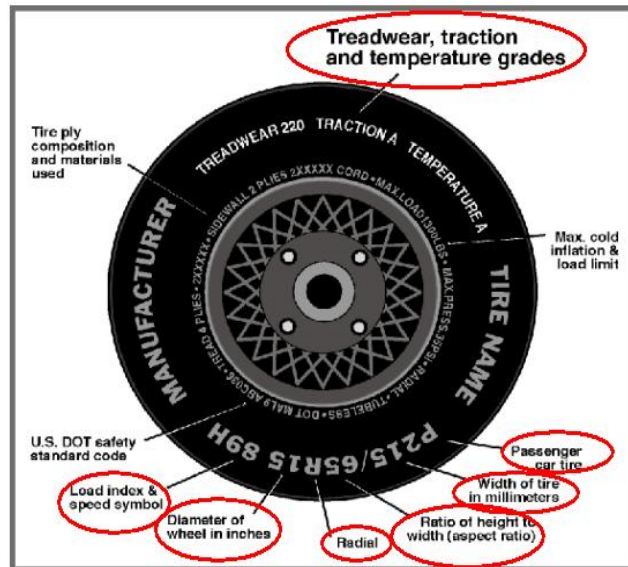
VEHICLE SEAT TYPE

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

DATA SHEET NO. 1 ... (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202
 Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23



| Measured Parameter | Front | Rear |
|--------------------------|-----------------------------------|-----------------------------------|
| Max. Tire Pressure (kpa) | 350 | 350 |
| Cold Pressure (kPa) | 240 | 240 |
| Recommended Tire Size | P245/60R18 | P245/60R18 |
| Tire Size on Vehicle | P245/60R18 | P245/60R18 |
| Tire Manufacturer | Kumho | Kumho |
| Tire Model | Crugen | Crugen |
| Treadware | 540 | 540 |
| Traction Grade | A | A |
| Temperature Grade | A | A |
| Tire Plies Sidewall | 2 Polyester | 2 Polyester |
| Tire Plies Body | 2 Steel, 2 Polyester, 1 Polyamide | 2 Steel, 2 Polyester, 1 Polyamide |
| Load Index/Speed Symbol | 105H | 105H |
| Tire Material | Steel, Polyester, Polyamide | Steel, Polyester, Polyamide |
| DOT Safety Code Left | 000J8YA8E3122 | 000J8YA8E3122 |
| DOT Safety Code Right | 000J8YA8E2422 | 000J8YA8E4322 |

DATA SHEET NO. 1 ... (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202
 Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23

TIRE PRESSURES

| | Units | LF | RF | LR | RR |
|----------------|-------|-----|-----|-----|-----|
| As Delivered | kPa | 240 | 240 | 240 | 240 |
| Tire Placard | kPa | 240 | 240 | 240 | 240 |
| Owner's Manual | kPa | 240 | 240 | 240 | 240 |
| As Tested | kPa | 240 | 240 | 240 | 240 |

MDB TIRE SPECIFICATIONS

| | Units | Requirement | LF | RF | LR | RR |
|---------------|-------|-------------|------------|------------|------------|------------|
| Tire Size | | P205/75R15 | P205/75R15 | P205/75R15 | P205/75R15 | P205/75R15 |
| Tire Pressure | kPa | 200 ± 21 | 220 | 220 | 220 | 220 |

TEST VEHICLE AXLE WEIGHTS

| | Units | As Delivered (UVW) | | | As Tested (ATW) | | | Fully Loaded | | |
|-------|-------|--------------------|-------|--------|-----------------|--------|--------|--------------|-------|--------|
| | | Front | Rear | Total | Front | Rear | Total | Front | Rear | Total |
| Left | kg | 480.5 | 386.5 | | 482.5 | 561.5 | | 553.0 | 503.0 | |
| Right | kg | 493.0 | 372.5 | | 487.0 | 456.0 | | 497.5 | 440.0 | |
| Ratio | % | 56.2% | 43.8% | | 48.8% | 51.2% | | 52.7% | 47.3% | |
| Total | kg | 973.5 | 759.0 | 1732.5 | 969.5 | 1017.5 | 1987.0 | 1050.5 | 943.0 | 1993.5 |

TARGET TEST WEIGHT CALCULATION

| Measured Parameter | Units | Value | |
|-------------------------------------|-------|--------|-------|
| Total Delivered Weight (UVW) | kg | 1732.5 | A |
| Actual Weight of 2 P572 ATD Used | kg | 125.0 | B |
| Rated Cargo/Luggage Wt (RCLW) | kg | 136.0 | C |
| Calculated Vehicle Target Wt (TVTW) | kg | 1993.5 | A+B+C |

Does the measured As Tested Vehicle Weight lie within the required weight range (i.e. Calculated Test Vehicle Target Weight -4.5 kg to -9.0 kg)? Yes No

TEST VEHICLE ATTITUDE AND CG

| Measurement Description | Units | Fully Loaded | As Tested | Meets Requirement*** |
|--|-------|--------------|-----------|----------------------|
| LF | mm | 820 | 830 | Yes |
| RF | mm | 822 | 825 | Yes |
| LR | mm | 812 | 821 | Yes |
| RR | mm | 811 | 820 | Yes |
| Vehicle CG (Aft of Front Axle) | mm | 1421 | 1538 | |
| Vehicle CG (Left (+)/Right (-) from Longitudinal Centerline) | mm | 48 | 41 | |

***The "As Tested" vehicle attitude measurements must be equal to or within ±10 mm of the "Fully Loaded" vehicle attitude measurements at each wheel well. Indicate "Yes" or "No" for "Meets Requirement"

DATA SHEET NO. 1 ... (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202
Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23

| | |
|--|--|
| Test Height Adjustable Setting (If Applicable) | |
|--|--|

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

| Component Description | Weight (kg) |
|-----------------------|-------------|
| N/A | N/A |

TEST SURFACE MARKINGS

| | Distance from 63° Impact Angle Line (mm) |
|-----------------------|--|
| Fore 25 mm target | 0 |
| Aft 25 mm target | 0 |
| Pre-Impact Angle Line | 63° |

| Parallel Track Target | X Location (mm) | Y Location (mm) |
|-----------------------|-----------------|-----------------|
| A | 0 | 0 |
| B | 1355 | 689 |
| C | 1355 | 3756 |
| D | 0 | 3059 |

DATA SHEET NO. 2

SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT, AND FUEL SYSTEM DATA

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202
 Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23

SEAT POSITIONING

The driver’s seat, front center seat (if applicable), and right front passenger’s seat should be set to the mid-track, lowest, mid-angle position. The struck side rear passenger’s seat, rear center seat, and non-struck side rear passenger’s seats should be set to the rearmost, lowest, mid-angle position.

SCRL ANGLE RANGE

| Seat | SCRL (°) | | |
|---------------------------|----------|-------|-------|
| | Max | Min | Mid |
| Driver Seat | 6.4 | 0.5 | 3.4 |
| Front Passenger Seat | Fixed | Fixed | Fixed |
| Front Center Seat | | | |
| Struck Side Rear Seat | Fixed | Fixed | Fixed |
| Non-Struck Side Rear Seat | Fixed | Fixed | Fixed |
| Rear Center Seat | Fixed | Fixed | Fixed |

SEAT HEIGHT AND ANGLE

| Seat | As Tested SCRL Angle (Mid) (°) | As Tested SCRP Height (mm) | SCRP Height Position | SCRP Height (mm) | | |
|---------------------------|--------------------------------|----------------------------|----------------------|------------------|--------------|-------------|
| | | | | Rearmost | Mid Fore/Aft | Forwardmost |
| Driver Seat | 3.4 | 708 | Max | 731 | 737 | 744 |
| | | | Mid | 715 | 724 | 728 |
| | | | Min | 700 | 708 | 714 |
| Front Passenger Seat | 7.6 | 664 | Max | 659 | 664 | 671 |
| | | | Mid | 659 | 664 | 671 |
| | | | Min | 659 | 664 | 671 |
| Front Center Seat | | | Max | | | |
| | | | Mid | | | |
| | | | Min | | | |
| Struck Side Rear Seat | Fixed | Fixed | Max | Fixed | Fixed | Fixed |
| | | | Mid | Fixed | Fixed | Fixed |
| | | | Min | Fixed | Fixed | Fixed |
| Non-Struck Side Rear Seat | Fixed | Fixed | Max | Fixed | Fixed | Fixed |
| | | | Mid | Fixed | Fixed | Fixed |
| | | | Min | Fixed | Fixed | Fixed |
| Rear Center Seat | Fixed | Fixed | Max | Fixed | Fixed | Fixed |
| | | | Mid | Fixed | Fixed | Fixed |
| | | | Min | Fixed | Fixed | Fixed |

DATA SHEET NO. 2 ... (CONTINUED)

SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT, AND FUEL SYSTEM DATA

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202
 Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23

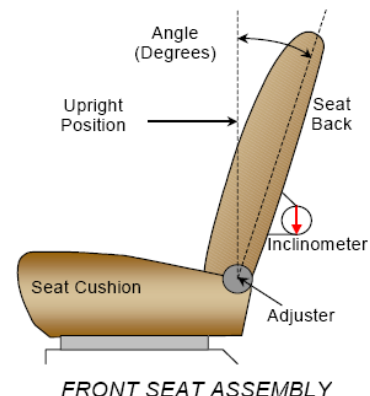
SEAT FORE/AFT POSITION

| Seat | Total Fore/Aft Travel | | Test Position From Forwardmost Position | |
|---------------------------|-----------------------|----------|---|---------|
| | mm | Detents* | mm | Detent* |
| Driver Seat | 240 | | 120 | |
| Front Passenger Seat | 240 | 37 | 120 | 18 |
| Front Center Seat | | | | |
| Struck Side Rear Seat | Fixed | Fixed | Fixed | Fixed |
| Non-Struck Side Rear Seat | Fixed | Fixed | Fixed | Fixed |
| Rear Center Seat | Fixed | Fixed | Fixed | Fixed |

*Detent zero (0) is the forward most detent

SEAT BACK ADJUSTMENT

The driver's seat back is positioned to the manufacturer's designated design angle. The right front passenger's seat back is positioned in a similar manner as the driver's seat back. The struck side rear seat back is fixed. The rear center and non-struck side rear outboard seat backs are positioned in a similar manner as the struck side rear seat back. Seat back angle is measured at the head rest post.



SEAT BACK POSITION

| Seat | Total Seat Back Angle Range | | Test Position from Most Upright | |
|--------------------------------------|-----------------------------|----------|---------------------------------|---------|
| | Degrees | Detents* | Degree | Detent* |
| Driver Seat w/ Seated Dummy | 63.8 | | 0.5 | |
| Front Passenger Seat | 60.1 | 33 | 0.5 | |
| Front Center Seat | | | | |
| Struck Side Rear Seat w/Seated Dummy | Fixed | Fixed | Fixed | Fixed |
| Non-Struck Side Rear Seat | Fixed | Fixed | Fixed | Fixed |
| Rear Center Seat | Fixed | Fixed | Fixed | Fixed |

*Detent zero (0) is the forward most detent

DATA SHEET NO. 2 ... (CONTINUED)

SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT, AND FUEL SYSTEM DATA

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202
 Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23

SEAT BELT ANCHORAGE ADJUSTMENT

Seat belt anchorages are adjusted in accordance with the information provided by the manufacturer on Form No. 1. The positions are marked H, M2, M1, L from top to bottom.

| | Total No. of Positions | Placed in Position |
|-------------|------------------------|--------------------|
| Driver Seat | 4 | H |
| Rear Seat | Fixed | Fixed |

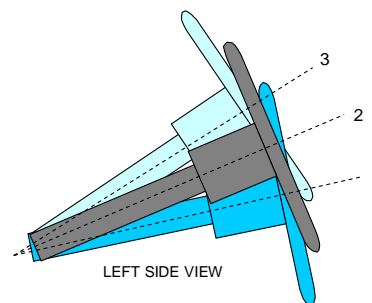
HEAD RESTRAINT ADJUSTMENT

The driver's head restraint is adjusted to the highest and most full forward in-use position. The struck-side rear passenger's head restraint is adjusted to the lowest and most full forward in-use position.

| | Total No. of Positions | Placed in Position |
|-------------|------------------------|--------------------|
| Driver Seat | 5 | H |
| Rear Seat | 3 | L |

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the center of the geometric locus it describes when it moves through its full range of motion.



LEFT SIDE VIEW
STEERING COLUMN ASSEMBLY

STEERING COLUMN POSITIONING

| | Degrees | Fore-Aft Position (mm) |
|-----------------------------------|---------|------------------------|
| Lowermost Position, No. 1 | 62.0 | 225 |
| Geometric Center Position, No. 2 | 64.5 | 250 |
| Uppermost Position, No. 3 | 66.9 | 275 |
| Telescoping Steering Wheel Travel | | 50 |
| Test Position | 64.5 | 250 |

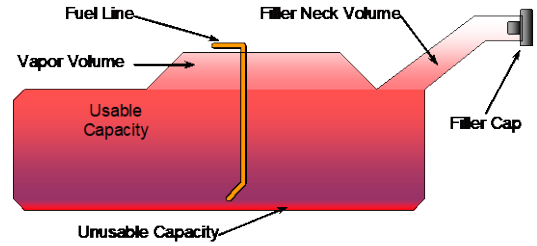
DATA SHEET NO. 2 ... (CONTINUED)

SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT, AND FUEL SYSTEM DATA

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202
 Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23

FUEL PUMP

The vehicle is equipped with an electric fuel pump. The fuel pump is activated when the ignition is turned to "ON" position.



FUEL TANK CAPACITY

VEHICLE FUEL TANK ASSEMBLY

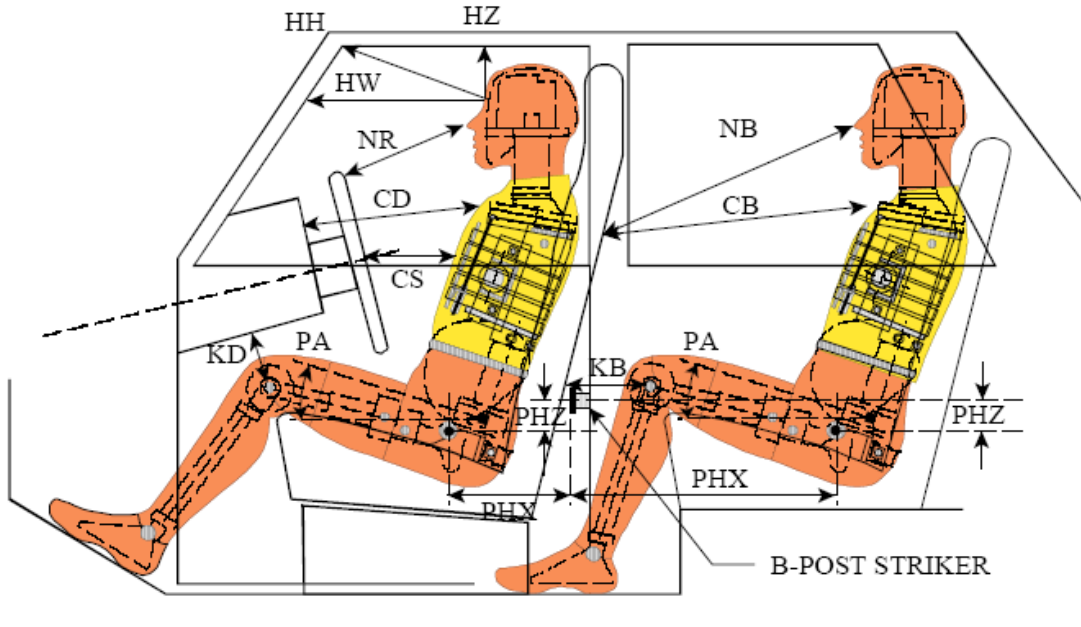
| Description | Liters |
|---|--------|
| Usable Capacity of "Standard Tank" (see Form No. 1) | 67.00 |
| Usable Capacity of "Optional Tank" (see Form No. 1) | |
| Usable Capacity of "Standard Tank" (see Owner's Manual) | |
| Usable Capacity of "Optional Tank" (see Owner's Manual) | |
| 93% of Usable Capacity | 16.46 |
| Actual amount of Solvent Used in Test | 16.50 |
| 1/3 of Usable Capacity | 22.33 |

Is the Actual Amount of Solvent Used in the test equal to 93% ± 1% of the Usable Capacity stated in the Form No. 1? **Yes** **No**

DATA SHEET NO. 3

DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202
 Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23



LEFT SIDE VIEW

NOTE: 2-DOOR VEHICLE SHOWN.
 REAR DUMMY PHX & PHZ
 MEASUREMENTS FOR A 4-DOOR
 VEHICLE WOULD USE THE C-POST
 STRIKER AS A REFERENCE POINT

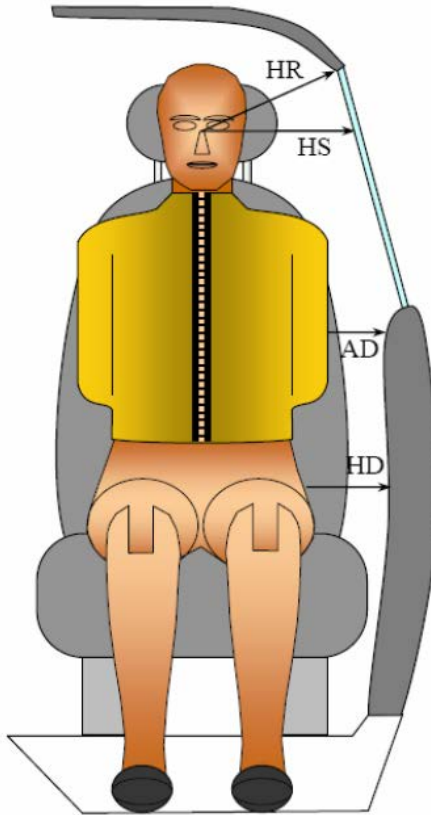
DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION

| Driver Code | Pass. Code | Description | Driver | | Passenger | |
|---------------|---------------|-------------------------------|-------------|-----------|-------------|-----------|
| | | | Length (mm) | Angle (°) | Length (mm) | Angle (°) |
| HH | | Head to Header | 397 | | | |
| HW | | Head to Windshield | 583 | | | |
| HZ | HZ | Head to Roof | 174 | | 325 | |
| NR | NB | Nose to Rim/Seat Back | 458 | | 559 | |
| CD | CB | Chest to Dash/Seat Back | 667 | | 492 | |
| CS | | Chest to Steering Wheel | 370 | | | |
| KD(L)/KDA(L)° | KB(L)/KBA(L)° | Left Knee to Dash/Seat Back | 216 | 25.7 | 202 | 22.5 |
| KD(R)/KDA(R)° | KB(R)/KBA(R)° | Right Knee to Dash/Seat Back | 218 | 23.8 | 207 | 27.8 |
| PAX° | PAX° | Pelvic Tilt Angle X | | 4.3 | | 23.8 |
| | PAY° | Pelvic Tilt Angle Y | | 0.0 | | 1.4 |
| PHX | PHX | Hip Point to Striker (x-axis) | 163 | | 293 | |
| PHZ | PHZ | Hip Point to Striker (z-axis) | 201 | | 255 | |

DATA SHEET NO. 4

DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202
Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23



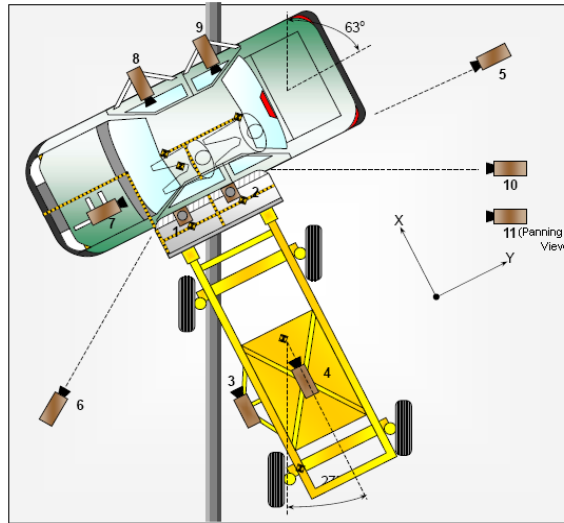
DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

| Code | Measurement Description | Units | Driver | Passenger |
|------|-------------------------|-------|--------|-----------|
| HR | Head to Side Header | mm | 224 | 285 |
| HS | Head to Side Window | mm | 355 | 377 |
| AD | Arm to Door | mm | 105 | 170 |
| HD | H-Point to Door | mm | 177 | 186 |

DATA SHEET NO. 5

CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202
 Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23



CAMERA LOCATIONS AND DATA

| No. | View | Coordinates (mm) | | | Lens Length (mm) | Operating Frame Rate (fps) |
|-----|---------------------------|------------------|-------|-------|------------------|----------------------------|
| | | X | Y | Z | | |
| 1 | Overhead Overall | 1220 | 2287 | -5486 | 14 | 1000 |
| 2 | Overhead Close-Up | 609 | 2287 | -5102 | 35 | 1000 |
| 3 | Left Impact Point (MDB) | -2134 | 0 | -1143 | 25 | 1000 |
| 4 | Side Overall (MDB) | -3912 | 838 | -1829 | 12.5 | 1000 |
| 5 | Rear | -64 | 2485 | -1348 | 85 | 1000 |
| 6 | Left Front | -2266 | -3564 | -1475 | 24 | 1000 |
| 7 | Driver Front (On-Board) | 316 | -1424 | 608 | 8.5 | 1000 |
| 8 | Driver Side (On-Board) | 435 | -1451 | 576 | 8 | 1000 |
| 9 | Passenger Side (On-Board) | 342 | -1418 | 650 | 8 | 1000 |
| 10 | Real Time Overall | | | | Zoom | 30 |
| 11 | Real Time Inrun | | | | Zoom | 30 |

Reference: Impact Point Projected to Ground; +X = To Front of MDB, +Y = To Right of MDB, +Z = Down

*All measurements accurate to ±6 mm

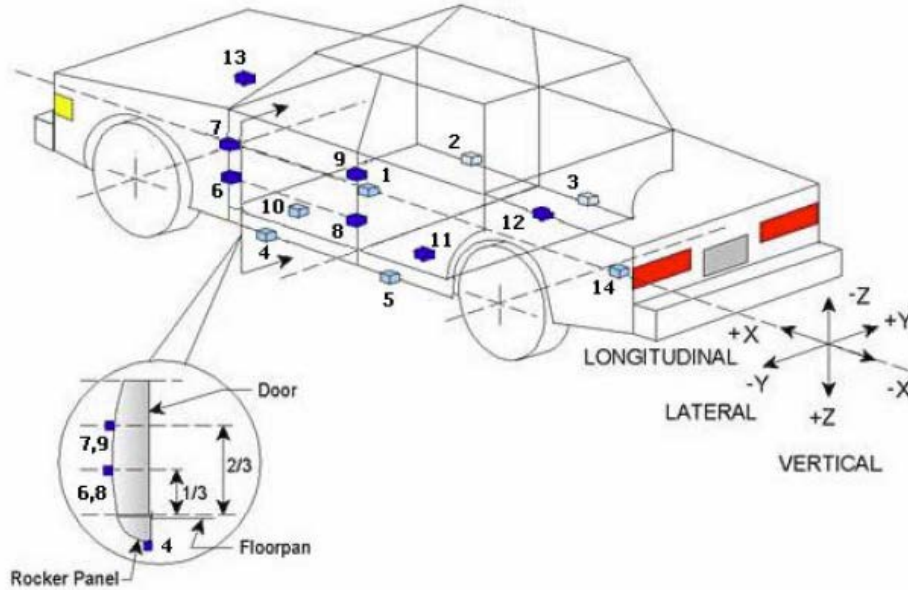
INSTRUMENTATION

| | |
|----------------------------------|-----------|
| Driver Dummy Channels | 16 |
| Passenger Dummy Channels | 19 |
| Vehicle Structure Accelerometers | 23 |
| MDB Channels | 5 |
| Total | 63 |

DATA SHEET NO. 6

TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202
 Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

| Loc. No. | Sensor Description | Coordinates (mm) | | |
|----------|---------------------------------|------------------|------|------|
| | | X | Y | Z |
| 1 | Vehicle CG | 2926 | 0 | 761 |
| 2 | Right Sill at Front Seat | 3664 | 782 | 545 |
| 3 | Right Sill at Rear Seat | 2452 | 782 | 545 |
| 4 | Left Sill at Front Door | 3680 | -795 | 448 |
| 5 | Left Sill at Rear Door | 2615 | -795 | 448 |
| 6 | A-Pillar Lower | 4245 | -878 | 722 |
| 7 | A-Pillar Middle | 4245 | -878 | 1165 |
| 8 | B-Pillar Lower | 3147 | -794 | 672 |
| 9 | B-Pillar Middle | 3147 | -794 | 1125 |
| 10 | Front Seat Track | 3391 | -275 | 653 |
| 11 | Rear Seat Structure | 2650 | -390 | 605 |
| 12 | Right Rear Occupant Compartment | 2926 | 445 | 577 |
| 13 | Engine Block | 4846 | 0 | 1124 |
| 14 | Rear Floorpan Above Axle | 1231 | 0 | 820 |

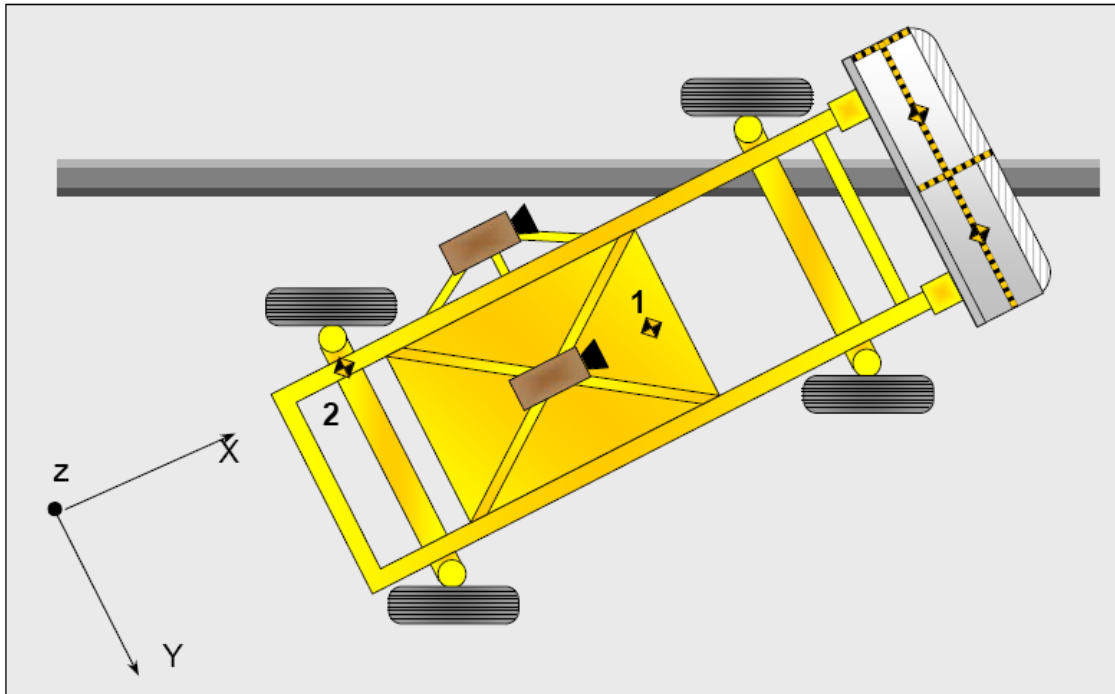
Reference: X – Rear surface of vehicle (+ forward)
 Y – Vehicle centerline (+ to right)
 Z – Ground plane (+ down)

DATA SHEET NO. 7

MDB ACCELEROMETER LOCATIONS

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202

Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23



MDB ACCELEROMETER LOCATIONS

| Loc. No. | Accelerometer Location | Measurement | | |
|----------|------------------------|-------------|------|------|
| | | X | Y | Z |
| 1 | MDB CG | -1195 | 0 | -430 |
| 2 | MDB Rear | -2642 | -593 | -608 |

Reference: X – Face of MDB (+ forward)
 Y – MDB centerline (+ to right)
 Z – Ground plane (+ down)

DATA SHEET NO. 8
POST-TEST OBSERVATIONS

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202
 Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23

TEST DUMMY INFORMATION AND CONTACT POINTS

| Dummy Body Part | Front Seat Dummy (ES-2re) | Rear Seat Dummy (SID-IIs) |
|-------------------|-------------------------------------|---------------------------|
| Face | Curtain Airbag | Curtain Airbag |
| Top of Head | Side Header | Curtain Airbag |
| Left Side of Head | Curtain Airbag | Curtain Airbag |
| Back of Head | Curtain Airbag, Headrest | Curtain Airbag, Headrest |
| Left Shoulder | Curtain Airbag | Door Trim |
| Upper Torso | Seat Bolster, Side Airbag | Seat Bolster, Door Trim |
| Lower Torso | Seat Bolster, Side Airbag | Door Trim |
| Left Hip | Side Airbag, Seatback, Seat Bolster | Seat Cushion, Door Trim |
| Left Knee | None | Door Trim |

POST-TEST DOOR PERFORMANCE

| Description | Struck Side | | Non-Struck Side | | Rear Hatch/Other |
|--|-------------|------|-----------------|------|------------------|
| | Front | Rear | Front | Rear | |
| Remained Closed and Operational | No | No | Yes | Yes | Yes |
| Total Separation from Vehicle at Hinges or Latches | No | No | No | No | No |
| Latch or Hinge System Pulled Out of Their Anchorages | No | No | No | No | No |
| Disengaged from Latched Position | No | No | No | No | No |
| Latch Separated from Striker | No | No | No | No | No |
| Jammed Shut | Yes | Yes | No | No | No |
| If Door Opened at Striker, Record Width of Opening at Striker (mm) | N/A | N/A | N/A | N/A | N/A |

DATA SHEET NO. 8 ... (CONTINUED)

POST-TEST OBSERVATIONS

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202
Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23

POST-TEST SEAT PERFORMANCE

| Description | Struck Side | | Non-Struck Side | |
|--|-------------|------|-----------------|------|
| | Front | Rear | Front | Rear |
| Seat Movement Along Seat Track | No | No | No | No |
| Seat Disengagement from Floor Pan | No | No | No | No |
| Seat Back Movement from Initial Position | No | No | No | No |
| Seat Back Collapse | No | No | No | No |

POST-TEST STRUCTURAL OBSERVATIONS

| Critical Areas of Performance | Observations and Conclusions |
|-------------------------------|------------------------------|
| Pillar Performance | Good |
| Sill Separation | No separation |
| Windshield Damage | None |
| Side Window Damage | Broken |
| Other Notable Effects | None |

DATA SHEET NO. 8 ... (CONTINUED)

POST-TEST OBSERVATIONS

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202
 Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

| Restraint Type | Struck Side | | Struck Side | |
|------------------------------|-------------|----------|----------------|----------|
| | Driver | | Rear Passenger | |
| | Mounted | Deployed | Mounted | Deployed |
| Frontal Airbag | Yes | No | | |
| Knee Airbag | No | | | |
| Side Airbag 1 (Curtain) | Yes | Yes | Yes | Yes |
| Side Airbag 2 (Torso/Pelvis) | Yes | Yes | No | |
| Seat Belt Pretensioner | Yes | Yes | No | |
| Seat Belt Load Limiter | Yes | Yes | No | |

IMPACT POINT LOCATION DATA

| Measured Parameter | Units | Tolerance | Value |
|---|-------|-------------------------------|-------|
| Vehicle Wheelbase | mm | | 3004 |
| Vertical Impact Reference Line (Aft of Front Axle)(Intended Impact Point) | mm | | 505 |
| Actual Impact Point (Aft of Front Axle) | mm | | 520 |
| Horizontal Offset (+ forward / - rearward) | mm | ± 50 of Intended Impact Point | -16 |
| Vertical Offset (+ down / - up) | mm | ± 20 of Intended Impact Point | 13 |

DATA SHEET NO. 9
MDB SUMMARY OF RESULTS

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202
 Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23

MDB SPECIFICATIONS

| Measurement Description | Length (mm) |
|---|-------------|
| Overall Width of Framework Carriage | 1251 |
| Overall Length including Honeycomb Face | 4115 |
| Wheel Base of Framework Carriage | 2595 |
| CG location aft of Front Axle | 1118 |

MDB WEIGHTS

| | Units | Front Axle | Rear Axle | Total |
|--------|-------|------------|-----------|--------|
| Left | kg | 402.0 | 297.5 | 699.5 |
| Right | kg | 377.0 | 290.0 | 667.0 |
| Ratio | % | 57.0% | 43.0% | 100.0% |
| Totals | kg | 779.0 | 587.5 | 1366.5 |

SPEED AND IMPACT DATA

| Measured Parameter | Units | Requirement | Value |
|---|---------|--------------|-------|
| Trap No. 1 Velocity (Primary) | km/h | 61.1 to 62.7 | 61.79 |
| Trap No. 2 Velocity (Redundant) | km/h | 61.1 to 62.7 | 61.88 |
| MDB CL to Target Vehicle CL | degrees | 88.5 to 91.5 | 90.1 |
| MDB Forward Line of Motion to Target Vehicle CL | degrees | 62.5 to 63.5 | 63.4 |
| MDB Crabbed Angle to MDB Forward Line of Motion | degrees | 26.0 to 28.0 | 26.7 |

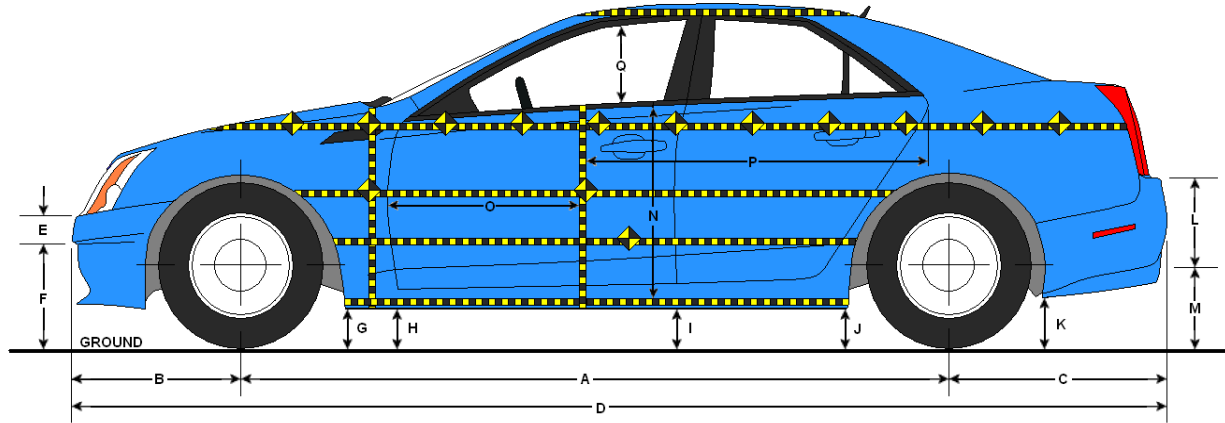
MAXIMUM STATIC CRUSH OF HONEYCOMB FACE

| Vertical Location | | | From Centerline | | Max. Crush (mm) |
|-------------------|------------------|-------------|-----------------|-----------|-----------------|
| Row | Description | Height (mm) | Distance (mm) | Direction | |
| A | Center of Bumper | 432 | 800 | Right | 253 |
| B | Top of Bumper | 533 | 800 | Right | 135 |
| C | Mid Level | 686 | 800 | Right | 101 |
| D | Top of Stack | 813 | 800 | Left | 116 |

DATA SHEET NO. 10

TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202
 Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23



LEFT SIDE VIEW

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

| Code | Description | Pre-Test | Post-Test | Change |
|------|--|----------|-----------|--------|
| A | Vehicle Wheelbase | 3004 | 2984 | -20 |
| B | Front Axle to FSOV | 907 | 905 | -2 |
| C | Rear Axle to RSOV | 1071 | 1090 | 19 |
| D | Total Vehicle Length at Centerline | 4987 | 4979 | -8 |
| E | Front Bumper Thickness | 81 | 79 | -2 |
| F | Front Bumper Bottom to Ground | 529 | 521 | -8 |
| G | Sill Height at Front Wheel Well | 341 | 339 | -2 |
| H | Sill Height at Front Door Leading Edge | 342 | 343 | 1 |
| I | Sill Height at B-Pillar | 343 | 378 | 35 |
| J1 | Sill Height at Rear Wheel Well | 343 | 332 | -11 |
| J2 | Pinch Weld Height at Rear Wheel Well | 324 | 313 | -11 |
| K | Sill Height Aft of Rear Wheel Well | 380 | 392 | 12 |
| L | Rear Bumper Thickness | 148 | 148 | 0 |
| M | Rear Bumper Bottom to Ground | 500 | 505 | 5 |
| N | Sill Height to Window Sill Bottom | 728 | 675 | -53 |
| O | Front Door Leading Edge to Impact CL | 819 | 818 | -1 |
| P | Rear Door Trailing Edge to Impact CL | 1079 | 1182 | 103 |
| Q | Front Window Opening | 435 | 451 | 16 |
| R | Right Side Length | 4239 | 4238 | -1 |
| S | Left Side Length | 4230 | 4125 | -105 |
| T | Vehicle Width at B-Pillar | 1836 | 1740 | -96 |

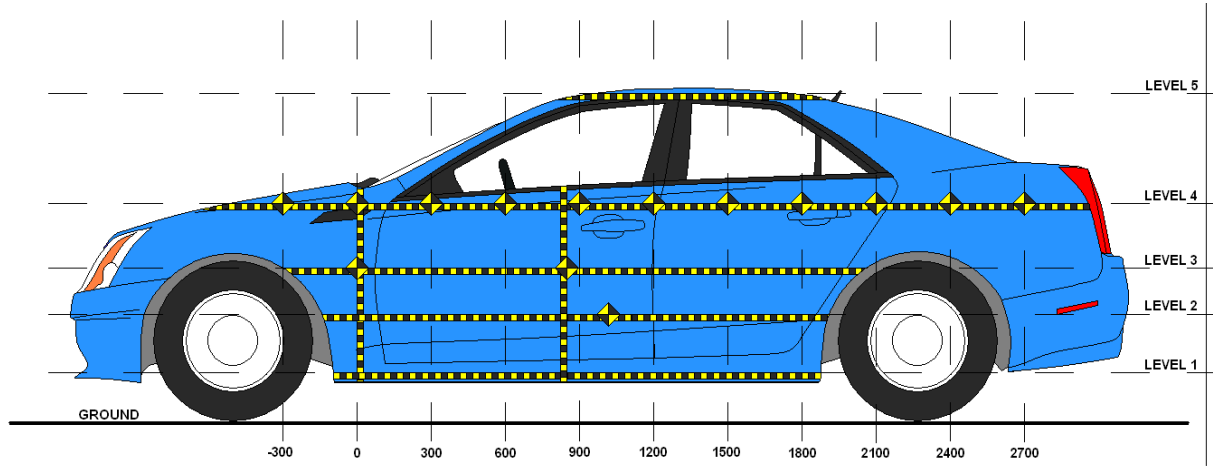
All measurements in mm with tolerance of ± 3mm

DATA SHEET NO. 11

TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202

Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23



LEFT SIDE VIEW

| Level | Description | Height Above Ground (mm) | Maximum Exterior Static Crush | Distance from Impact |
|-------|------------------|--------------------------|-------------------------------|----------------------|
| 1 | Sill Top | 420 | 87 | 150 |
| 2 | Occupant H-Point | 722 | 223 | 1500 |
| 3 | Mid-Door | 783 | 217 | 1500 |
| 4 | Window Sill | 1139 | 50 | 1200 |
| 5 | Window Top | 1639 | 0 | 600 |

DATA SHEET NO. 11 ... (CONTINUED)

TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202
 Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23

EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

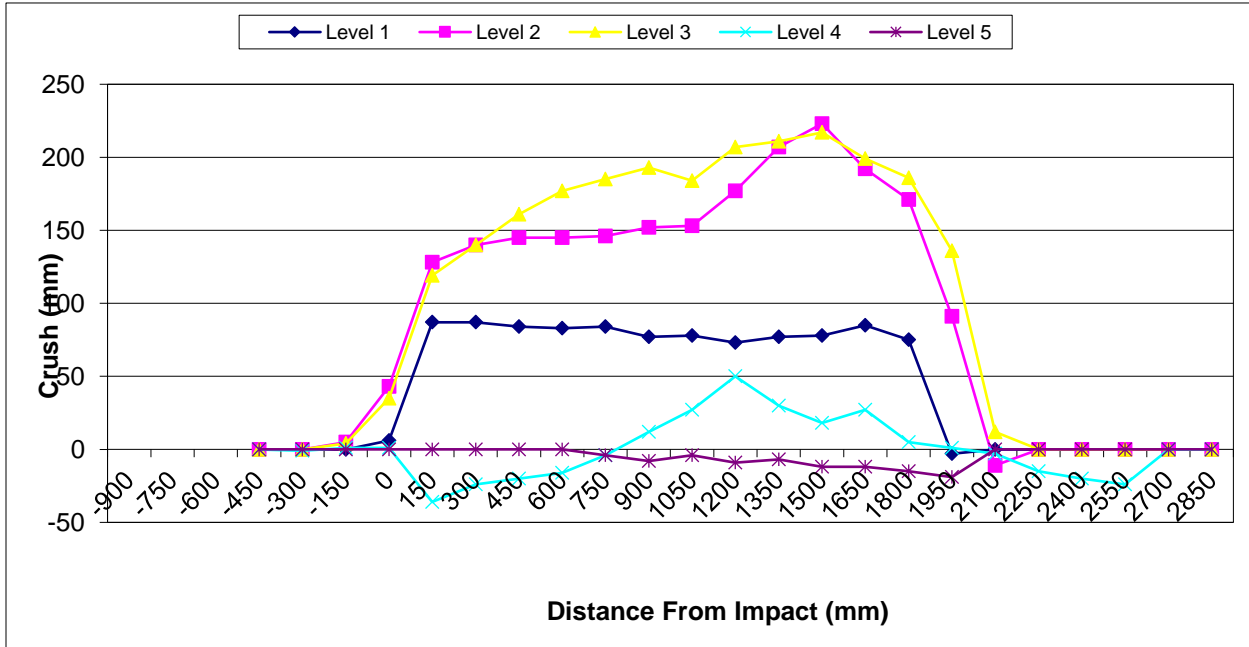
| | Pre-Test (mm) | | | | | Post-Test (mm) | | | | | Crush (mm) | | | | |
|------|---------------|-----|-----|-----|-----|----------------|-----|-----|-----|-----|------------|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| -900 | | | | | | | | | | | | | | | |
| -750 | | | | | | | | | | | | | | | |
| -600 | | | | | | | | | | | | | | | |
| -450 | | | | 726 | | | | | 726 | | | | | 0 | |
| -300 | | | | 713 | | | | | 712 | | | | | -1 | |
| -150 | | 562 | 561 | 700 | | | 567 | 565 | 701 | | | 5 | 4 | 1 | |
| 0 | 590 | 564 | 567 | 689 | | 596 | 607 | 602 | 690 | | 6 | 43 | 35 | 1 | |
| 150 | 587 | 575 | 576 | 688 | | 674 | 703 | 695 | 652 | | 87 | 128 | 119 | -36 | |
| 300 | 587 | 583 | 582 | 693 | | 674 | 723 | 722 | 669 | | 87 | 140 | 140 | -24 | |
| 450 | 589 | 589 | 586 | 688 | | 673 | 734 | 747 | 668 | | 84 | 145 | 161 | -20 | |
| 600 | 593 | 590 | 587 | 679 | 882 | 676 | 735 | 764 | 663 | 882 | 83 | 145 | 177 | -16 | 0 |
| 750 | 595 | 591 | 586 | 671 | 885 | 679 | 737 | 771 | 667 | 881 | 84 | 146 | 185 | -4 | -4 |
| 900 | 597 | 592 | 586 | 662 | 886 | 674 | 744 | 779 | 674 | 878 | 77 | 152 | 193 | 12 | -8 |
| 1050 | 599 | 591 | 586 | 657 | 887 | 677 | 744 | 770 | 684 | 883 | 78 | 153 | 184 | 27 | -4 |
| 1200 | 600 | 592 | 587 | 652 | 891 | 673 | 769 | 794 | 702 | 882 | 73 | 177 | 207 | 50 | -9 |
| 1350 | 599 | 593 | 588 | 649 | 890 | 676 | 800 | 799 | 679 | 883 | 77 | 207 | 211 | 30 | -7 |
| 1500 | 600 | 594 | 589 | 645 | 895 | 678 | 817 | 806 | 663 | 883 | 78 | 223 | 217 | 18 | -12 |
| 1650 | 599 | 595 | 590 | 641 | 898 | 684 | 787 | 789 | 668 | 886 | 85 | 192 | 199 | 27 | -12 |
| 1800 | 598 | 587 | 588 | 640 | 901 | 673 | 758 | 774 | 645 | 886 | 75 | 171 | 186 | 5 | -15 |
| 1950 | 596 | 566 | 571 | 639 | 907 | 593 | 657 | 707 | 640 | 888 | -3 | 91 | 136 | 1 | -19 |
| 2100 | | 566 | 558 | 638 | | | 555 | 570 | 635 | | | -11 | 12 | -3 | |
| 2250 | | | | 640 | | | | | 625 | | | | | -15 | |
| 2400 | | | | 643 | | | | | 623 | | | | | -20 | |
| 2550 | | | | 646 | | | | | 622 | | | | | -24 | |
| 2700 | | | | | | | | | | | | | | | |
| 2850 | | | | | | | | | | | | | | | |

DATA SHEET NO. 11 ... (CONTINUED)

TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202

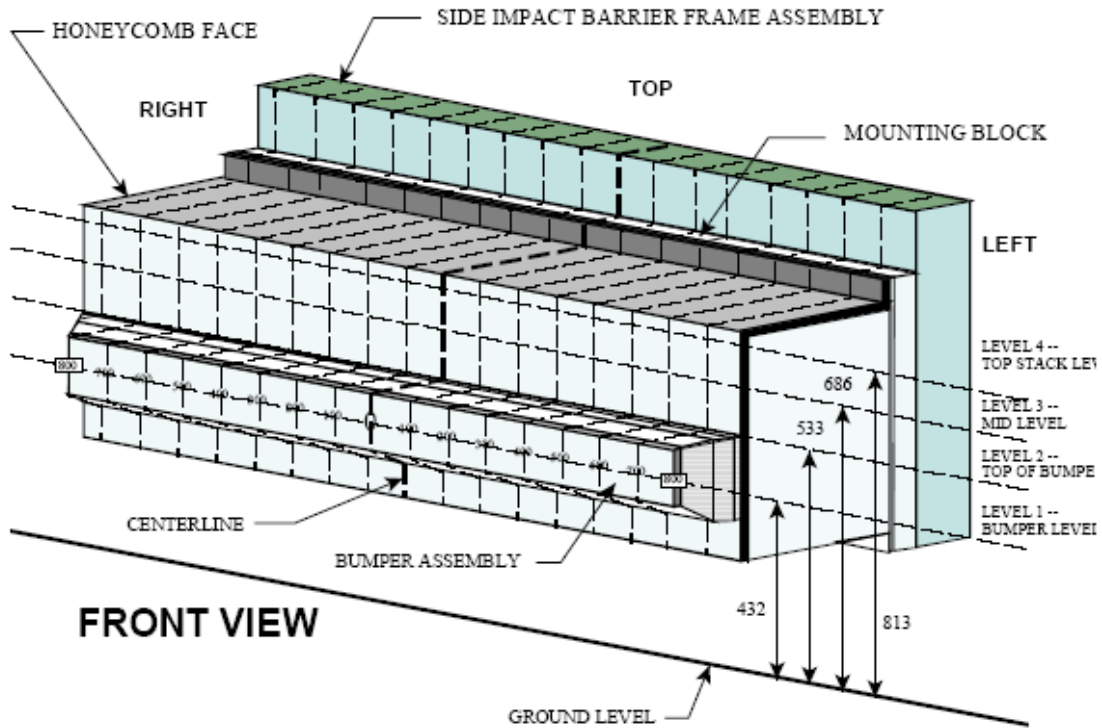
Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23



DATA SHEET NO. 12

MDB EXTERIOR STATIC CRUSH MEASUREMENTS

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202
 Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23



NOTE: Dimensions are shown in millimeters, mm

DEFORMABLE BARRIER STATIC CRUSH

| Stack Level | Distance Right of Center | | | | | | | | C/L | Distance Left of Center | | | | | | | |
|-------------|--------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-------------------------|-----|-----|-----|-----|-----|-----|-----|
| | 800 | 700 | 600 | 500 | 400 | 300 | 200 | 100 | | 0 | 100 | 200 | 300 | 400 | 500 | 600 | 700 |
| 1 | 253 | 238 | 227 | 223 | 224 | 217 | 222 | 212 | 215 | 209 | 203 | 203 | 204 | 193 | 184 | 175 | 184 |
| 2 | 135 | 133 | 130 | 126 | 121 | 114 | 111 | 104 | 101 | 105 | 103 | 105 | 101 | 101 | 99 | 100 | 101 |
| 3 | 101 | 61 | 37 | 34 | 41 | 56 | 82 | 81 | 61 | 52 | 50 | 40 | 34 | 35 | 46 | 71 | 96 |
| 4 | 103 | 83 | -6 | 47 | 45 | 43 | 36 | 46 | 43 | 21 | 20 | 26 | 32 | 44 | 60 | 81 | 116 |

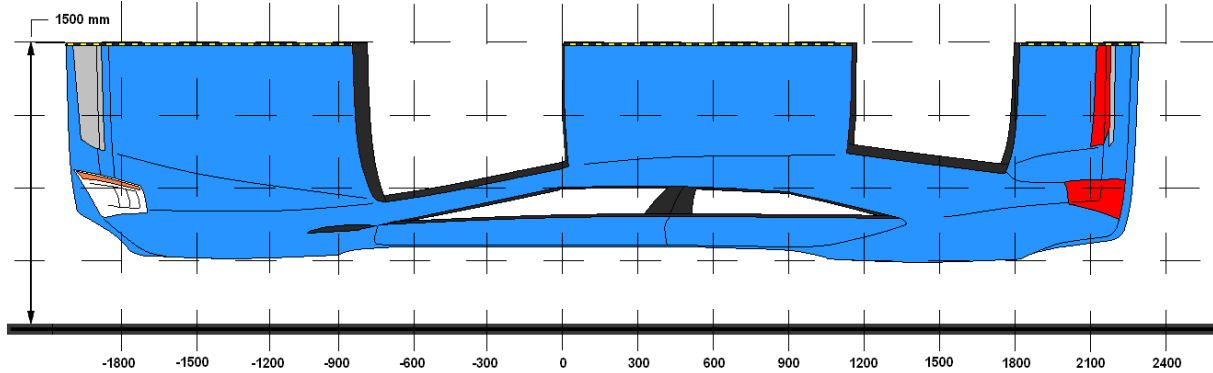
All dimensions in millimeters.

DATA SHEET NO. 13

VEHICLE AND MDB DAMAGE PROFILE DISTANCES

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202

Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23



VEHICLE DAMAGE PROFILE DISTANCES

| DPD | Distance From Impact Point (mm) | Level | Pre-Test (mm) | Post-Test (mm) | Crush (mm) |
|-----|---------------------------------|-------|---------------|----------------|------------|
| 1 | 2550 | 4 | 646 | 622 | -24 |
| 2 | 1950 | 3 | 571 | 707 | 136 |
| 3 | 1350 | 3 | 588 | 799 | 211 |
| 4 | 750 | 3 | 586 | 771 | 185 |
| 5 | 150 | 2 | 575 | 703 | 128 |
| 6 | -450 | 4 | 726 | 726 | 0 |

MDB DAMAGE PROFILE DISTANCES

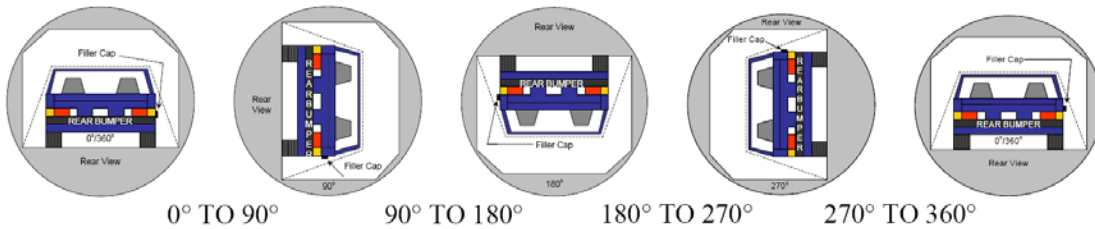
| DPD | From MDB Centerline | | Level | Crush (mm) |
|-----|---------------------|-----------|-------|------------|
| | Distance (mm) | Direction | | |
| 1 | 800 | Left | 1 | 184 |
| 2 | 500 | Left | 1 | 193 |
| 3 | 200 | Left | 1 | 203 |
| 4 | 200 | Right | 1 | 222 |
| 5 | 500 | Right | 1 | 223 |
| 6 | 800 | Right | 1 | 253 |

DATA SHEET NO. 14

FMVSS NO. 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202
 Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23
 Temperature at Time of Impact: 4.0°C Test Time: 4:05 P.M.

- A. From impact until vehicle motion ceases: N/A oz.
(Maximum allowable = 1 oz.)
- B. For the 5 minute period after motion ceases: N/A oz.
(Maximum allowable = 5 oz.)
- C. For the following 25 minutes: N/A oz.
(Maximum allowable = 1 oz./minute)
- D. Spillage Details: _____



SOLVENT COLLECTION TIME TABLE IN SECONDS

| Test Phase | Rotation Time | Hold Time | Total Time |
|--------------|---------------|-----------|------------|
| 0° To 90° | 120 | 300 | 420 |
| 90° To 180° | 125 | 300 | 425 |
| 180° To 270° | 121 | 300 | 421 |
| 270° To 360° | 120 | 300 | 420 |

FMVSS 301 SPILLAGE TABLE

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

SOLVENT SPILLAGE LOCATION TABLE

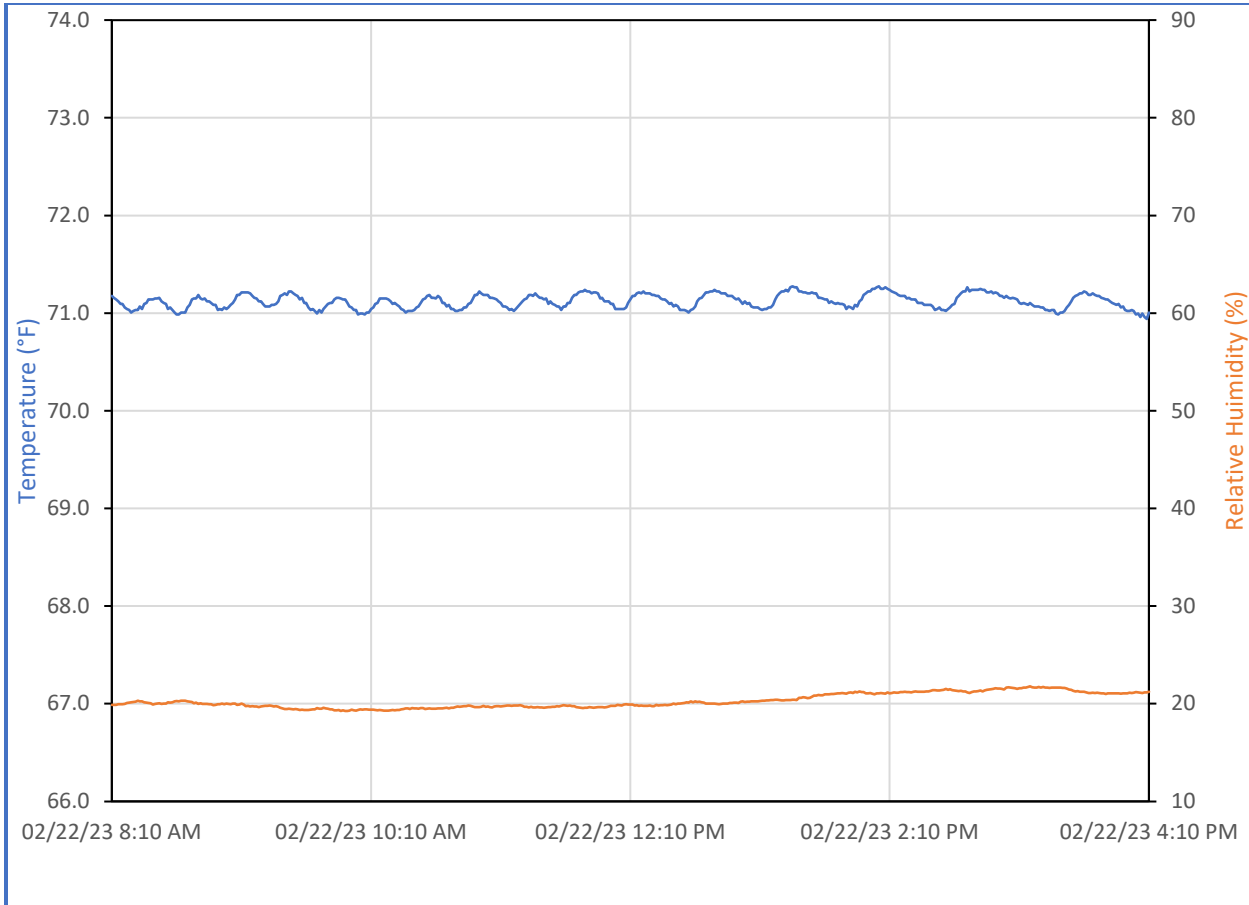
| Test Phase | Spillage Location |
|--------------|-------------------|
| 0° To 90° | |
| 90° To 180° | |
| 180° To 270° | |
| 270° To 360° | |

DATA SHEET NO. 15

DUMMY/VEHICLE TEMPERATURE AND HUMIDITY STABILIZATION

Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck NHTSA No. M20234202

Test Program: NCAP MDB Side Impact Test Test Date: 02/22/23



**APPENDIX A
PHOTOGRAPHS**

TABLE OF PHOTOGRAPHS

| Figure | | Page |
|--------|--|------|
| 1 | As-Delivered Right Front $\frac{3}{4}$ View of Test Vehicle | A-1 |
| 2 | As-Delivered Left Rear $\frac{3}{4}$ View of Test Vehicle | A-1 |
| 3 | Pre-Test Frontal View of Test Vehicle | A-2 |
| 4 | Post-Test Frontal View of Test Vehicle | A-2 |
| 5 | Pre-Test Left Front $\frac{3}{4}$ View of Test Vehicle | A-3 |
| 6 | Post-Test Left Front $\frac{3}{4}$ View of Test Vehicle | A-3 |
| 7 | Pre-Test Left Side View of Test Vehicle | A-4 |
| 8 | Post-Test Left Side View of Test Vehicle | A-4 |
| 9 | Pre-Test Left Rear $\frac{3}{4}$ View of Test Vehicle | A-5 |
| 10 | Post-Test Left Rear $\frac{3}{4}$ View of Test Vehicle | A-5 |
| 11 | Pre-Test Rear View of Test Vehicle | A-6 |
| 12 | Post-Test Rear View of Test Vehicle | A-6 |
| 13 | Pre-Test Right Side View of Test Vehicle | A-7 |
| 14 | Post-Test Right Side View of Test Vehicle | A-7 |
| 15 | Pre-Test Overhead View of Test Area | A-8 |
| 16 | Post-Test Overhead View of Test Area | A-8 |
| 17 | Pre-Test Left Side View of MDB Positioned Against Side of Test Vehicle | A-9 |
| 18 | Pre-Test Right Side View of MDB Positioned Against Side of Test Vehicle | A-9 |
| 19 | Pre-Test Close-Up View of Impact Point Target | A-10 |
| 20 | Post-Test Close-Up View of Impact Point Target | A-10 |
| 21 | Pre-Test Left Front Door Latch Close-Up | A-11 |
| 22 | Post-Test Left Front Door Latch Close-Up | A-11 |
| 23 | Pre-Test Left Rear Door Latch Close-Up | A-12 |
| 24 | Post-Test Left Rear Door Latch Close-Up | A-12 |
| 25 | Pre-Test Front Close-Up View of Driver Dummy | A-13 |
| 26 | Post-Test Front Close-Up View of Driver Dummy | A-13 |
| 27 | Pre-Test Left Side View of Driver Dummy Showing Belt and Chalking | A-14 |
| 28 | Pre-Test Left Side View of Driver Dummy Shoulder and Door Top View | A-14 |
| 29 | Post-Test Left Side View of Driver Dummy Shoulder and Door Top View | A-15 |
| 30 | Pre-Test Frontal View of Driver Seat Back Prior to Dummy Positioning | A-15 |
| 31 | Pre-Test Frontal View of Driver Dummy Head and Shoulders in Relation to Head Restraint | A-16 |
| 32 | Pre-Test Overhead View of Driver Seat Pan Prior to Dummy Positioning | A-16 |
| 33 | Pre-Test Overhead View of Driver Dummy Thighs on Seat Pan | A-17 |
| 34 | Pre-Test Placement of Driver Dummy's Feet | A-17 |
| 35 | Pre-Test View of Belt Anchorage for Driver Dummy | A-18 |

TABLE OF PHOTOGRAPHS ... (CONTINUED)

| Figure | | Page |
|--------|--|------|
| 36 | Pre-Test Left Side View of Steering Wheel | A-18 |
| 37 | View of Disengaged Parking Brake | A-19 |
| 38 | Pre-Test View of Parking Brake | A-19 |
| 39 | Pre-Test Close-Up Left Side View of Driver Seat Track | A-20 |
| 40 | Pre-Test Close-Up Left Side View of Driver Seat Back | A-20 |
| 41 | Pre-Test Close-Up View of Driver Seat Back or Head Restraint | A-21 |
| 42 | Pre-Test Driver Dummy and Door Clearance View | A-21 |
| 43 | Post-Test Driver Dummy and Door Clearance View | A-22 |
| 44 | Pre-Test Right Side View of Driver Dummy and Front Seat Occupant Compartment | A-22 |
| 45 | Post-Test Right Side View of Driver Dummy and Front Seat Occupant Compartment | A-23 |
| 46 | Pre-Test Driver Inner Door Panel View | A-23 |
| 47 | Post-Test Driver Inner Door Panel View Showing Driver Dummy Contact Locations | A-24 |
| 48 | Post-Test Driver Dummy Close-Up Head Contact with Vehicle Interior View | A-24 |
| 49 | Post-Test Driver Dummy Close-Up Head Contact with Side Airbag View | A-25 |
| 50 | Post-Test Driver Dummy Close-Up Torso Contact with Vehicle Interior View | A-25 |
| 51 | Post-Test Driver Dummy Close-Up Torso Contact with Side Airbag View | A-26 |
| 52 | Post-Test Driver Dummy Close-Up Pelvis Contact with Vehicle Interior View | A-26 |
| 53 | Post-Test Driver Dummy Close-Up Pelvis Contact with Side Airbag View | A-27 |
| 54 | Post-Test Driver Dummy Close-Up Knee Contact View | A-27 |
| 55 | Pre-Test Left Side View of Rear Passenger Dummy Showing Belt and Chalking | A-28 |
| 56 | Pre-Test Left Side View of Rear Passenger Dummy Shoulder and Door Top View | A-28 |
| 57 | Post-Test Left Side View of Rear Passenger Dummy Shoulder and Door Top View | A-29 |
| 58 | Pre-Test Frontal View of Rear Passenger Seat Back Prior to Dummy Positioning | A-29 |
| 59 | Pre-Test Frontal View of Rear Passenger Dummy Head and Shoulders in Relation to Head Restraint | A-30 |
| 60 | Pre-Test Overhead View of Rear Passenger Seat Pan Prior to Dummy Positioning | A-30 |
| 61 | Pre-Test Overhead View of Rear Passenger Dummy Thighs on Seat Pan | A-31 |
| 62 | Pre-Test View of Rear Passenger Dummy's Neck Showing Position of Adjustable Neck Bracket | A-31 |
| 63 | Pre-Test View of Rear Passenger Dummy's Head Showing Dummy's Head is Level | A-32 |
| 64 | Pre-Test Placement of Rear Passenger Dummy's Feet | A-32 |
| 65 | Pre-Test View of Belt Anchorage for Rear Passenger Dummy | A-33 |
| 66 | Pre-Test Close-Up Left Side View of Rear Passenger Seat Track | A-33 |
| 67 | Pre-Test Close-Up Left Side View of Rear Passenger Seat Back | A-34 |
| 68 | Pre-Test Close-Up View of Rear Passenger Seat Back or Head Restraint | A-34 |
| 69 | Pre-Test Rear Passenger Dummy and Door Clearance View | A-35 |

TABLE OF PHOTOGRAPHS ... (CONTINUED)

| Figure | | Page |
|--------|---|------|
| 70 | Post-Test Rear Passenger Dummy and Door Clearance View | A-35 |
| 71 | Pre-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment | A-36 |
| 72 | Post-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment | A-36 |
| 73 | Pre-Test Rear Passenger Inner Door Panel View | A-37 |
| 74 | Post-Test Rear Passenger Inner Door Panel View Showing Rear Passenger Dummy Contact Locations | A-37 |
| 75 | Post-Test Rear Passenger Dummy Close-Up Head Contact with Vehicle Interior View | A-38 |
| 76 | Post-Test Rear Passenger Dummy Close-Up Head Contact with Side Airbag View | A-38 |
| 77 | Post-Test Rear Passenger Dummy Close-Up Torso Contact with Vehicle Interior View | A-39 |
| 78 | Post-Test Rear Passenger Dummy Close-Up Torso Contact with Side Airbag View | A-39 |
| 79 | Post-Test Rear Passenger Dummy Close-Up Pelvis Contact with Vehicle Interior View | A-40 |
| 80 | Post-Test Rear Passenger Dummy Close-Up Pelvis Contact with Side Airbag View | A-40 |
| 81 | Post-Test Rear Passenger Dummy Close-Up Knee Contact View | A-41 |
| 82 | Pre-Test View of Fuel Filler Cap or Fuel Filler Neck | A-41 |
| 83 | Post-Test View of Fuel Filler Cap or Fuel Filler Neck | A-42 |
| 84 | Pre-Test Front View of MDB Impactor Face | A-42 |
| 85 | Post-Test Front View of MDB Impactor Face | A-43 |
| 86 | Pre-Test Top View of MDB Impactor Face | A-43 |
| 87 | Post-Test Top View of MDB Impactor Face | A-44 |
| 88 | Pre-Test Left Side View of MDB Impactor Face | A-44 |
| 89 | Post-Test Left Side View of MDB Impactor Face | A-45 |
| 90 | Pre-Test Right Side View of MDB Impactor Face | A-45 |
| 91 | Post-Test Right Side View of MDB Impactor Face | A-46 |
| 92 | Close-Up View of Vehicle's Certification Label | A-46 |
| 93 | Close-Up View of Vehicle's Tire Information Placard or Label | A-47 |
| 94 | Pre-Test Ballast View | A-47 |
| 95 | Post-Test Primary and Redundant Speed Trap Read-Out | A-48 |
| 96 | FMVSS No. 301 Static Rollover 0 Degrees | A-48 |
| 97 | FMVSS No. 301 Static Rollover 90 Degrees | A-49 |
| 98 | FMVSS No. 301 Static Rollover 180 Degrees | A-49 |
| 99 | FMVSS No. 301 Static Rollover 270 Degrees | A-50 |
| 100 | FMVSS No. 301 Static Rollover 360 Degrees | A-50 |
| 101 | Impact Event | A-51 |
| 102 | Monroney Label | A-51 |
| 103 | Driver Head Restraint Use and Adjustment Information from Vehicle Owner's Manual | A-52 |
| 104 | Left Rear Passenger Head Restraint Use and Adjustment Information from Vehicle Owner's Manual | A-52 |



FIGURE 1. As-Delivered Right Front 3/4 View of Test Vehicle



FIGURE 2. As-Delivered Left Rear 3/4 View of Test Vehicle



FIGURE 3. Pre-Test Frontal View of Test Vehicle



FIGURE 4. Post-Test Frontal View of Test Vehicle



FIGURE 5. Pre-Test Left Front 3/4 View of Test Vehicle



FIGURE 6. Post-Test Left Front 3/4 View of Test Vehicle



FIGURE 7. Pre-Test Left Side View of Test Vehicle



FIGURE 8. Post-Test Left Side View of Test Vehicle



FIGURE 9. Pre-Test Left Rear 3/4 View of Test Vehicle



FIGURE 10. Post-Test Left Rear 3/4 View of Test Vehicle



FIGURE 11. Pre-Test Rear View of Test Vehicle



FIGURE 12. Post-Test Rear View of Test Vehicle



FIGURE 13. Pre-Test Right Side View of Test Vehicle



FIGURE 14. Post-Test Right Side View of Test Vehicle

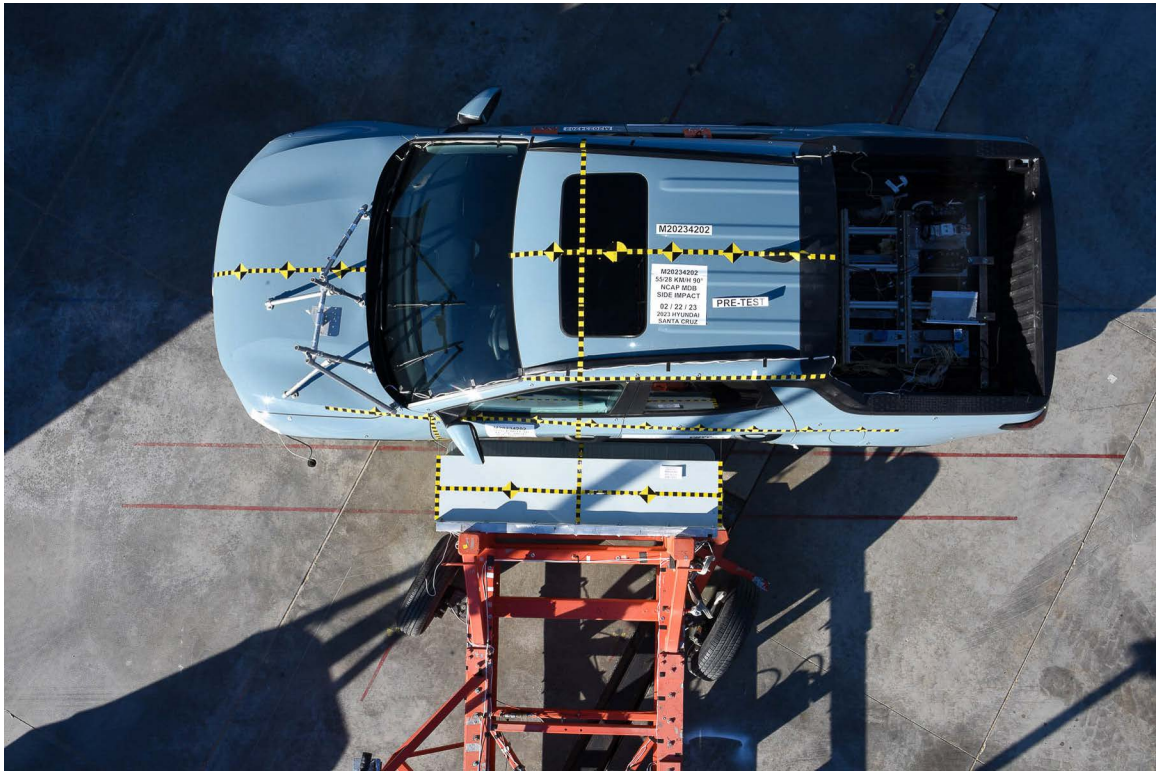


FIGURE 15. Pre-Test Overhead View of Test Area

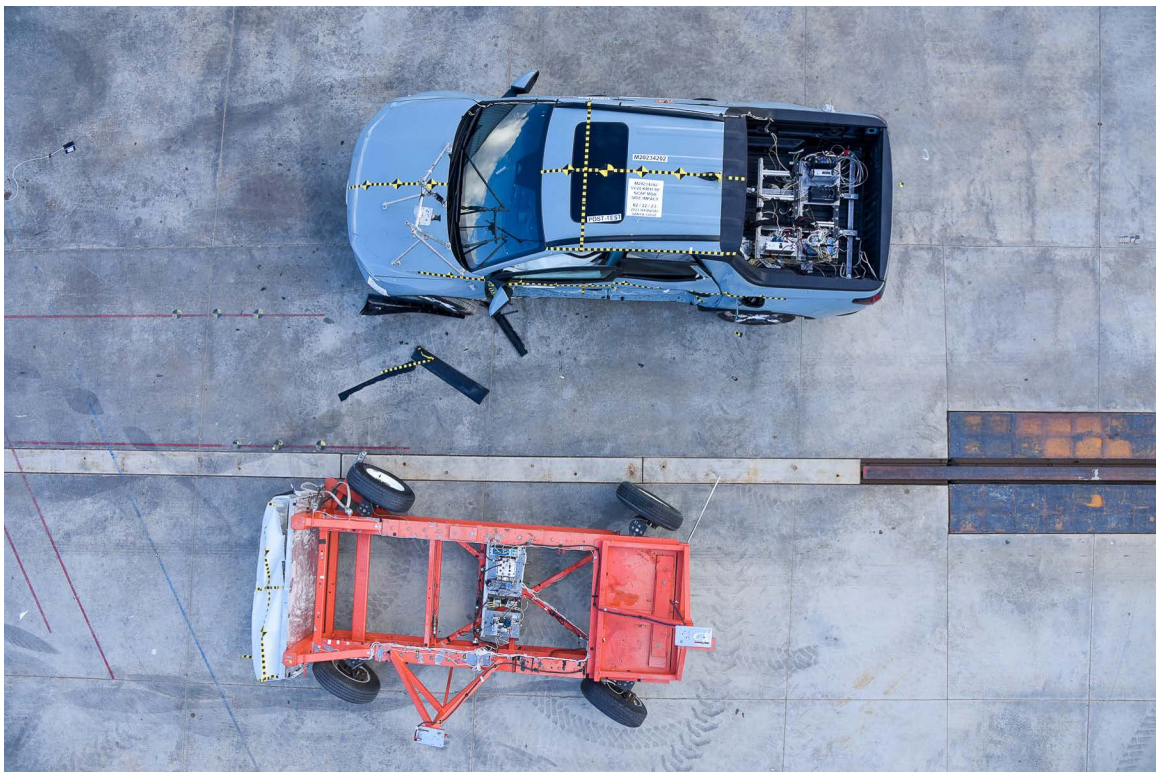


FIGURE 16. Post-Test Overhead View of Test Area



FIGURE 17. Pre-Test Left Side View of MDB Positioned Against Side of Test Vehicle



FIGURE 18. Pre-Test Right Side View of MDB Positioned Against Side of Test Vehicle



FIGURE 19. Pre-Test Close-Up View of Impact Point Target



FIGURE 20. Post-Test Close-Up View of Impact Point Target



FIGURE 21. Pre-Test Left Front Door Latch Close-Up



FIGURE 22. Post-Test Left Front Door Latch Close-Up



FIGURE 23. Pre-Test Left Rear Door Latch Close-Up



FIGURE 24. Post-Test Left Rear Door Latch Close-Up



FIGURE 25. Pre-Test Front Close-Up View of Driver Dummy



FIGURE 26. Post-Test Front Close-Up View of Driver Dummy



FIGURE 27. Pre-Test Left Side View of Driver Dummy Showing Belt and Chalking



FIGURE 28. Pre-Test Left Side View of Driver Dummy Shoulder and Door Top View



FIGURE 29. Post-Test Left Side View of Driver Dummy Shoulder and Door Top View



FIGURE 30. Pre-Test Frontal View of Driver Seat Back Prior to Dummy Positioning



FIGURE 31. Pre-Test Frontal View of Driver Dummy Head and Shoulders in Relation to Head Restraint



FIGURE 32. Pre-Test Overhead View of Driver Seat Pan Prior to Dummy Positioning



FIGURE 33. Pre-Test Overhead View of Driver Dummy Thighs on Seat Pan



FIGURE 34. Pre-Test Placement of Driver Dummy's Feet



FIGURE 35. Pre-Test View of Belt Anchorage for Driver Dummy



FIGURE 36. Pre-Test Left Side View of Steering Wheel



FIGURE 37. View of Disengaged Parking Brake



FIGURE 38. Pre-Test View of Parking Brake



FIGURE 39. Pre-Test Close-Up Left Side View of Driver Seat Track



FIGURE 40. Pre-Test Close-Up Left Side View of Driver Seat Back



FIGURE 41. Pre-Test Close-Up View of Driver Seat Back or Head Restraint



FIGURE 42. Pre-Test Driver Dummy and Door Clearance View



FIGURE 43. Post-Test Driver Dummy and Door Clearance View



FIGURE 44. Pre-Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment



FIGURE 45. Post-Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment



FIGURE 46. Pre-Test Driver Inner Door Panel View



FIGURE 47. Post-Test Driver Inner Door Panel View



FIGURE 48. Post-Test Driver Dummy Close-Up Head Contact with Vehicle Interior View

Photograph Not Available

FIGURE 49. Post-Test Driver Dummy Close-Up Head Contact with Side Air Bag View



FIGURE 50. Post-Test Driver Dummy Close-Up Torso Contact With Vehicle Interior View



FIGURE 51. Post-Test Driver Dummy Close-Up Torso Contact With Side Airbag View



FIGURE 52. Post-Test Driver Dummy Close-Up Pelvis Contact With Vehicle Interior View

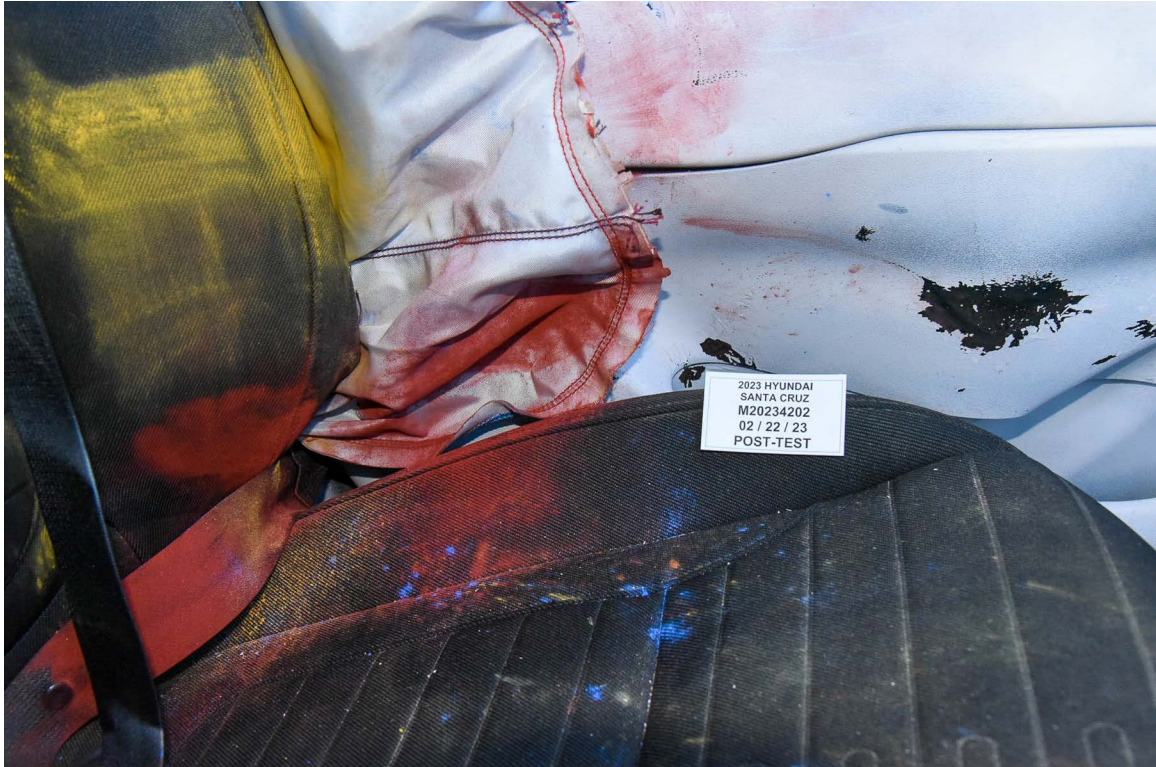


FIGURE 53. Post-Test Driver Dummy Close-Up Pelvis Contact With Side Airbag View

Photograph Not Applicable
No Driver Dummy Close-Up Knee Contact

FIGURE 54. Post-Test Driver Dummy Close-Up Knee Contact View



FIGURE 55. Pre-Test Left Side View of Rear Passenger Dummy Showing Belt and Chalking



FIGURE 56. Pre-Test Left Side View of Rear Passenger Dummy Shoulder and Door Top View



FIGURE 57. Post-Test Left Side View of Rear Passenger Dummy Shoulder and Door Top View



FIGURE 58. Pre-Test Frontal View of Rear Passenger Seat Back Prior to Dummy Positioning



FIGURE 59. Pre-Test Frontal View of Rear Passenger Dummy Head and Shoulders in Relation to Head Restraint



FIGURE 60. Pre-Test Overhead View of Rear Passenger Seat Pan Prior to Dummy Positioning



FIGURE 61. Pre-Test Overhead View of Rear Passenger Dummy Thighs on Seat Pan



FIGURE 62. Pre-Test View of Rear Passenger Dummy's Neck Showing Position of Adjustable Neck Bracket



FIGURE 63. Pre-Test View of Rear Passenger Dummy's Head Showing Dummy's Head is Level



FIGURE 64. Pre-Test Placement of Rear Passenger Dummy's Feet



FIGURE 65. Pre-Test View of Belt Anchorage for Rear Passenger Dummy



FIGURE 66. Pre-Test Close-Up Left Side View of Rear Passenger Seat Track



FIGURE 67. Pre-Test Close-Up Left Side View of Rear Passenger Seat Back



FIGURE 68. Pre-Test Close-Up View of Rear Passenger Seat Back or Head Restraint



FIGURE 69. Pre-Test Rear Passenger Dummy and Door Clearance View



FIGURE 70. Post-Test Rear Passenger Dummy and Door Clearance View



FIGURE 71. Pre-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment



FIGURE 72. Post-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment



FIGURE 73. Pre-Test Rear Passenger Inner Door Panel View



FIGURE 74. Post-Test Rear Passenger Inner Door Panel View



FIGURE 75. Post-Test Rear Passenger Dummy Close-Up Head Contact with Vehicle Interior View

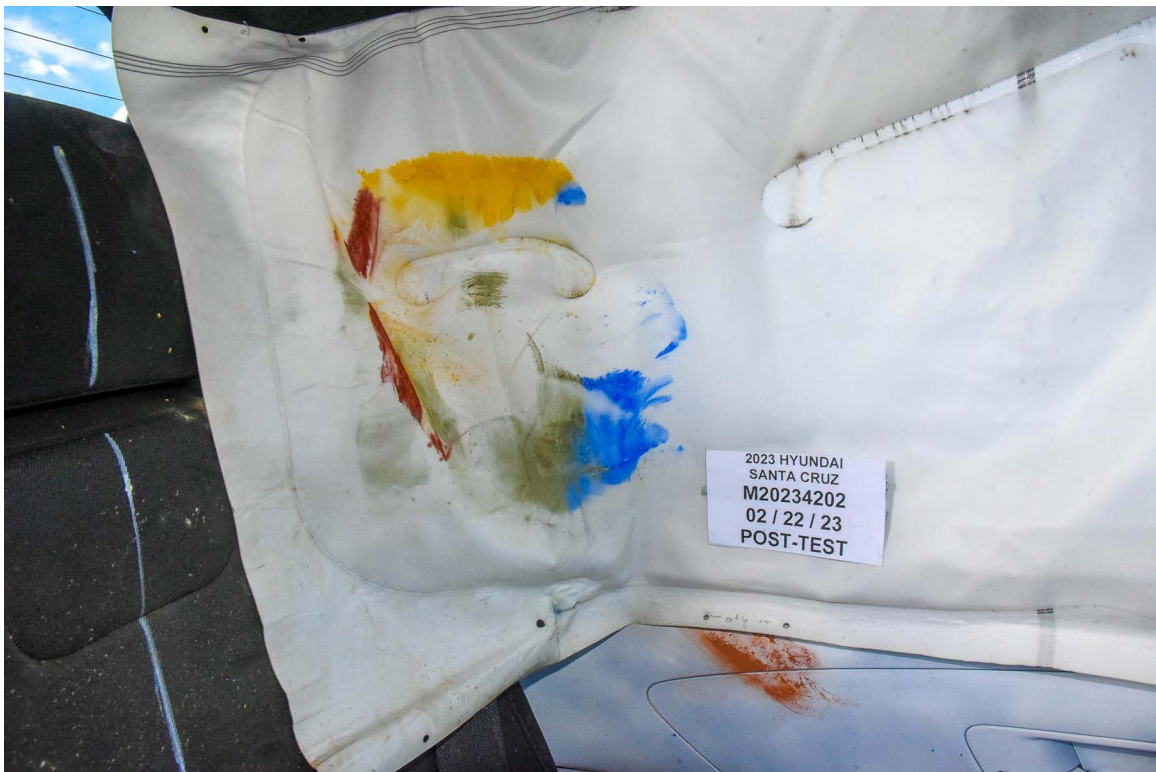


FIGURE 76. Post-Test Rear Passenger Dummy Close-Up Head Contact with Side Air-bag View



FIGURE 77. Post-Test Rear Passenger Dummy Close-Up Torso Contact with Vehicle Interior View

Photograph Not Applicable

No Rear Passenger Dummy Close-Up Torso Contact with Side Airbag View

FIGURE 78. Post-Test Rear Passenger Dummy Close-Up Torso Contact with Vehicle Side Airbag View



FIGURE 79. Post-Test Rear Passenger Dummy Close-Up Pelvis Contact with Vehicle Interior View

Photograph Not Applicable

No Rear Passenger Dummy Close-Up Pelvis Contact with Side Airbag View

FIGURE 80. Post-Test Rear Passenger Dummy Close-Up Pelvis Contact with Side Airbag View

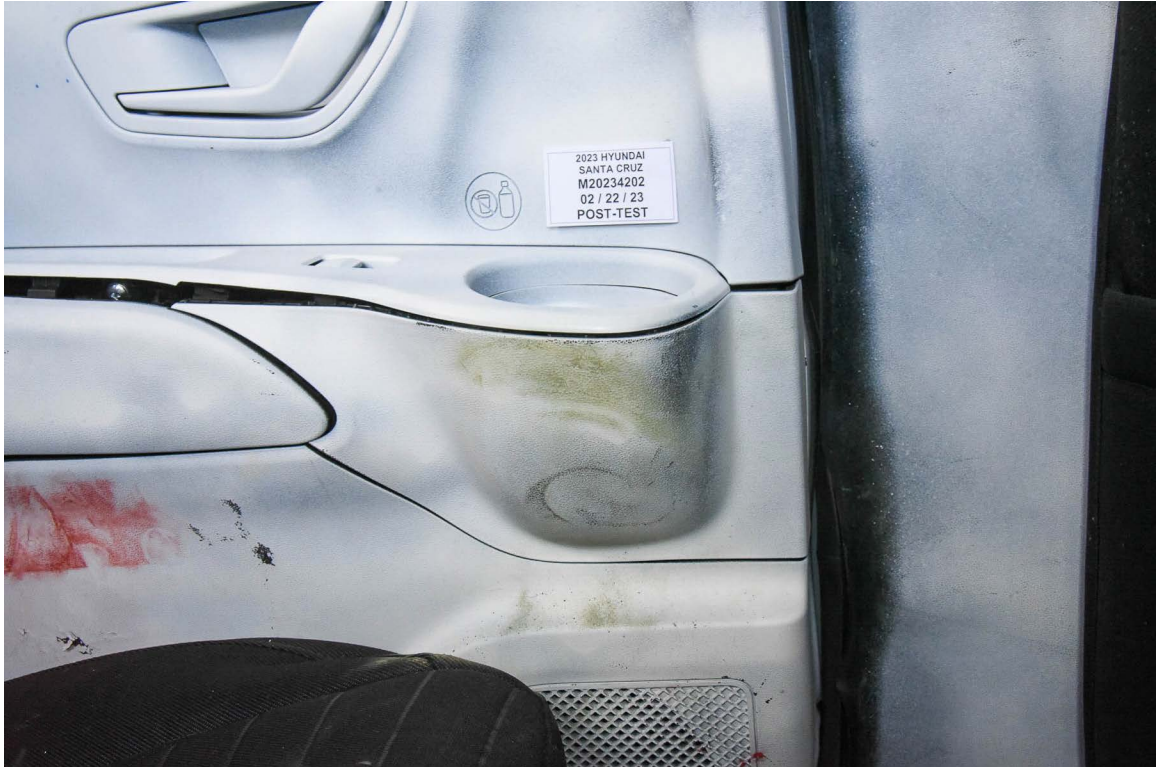


FIGURE 81. Post-Test Rear Passenger Dummy Close-Up Knee Contact View



FIGURE 82. Pre-Test View of Fuel Filler Cap or Fuel Filler Neck



FIGURE 83. Post-Test View of Fuel Filler Cap or Fuel Filler Neck



FIGURE 84. Pre-Test Front View of MDB Impactor Face



FIGURE 85. Post-Test Front View of MDB Impactor Face

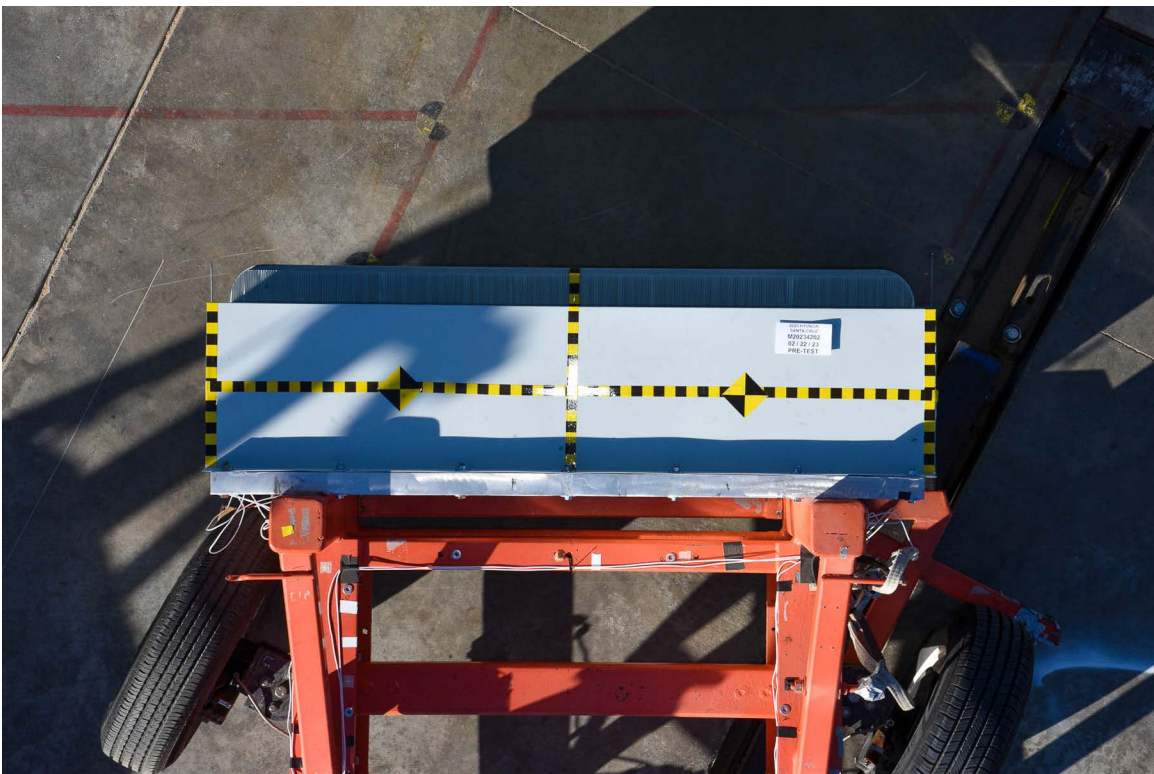


FIGURE 86. Pre-Test Top View of MDB Impactor Face



FIGURE 87. Post-Test Top View of MDB Impactor Face



FIGURE 88. Pre-Test Left View of MDB Impactor Face



FIGURE 89. Post-Test Left View of MDB Impactor Face



FIGURE 90. Pre-Test Right View of MDB Impactor Face



FIGURE 91. Post-Test Right View of MDB Impactor Face



FIGURE 92. Close-Up View of Vehicle's Certification Label



FIGURE 93. Close-Up View of Vehicle's Tire Information Placard or Label

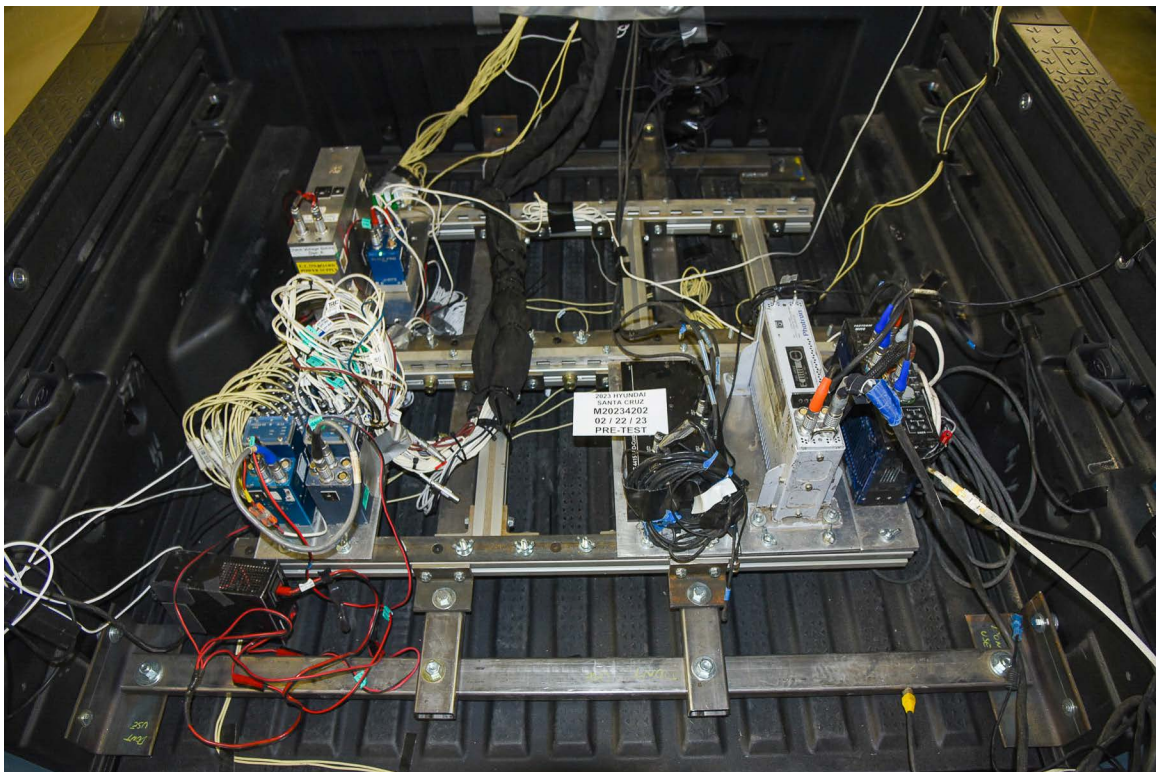


FIGURE 94. Pre-Test Ballast View



FIGURE 95. Post-Test Primary and Redundant Speed Trap Read-Out



FIGURE 96. FMVSS No. 301 Static Rollover 0 Degrees



FIGURE 97. FMVSS No. 301 Static Rollover 90 Degrees

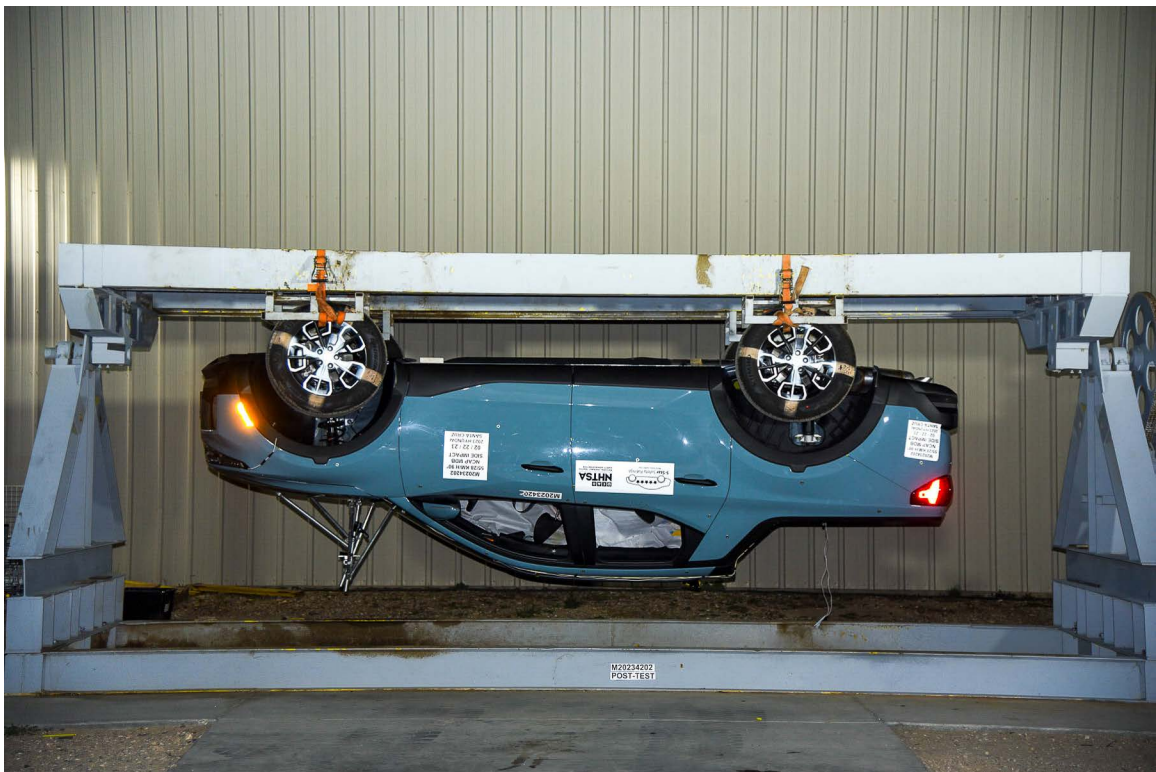


FIGURE 98. FMVSS No. 301 Static Rollover 180 Degrees



FIGURE 99. FMVSS No. 301 Static Rollover 270 Degrees

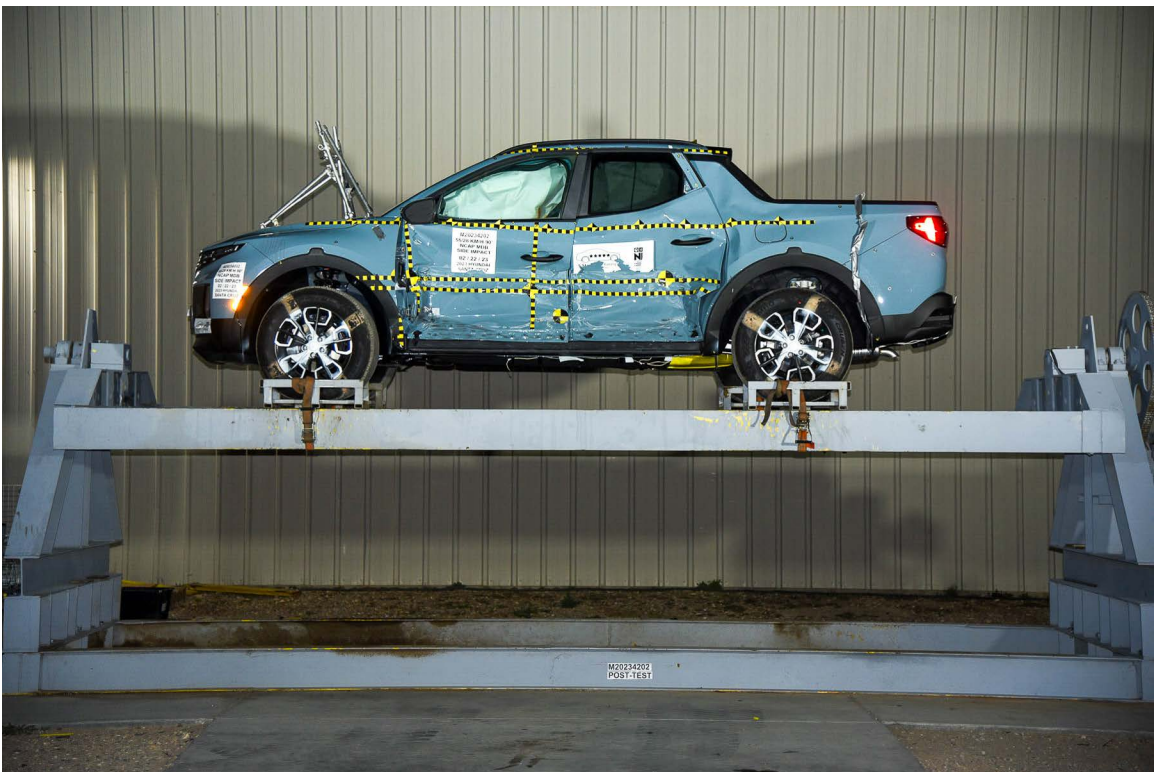


FIGURE 100. FMVSS No. 301 Static Rollover 360 Degrees



FIGURE 101. Impact Event

| | |
|---|--|
| 2023 SANTA CRUZ SEL FV | |
| SOLD TO: TX111 HUMBLE HYUNDAI 18577 HIGHWAY 59 N HUMBLE TX 77338 | SHIPPED TO: TX111 |
| VIN: 5NTJCAAE1PH052228 MODEL: 50XG0F4S ENGINE: G4KNK346215 PORT OF ENTRY: MA EXTERIOR COLOR: BLUE STONE INTERIOR/SEAT COLOR: BLACK/BLACK TRANSPORT: TRUCK ACCESSORY WEIGHT: 19 lbs / 9 kgs EMISSIONS: This vehicle is certified to meet emission requirements in all 50 states | GOVERNMENT 5-STAR SAFETY RATINGS <p>This vehicle has not been rated by the government for overall vehicle score, frontal crash, side crash or rollover risk.</p> <p>Source: National Highway Traffic Safety Administration (NHTSA). www.safercar.gov or 1-888-327-4231</p> |
| STANDARD FEATURES: AMERICA'S BEST WARRANTY 5-year/100,000-mile New Vehicle Warranty* 10-year/100,000-mile Powertrain Warranty* 5-year/50,000-mile Adaptive Performance Warranty* 3-year/50,000-mile Complimentary Maintenance* 5-year/100,000-mile Roadside Assistance *Limited warranties, see dealer for details ADVANCED SAFETY TECHNOLOGY Forward Collision-avoidance Assist Blind-spot Collision-avoidance Assist Rear Cross-traffic Collision-avoidance Assist Lane Keeping Assist, Lane Following Assist Driver Attention Warning Safe Exit Warning Front, Front Side & Side-curtain Airbags Immobilizer POWERTRAIN TECHNOLOGY SmartSense 2.5L 4-cylinder Engine 8-speed Automatic Transmission w/ SHIFTRONIC® EXTERIOR 18-inch Alloy Wheels Automatic Headlights LED Daytime Running Lights LED Tailgate Smart MaxLoad Composite Bed Under Bed & Storage Storage Compartments Rear Bumper Corner Steps Temporary Compact Spare Tire COMFORT & CONVENIENCE Proximity Key w/ Push Button Start Remote Engine Start Power Driver's Seat w/ Lumbar Support Heated Front Seats 60/40 Flip-up Rear Seats w/ Storage Bin Air Conditioning w/ Cabin Air Filter LCD Multi-information Display 8-inch Display Audio w/ Android Auto(TM) & Apple CarPlay(TM) AM/FM/HD Radio(TM) Audio System Rear View Mirror Dual USB Ports SmartSense Radio w/ 90-day Platinum trial subscription Not Available in AK, HI & IL Bluetooth® Connected Services 3-year Standard (enrollment req) BlueLink Remote Start (3-year Complimentary Service) | COMFORT & CONVENIENCE (cont.) Full Tank of Fuel Manufacturer's Suggested Retail Price: \$27,790.00 ADDED FEATURES: Active Noise Control Power Sunroof Integrated Tonneau Cover Adjustable L-Channel Cleat Pull System Roof Side Rails 110V AC Power Inverter in Bed 10.25-inch Digital Instrument Cluster Wireless Device Charging LED Interior Lights & Bed Lighting Rear Privacy Glass *Carpeted Floor Mats \$210.00 *Cargo Net, Envelop \$55.00 *Mud Guards \$120.00 *Crate Rails \$115.00 *Wheel Locks \$70.00 |
| Inland Freight & Handling: \$1,295.00 Total Price: \$33,125.00 | |

The 2023 Hyundai SANTA CRUZ. Our one-of-a-kind Sport Adventure Vehicle.

| | | |
|--|---|---|
| EPA DOT Fuel Economy and Environment Fuel Economy 23 MPG combined city/highway 4.3 gallons per 100 miles | MPG 22 city 26 highway | You spend \$1,500 more in fuel costs over 5 years compared to the average new vehicle. |
| Annual fuel cost \$1,900 | Fuel Economy & Greenhouse Gas Rating (passive only) 1 5 10 15 20 Best | Smog Rating (passive only) 1 5 10 Best |

Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 23 MPG and costs \$5,000 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at \$2.95 per gallon. MPGe is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

fuelconomy.gov
 Calculate personalized estimates and compare vehicles

Manufacturer's suggested retail price includes manufacturer's recommended pre-delivery service. Gasoline license and title fees, state and local taxes and dealer installed options and accessories are not included in the manufacturer's suggested retail price. This label has been affixed to this vehicle by Hyundai Motor America, pursuant to the requirements of 15 U.S.C. 1231 et seq. which prohibits its removal or alteration prior to delivery to the ultimate purchaser.

PARTS CONTENT INFORMATION FOR VEHICLE IN THIS CARLINE:
 U.S./CANADIAN PARTS CONTENT: 55 %
 MAJOR SOURCES OF FOREIGN PARTS CONTENT: KOREA: 35 %

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

FOR THIS VEHICLE:
 FINAL ASSEMBLY POINT: MONTGOMERY, ALABAMA, U.S.A.
 COUNTRY OF ORIGIN: ENGINE: U.S.A.
 TRANSMISSION: U.S.A./KOREA

348 A 1

FIGURE 102. Monroney Label

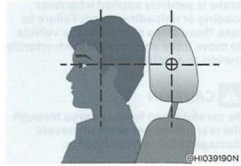
Head Restraints

The vehicle's front and rear (second row and/or third row) seats have adjustable head restraints. The head restraints provide comfort for passengers, but more importantly they are designed to help protect passengers from whiplash and other neck and spinal injuries during an accident, especially in a rear impact collision.

WARNING

To help reduce the risk of serious injury or death in an accident, take the following precautions when adjusting your head restraints:

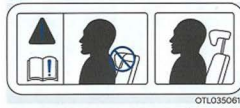
- Always properly adjust the head restraints for all passengers BEFORE starting the vehicle.
- NEVER let anyone ride in a seat with the head restraints removed or reversed.



- Adjust the head restraints so the middle of the head restraints is at the same height as the height of the top of the eyes.
- NEVER adjust the head restraints position of the driver's seat when the vehicle is in motion.
- Adjust the head restraints as close to the passenger's head as possible. Do not use a seat cushion that holds the body away from the seatback.
- Make sure the head restraints locks into position after adjusting it.

3-12

WARNING



When sitting on the rear seat, do not adjust the height of the head restraints to the lowest position.

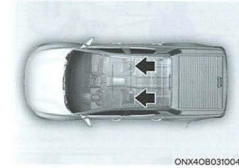
CAUTION

When there is no occupant in the rear seats, adjust the height of the head restraints to the lowest position. The rear seat head restraints can reduce the visibility of the rear area.

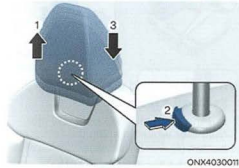
NOTICE

To prevent damage, NEVER hit or pull on the head restraints.

Front seat head restraints



The driver's and front passenger's seats are equipped with adjustable head restraint for the passengers safety and comfort.



Adjusting the height up and down

To raise the head restraint:

1. Pull it up to the desired position (1).

To lower the head restraint:

1. Push and hold the release button (2) on the head restraint support.
2. Lower the head restraint to the desired position (3).

NOTICE



If you recline the seatback towards the front with the head restraint and seat cushion raised, the head restraint may come in contact with the sunvisor or other parts of the vehicle.

3-13

FIGURE 103. Driver Head Restraint Use and Adjustment Information from Vehicle Owner's Manual

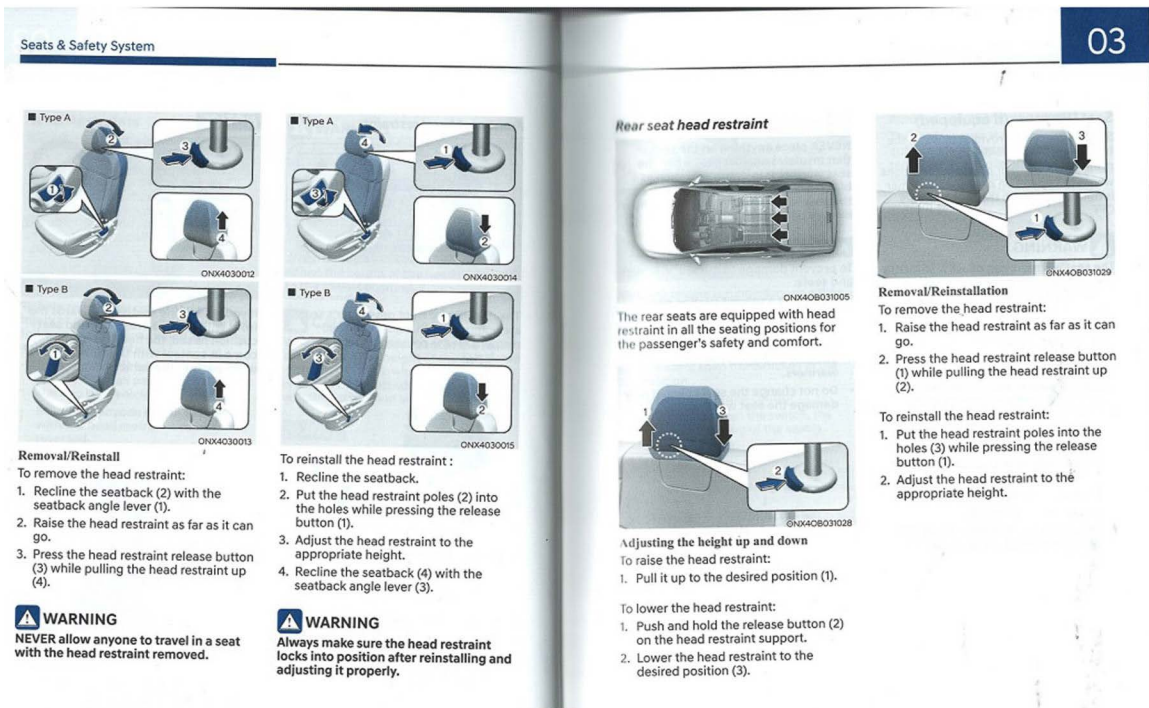


FIGURE 104. Left Rear Passenger Head Restraint Use and Adjustment Information from Vehicle Owner's Manual

APPENDIX B
VEHICLE AND DUMMY RESPONSE DATA PLOTS

TABLE OF DATA PLOTS

| Plot | | Page |
|------|---|------|
| 1 | Driver Head Acceleration (X) Primary vs. Time | B-1 |
| 2 | Driver Head Acceleration (Y) Primary vs. Time | B-1 |
| 3 | Driver Head Acceleration (Z) Primary vs. Time | B-1 |
| 4 | Driver Head Resultant Acceleration Primary vs. Time | B-1 |
| 5 | Driver Upper Thorax Rib Deflection (Y) vs. Time | B-2 |
| 6 | Driver Middle Thorax Rib Deflection (Y) vs. Time | B-2 |
| 7 | Driver Lower Thorax Rib Deflection (Y) vs. Time | B-2 |
| 8 | Driver Thorax Rib Deflection Maximum vs. Time | B-2 |
| 9 | Driver Anterior Abdominal Force (Y) vs. Time | B-3 |
| 10 | Driver Middle Abdominal Force (Y) vs. Time | B-3 |
| 11 | Driver Posterior Abdominal Force (Y) vs. Time | B-3 |
| 12 | Driver Total Abdominal Force (Y) vs. Time | B-3 |
| 13 | Driver Pubic Symphysis Force (Y) vs. Time | B-4 |
| 14 | Passenger Head Acceleration (X) vs. Time Primary | B-5 |
| 15 | Passenger Head Acceleration (Y) vs. Time Primary | B-5 |
| 16 | Passenger Head Acceleration (Z) vs. Time Primary | B-5 |
| 17 | Passenger Head Resultant Acceleration Primary vs. Time | B-5 |
| 18 | Passenger Lower Spine T12 Acceleration (X) vs. Time | B-6 |
| 19 | Passenger Lower Spine T12 Acceleration (Y) vs. Time | B-6 |
| 20 | Passenger Lower Spine T12 Acceleration (Z) vs. Time | B-6 |
| 21 | Passenger Lower Spine T12 Resultant Acceleration vs. Time | B-6 |
| 22 | Passenger Acetabulum Force on Impact Side (Y) vs. Time | B-7 |
| 23 | Passenger Iliac Force on Impact Side (Y) vs. Time | B-7 |
| 24 | Passenger Total Pelvic Force on Impact Side (Y) vs. Time | B-7 |

The following additional data for this test can be obtained from the Research and Development section of the NHTSA website (www.NHTSA.gov)

Additional Driver & Passenger Dummy Instrumentation Data

Driver Lower Spine T12 Acceleration (X)
Driver Lower Spine T12 Acceleration (Y)
Driver Lower Spine T12 Acceleration (Z)
Driver Head Acceleration Redundant (X)
Driver Head Acceleration Redundant (Y)
Driver Head Acceleration Redundant (Z)
Passenger Head Acceleration Redundant (X)
Passenger Head Acceleration Redundant (Y)
Passenger Head Acceleration Redundant (Z)

Vehicle Instrumentation Data

Vehicle Center of Gravity Acceleration (X)
Vehicle Center of Gravity Acceleration (Y)
Vehicle Center of Gravity Acceleration (Z)
Right Side Sill at Front Seat Acceleration (X)
Right Side Sill at Front Seat Acceleration (Y)
Right Side Sill at Front Seat Acceleration (Z)
Right Side Sill at Rear Seat Acceleration (X)
Right Side Sill at Rear Seat Acceleration (Y)
Right Side Sill at Rear Seat Acceleration (Z)
Left Side Sill at Front Seat Acceleration (Y)
Left Side Sill at Rear Seat Acceleration (Y)
Lower A-Post Acceleration (Y)
Middle A-Post Acceleration (Y)
Lower B-Post Acceleration (Y)
Middle B-Post Acceleration (Y)
Front Seat Track Acceleration (Y)
Rear Seat Structure Acceleration (Y)
Right Rear Occupant Compartment Acceleration (Y)
Engine Block (X)
Engine Block (Y)
Rear Floorpan Above Axle Acceleration (X)
Rear Floorpan Above Axle Acceleration (Y)
Rear Floorpan Above Axle Acceleration (Z)

MDB Instrumentation Data

MDB Center of Gravity Acceleration (X)

MDB Center of Gravity Acceleration (Y)

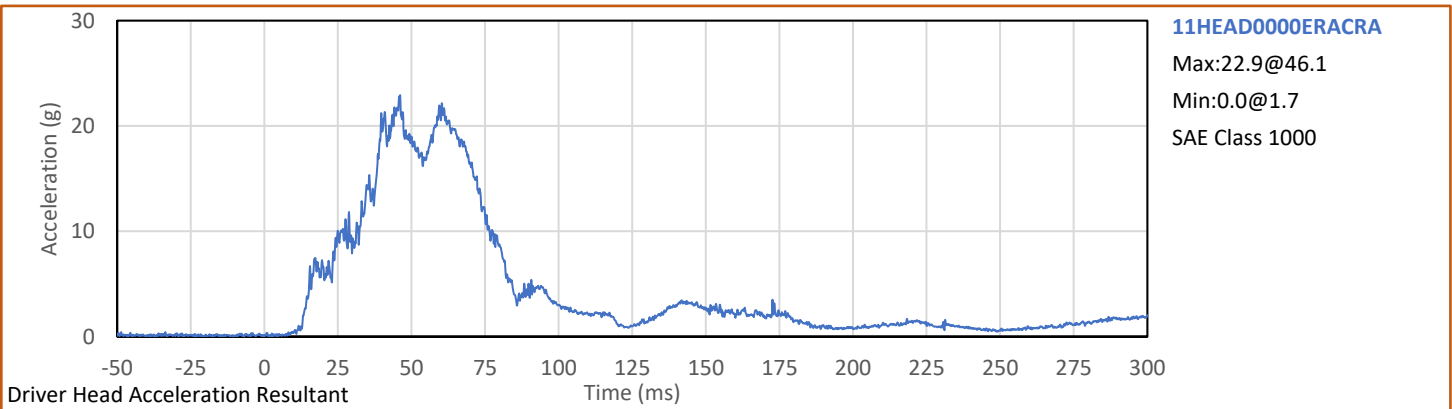
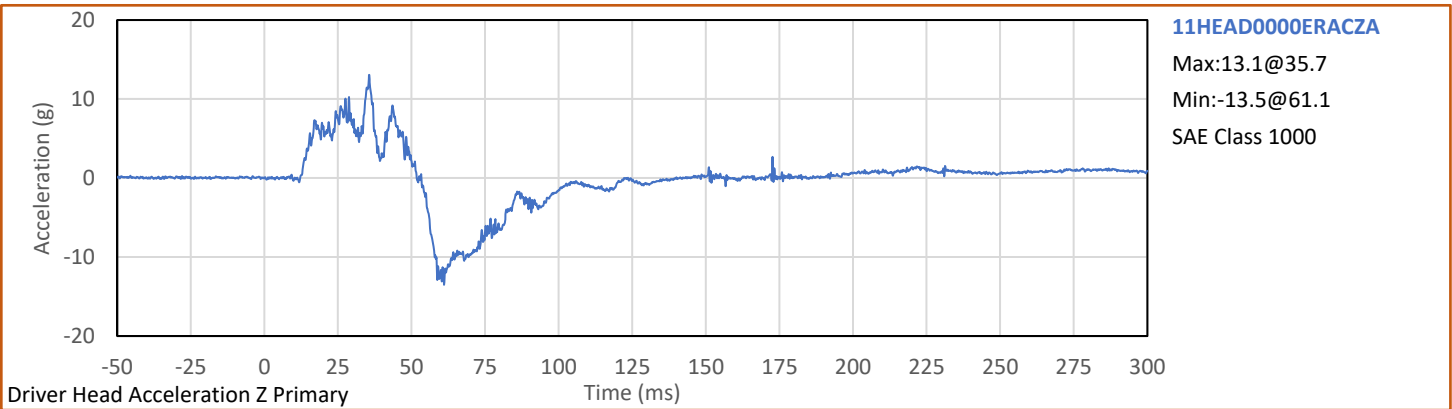
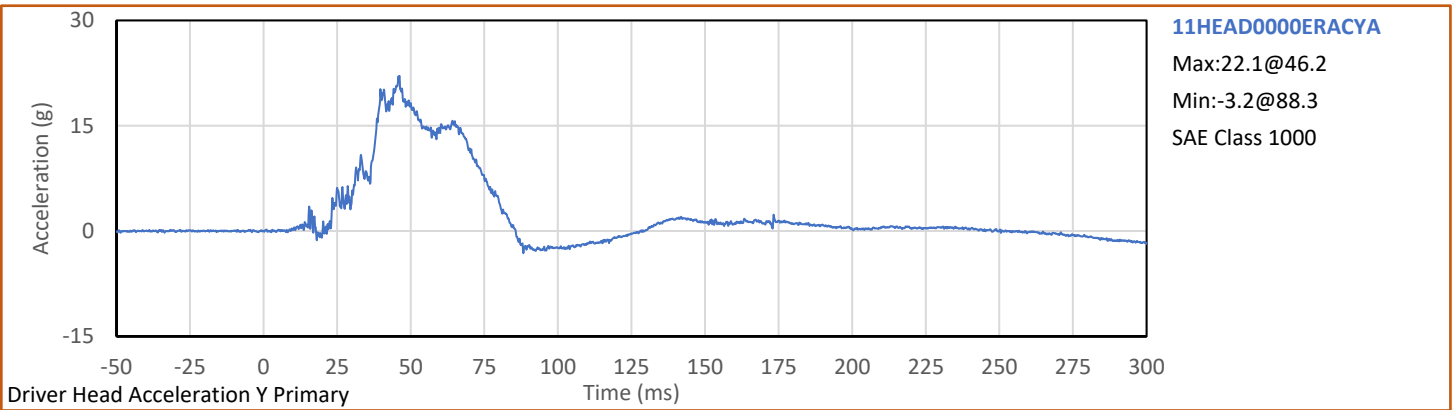
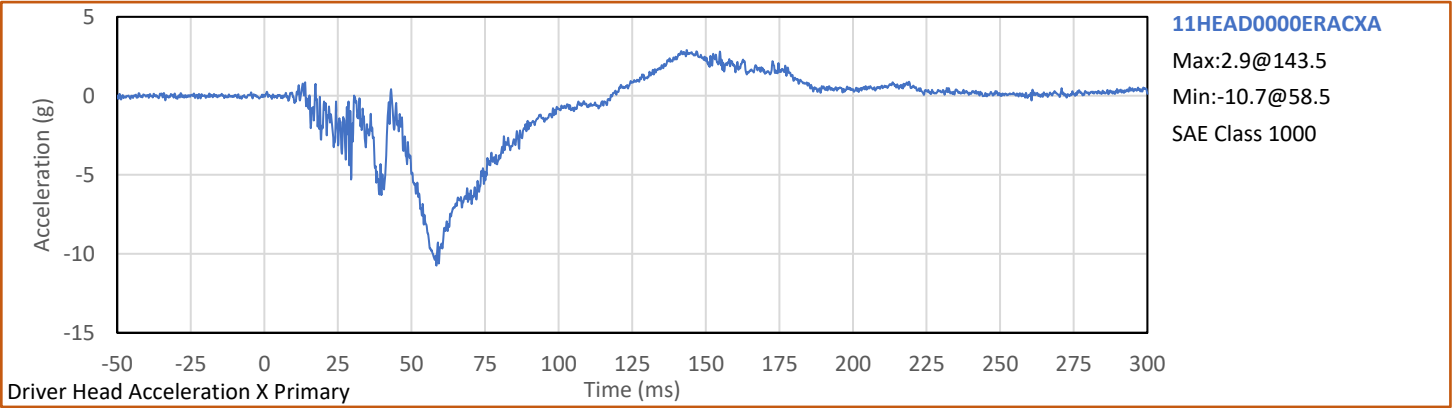
MDB Center of Gravity Acceleration (Z)

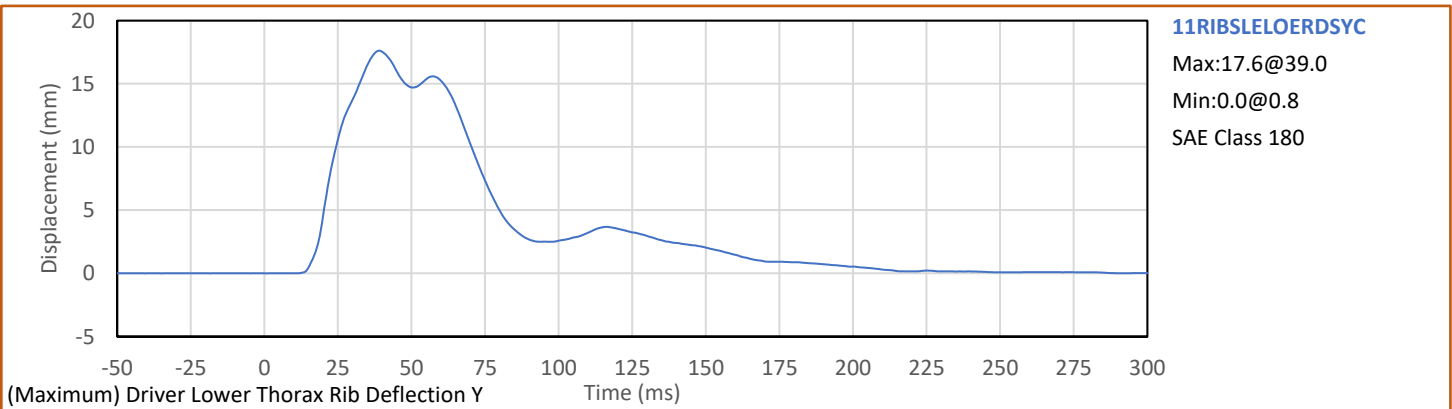
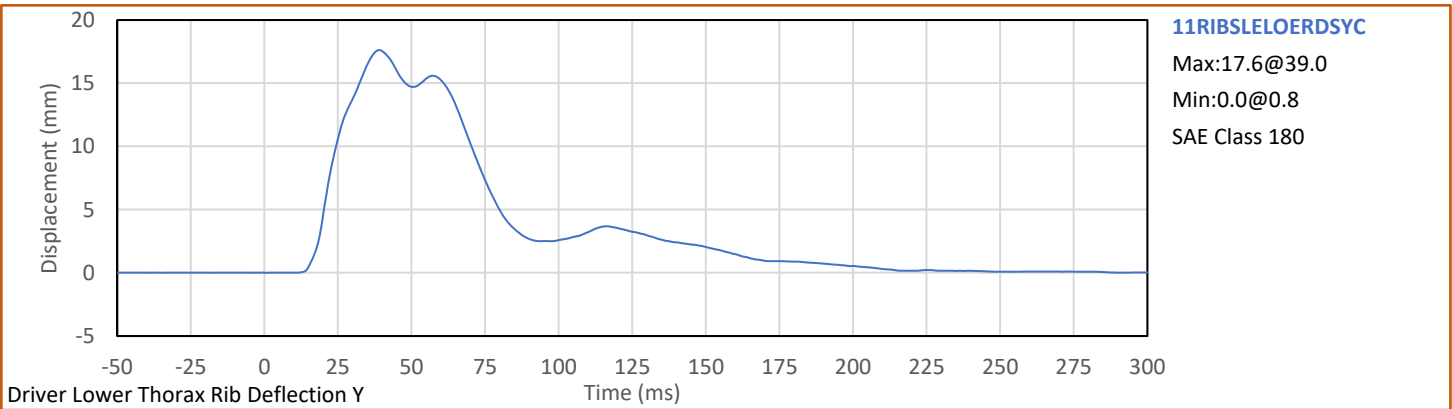
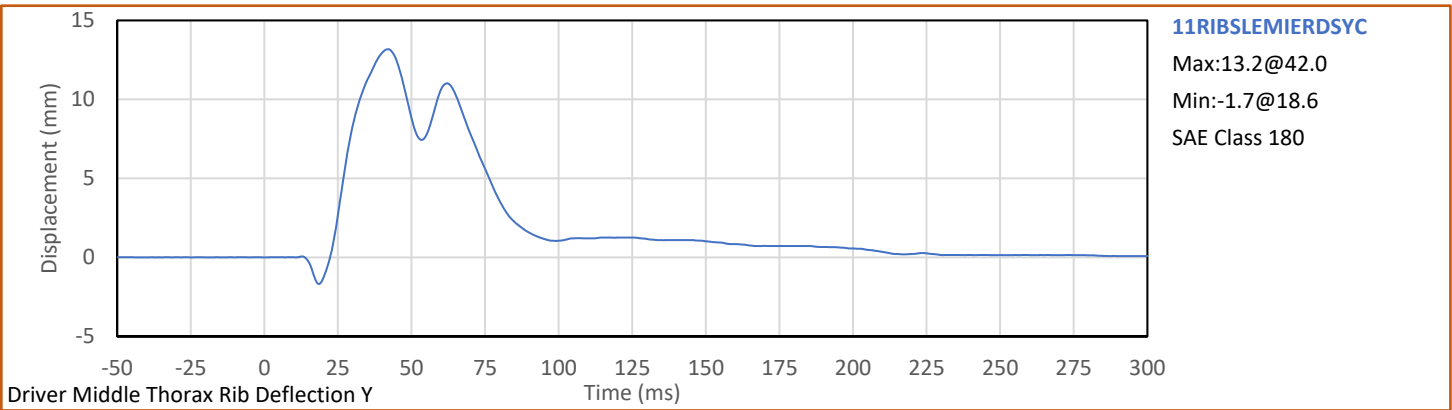
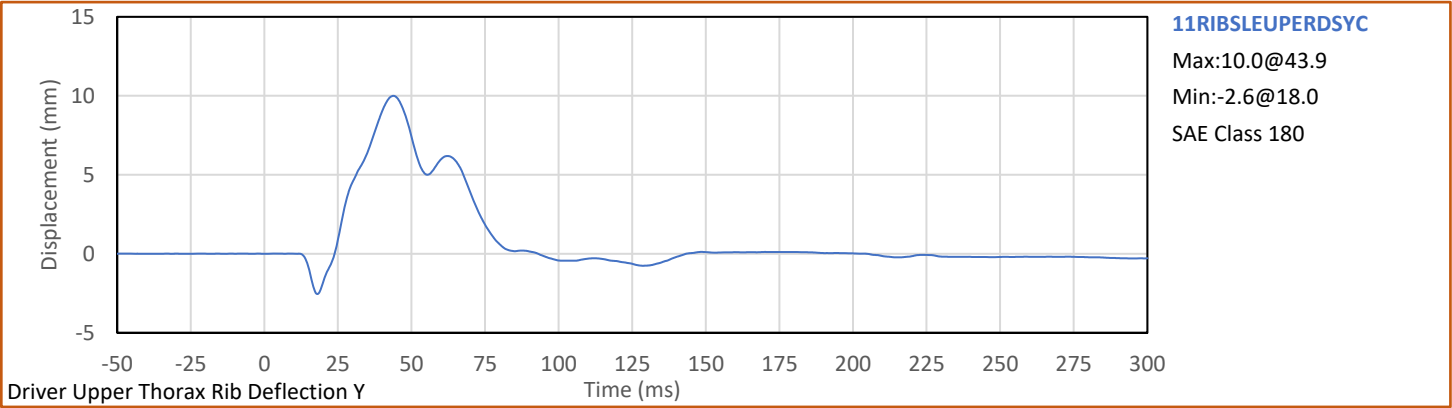
MDB Rear Acceleration (X)

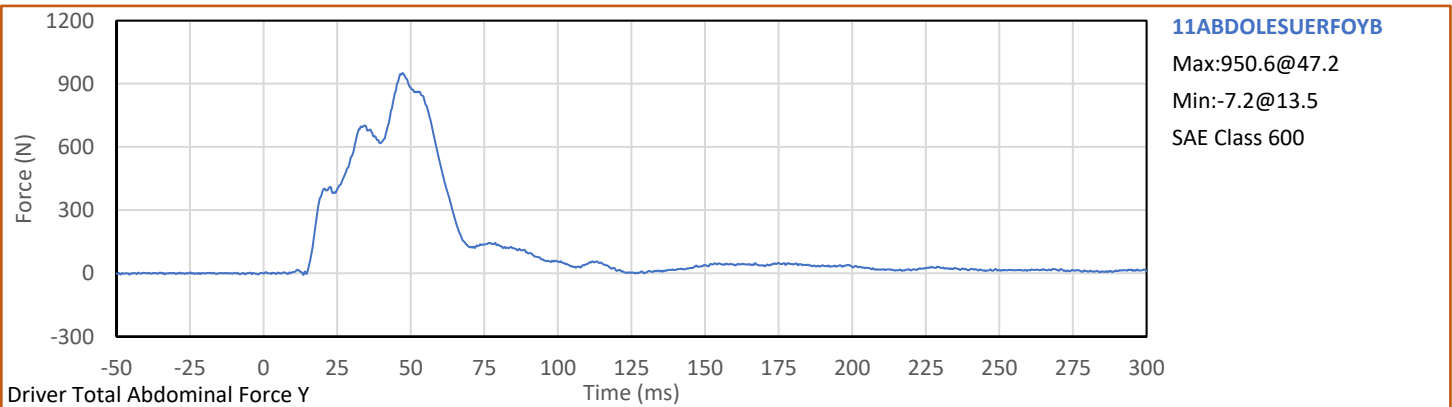
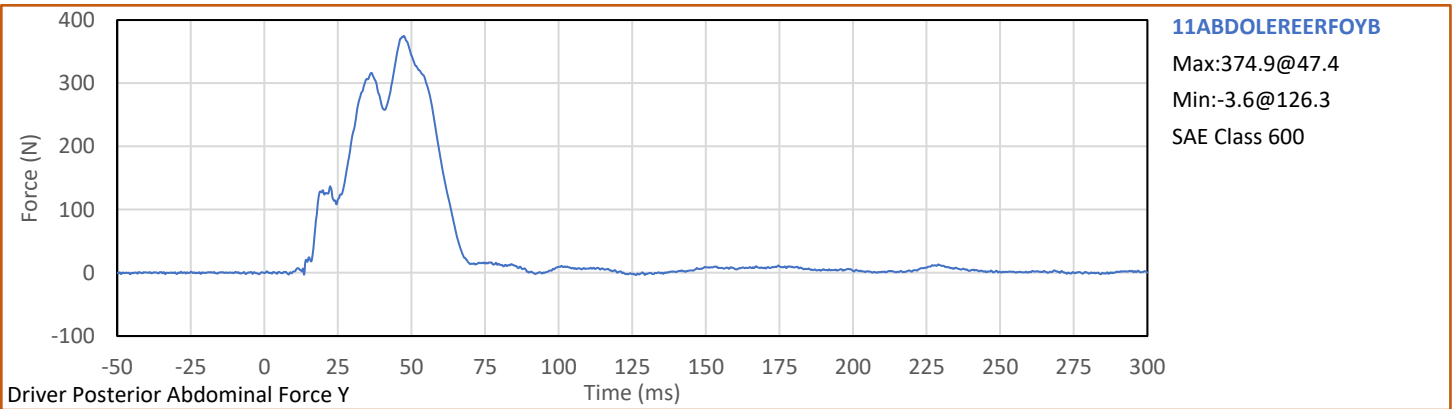
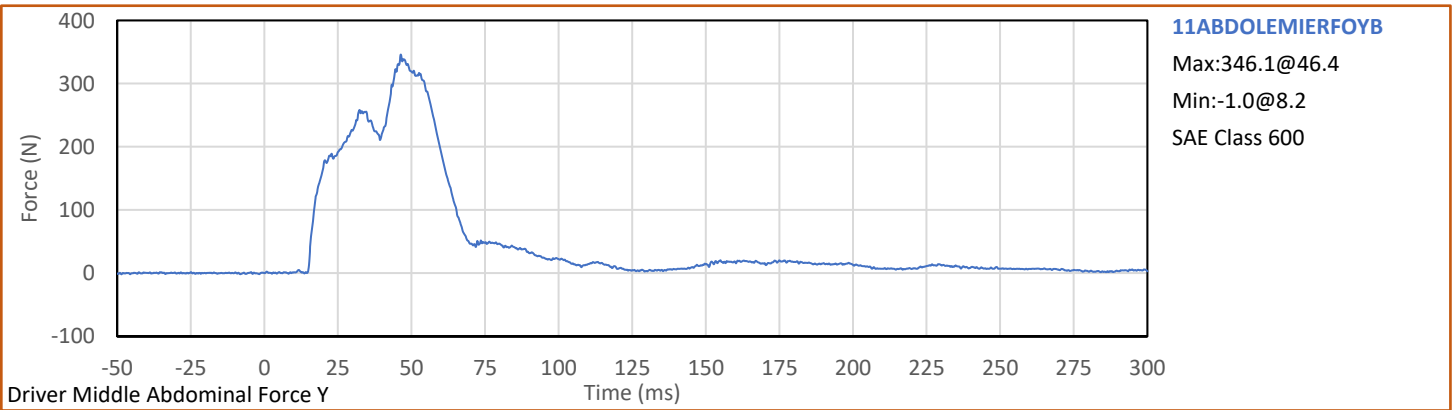
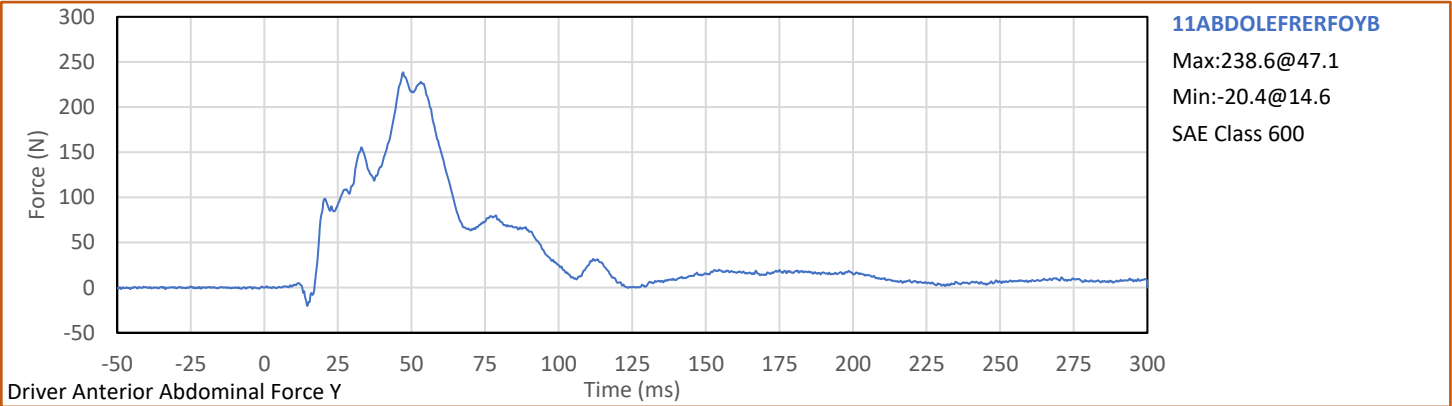
MDB Rear Acceleration (Y)

Left MDB Contact Switch

Right MDB Contact Switch







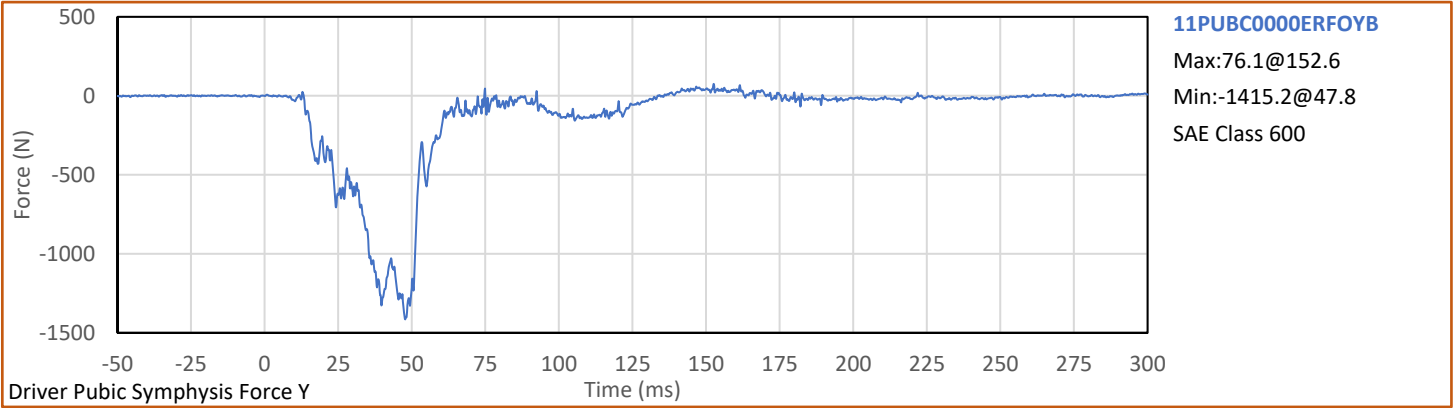
Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck

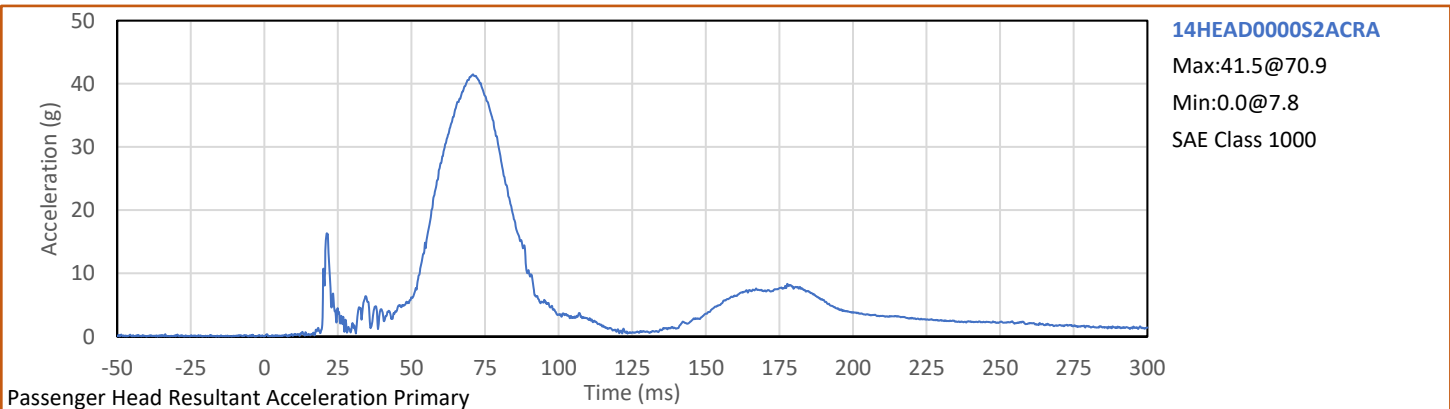
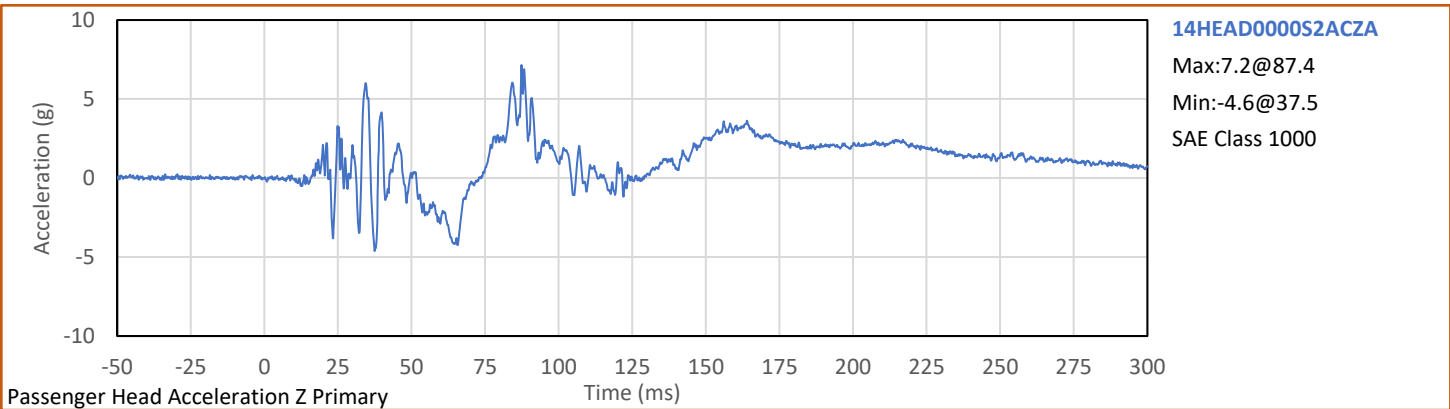
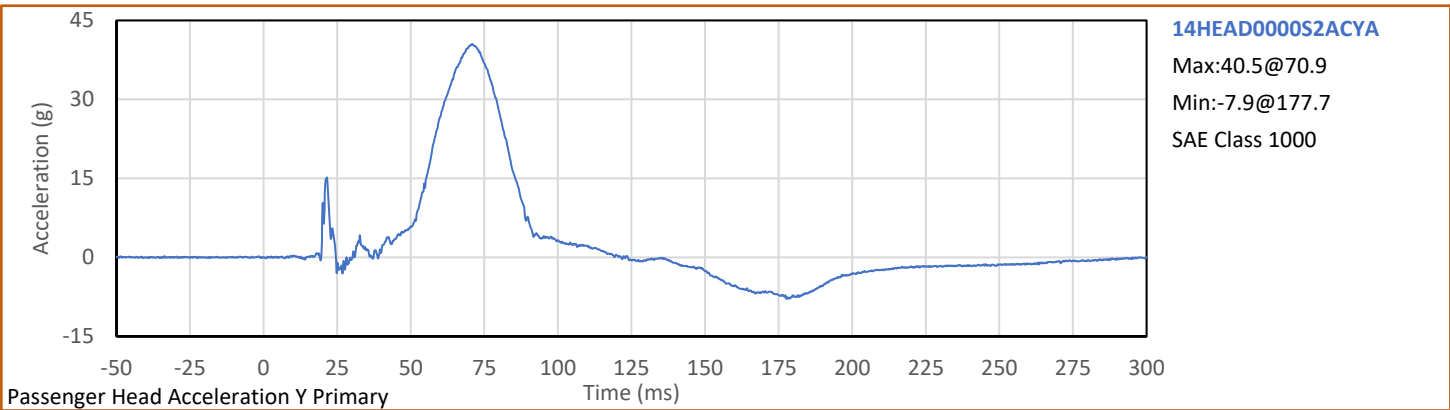
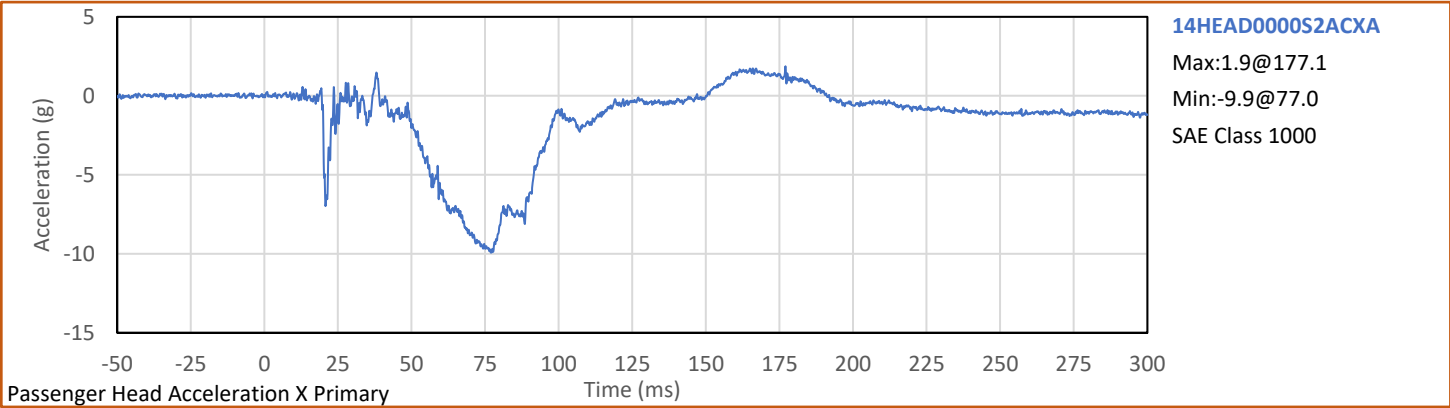
NHTSA No.: M20234202

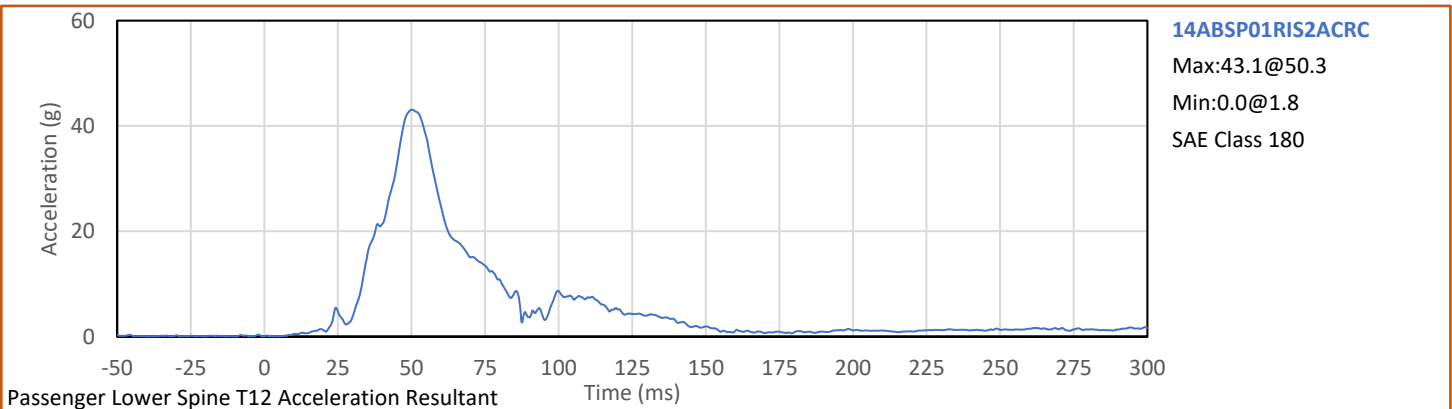
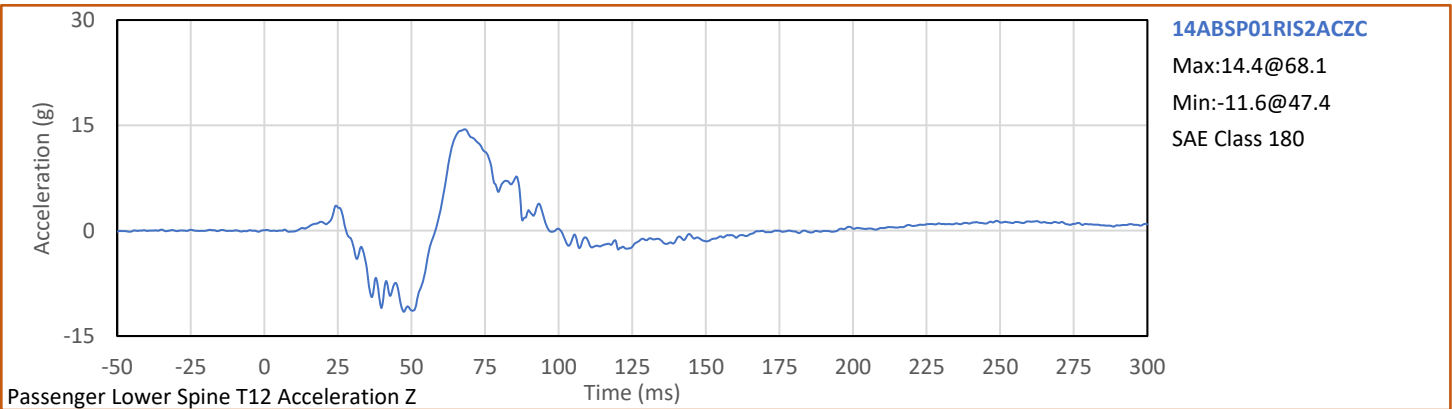
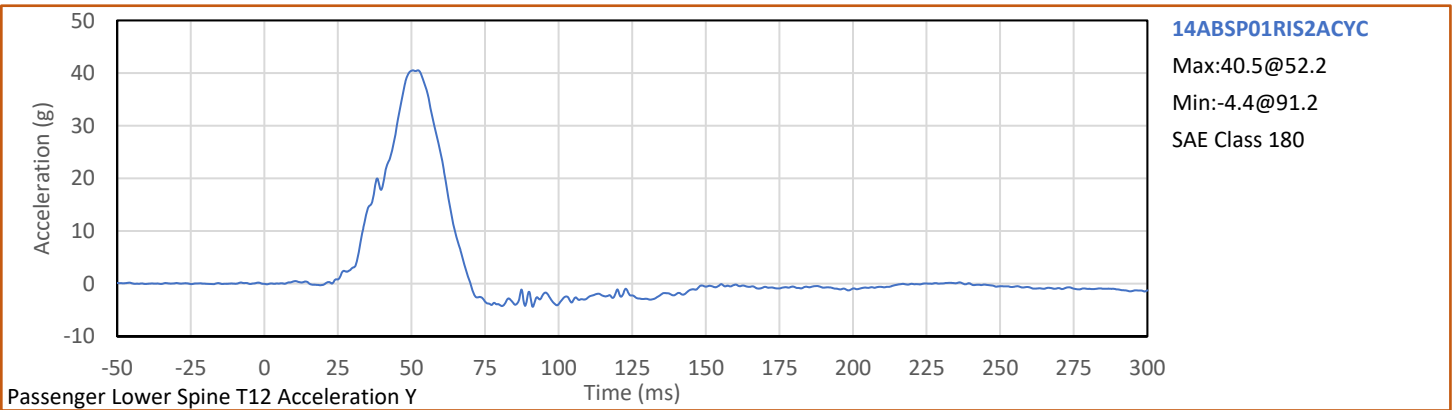
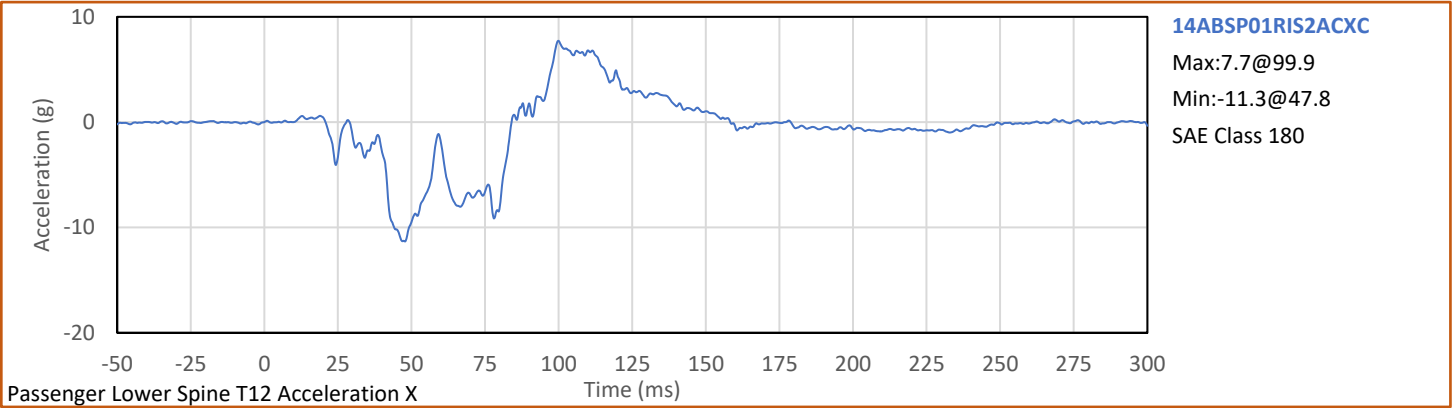


Test Program: NCAP MDB Side Impact Test

Test Date: 2/22/2023







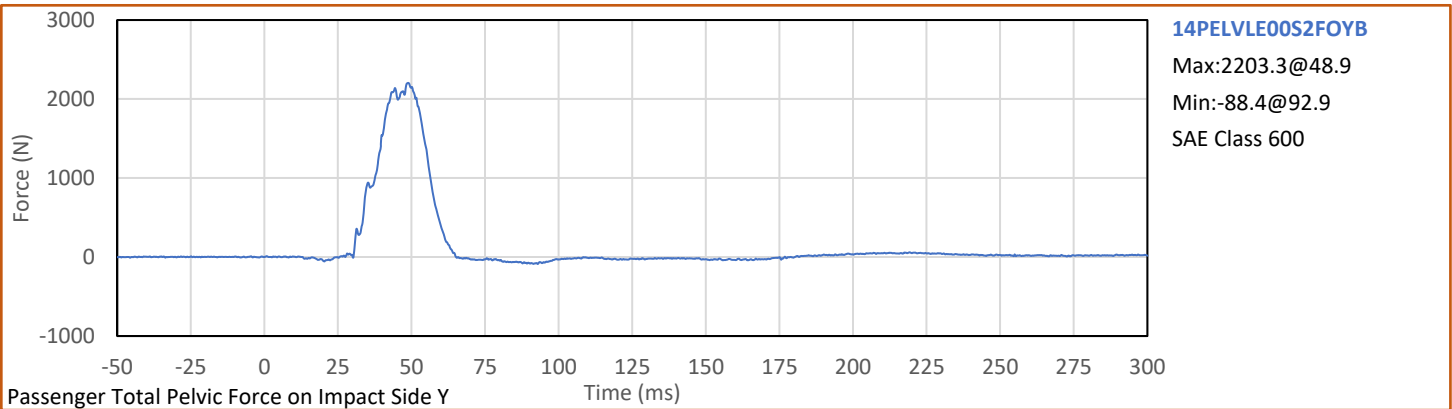
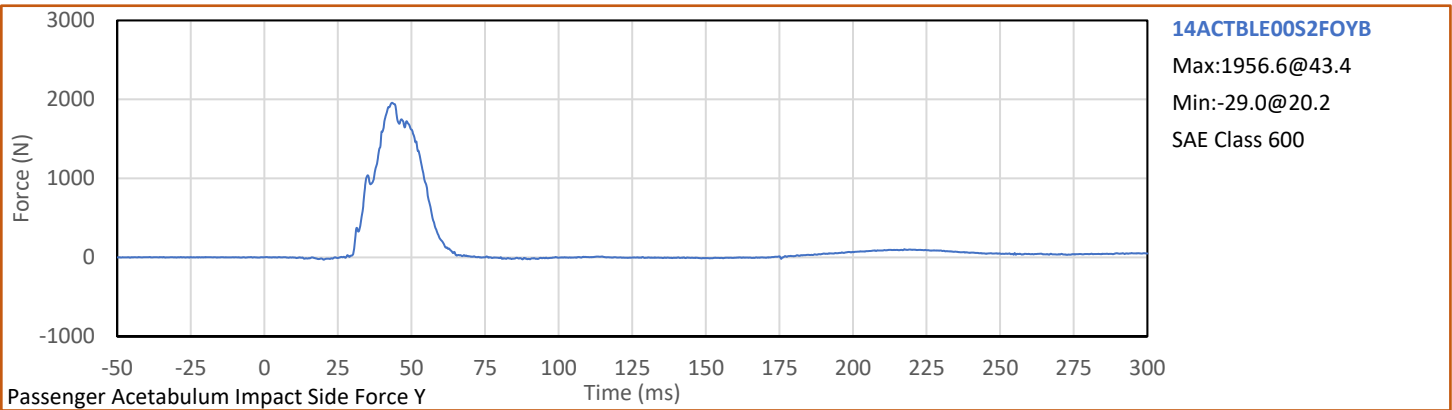
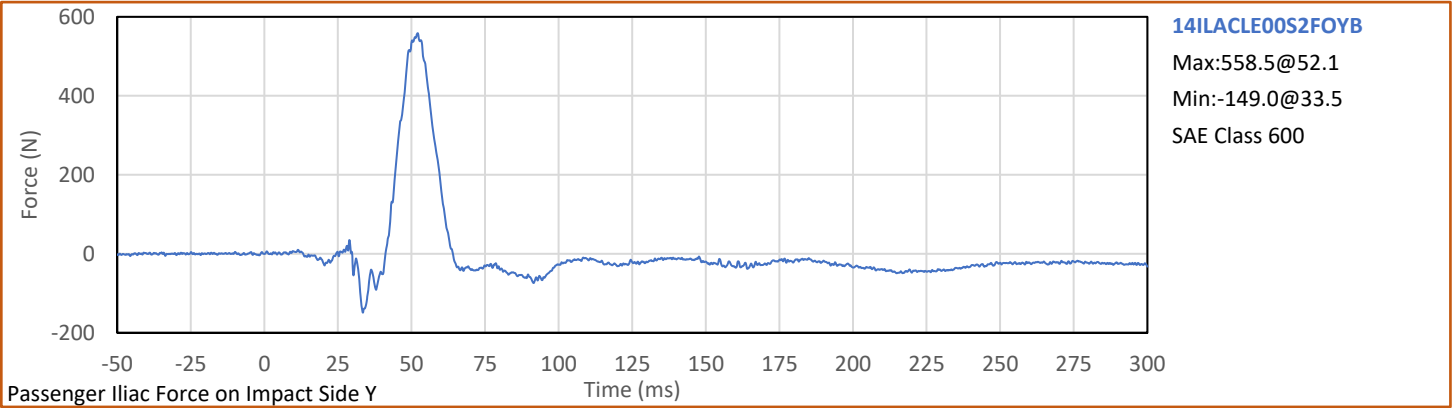
Test Vehicle: 2023 Hyundai Santa Cruz 4-Door Truck

NHTSA No.: M20234202



Test Program: NCAP MDB Side Impact Test

Test Date: 2/22/2023



APPENDIX C
ATD CONFIGURATION AND PERFORMANCE VERIFICATION DATA

APPENDIX C
Pre-Test ATD Qualification and Performance Verification
ES-2re 50th Male Side Impact ATD, Left Side Configuration
S/N: F037

| Tested Parameter | Units | Spec Low | Spec. High | Result | Pass/Fail |
|--|-------|----------|------------|--------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.0 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 29 | Pass |
| 1 - Sitting Height | mm | 900 | 918 | 909 | Pass |
| 2 - Seat to Shoulder Joint | mm | 558 | 572 | 563 | Pass |
| 3 - Seat to Lower Face of Thoracic Spine Box | mm | 346 | 356 | 349 | Pass |
| 4 - Seat to Hip Joint (bolt center) | mm | 97 | 103 | 101 | Pass |
| 5 - Sole to Seat, Sitting | mm | 433 | 451 | 439 | Pass |
| 6 - Head Width | mm | 152 | 158 | 155 | Pass |
| 7 - Shoulder/Arm Width | mm | 461 | 479 | 469 | Pass |
| 8 - Thorax Width | mm | 322 | 332 | 326 | Pass |
| 9 - Abdomen Width | mm | 273 | 287 | 280 | Pass |
| 10 - Pelvis Lap Width | mm | 359 | 373 | 368 | Pass |
| 11 - Head Depth | mm | 196 | 206 | 200 | Pass |
| 12 - Thorax Depth | mm | 262 | 272 | 269 | Pass |
| 13 - Abdomen Depth | mm | 194 | 204 | 201 | Pass |
| 14 - Pelvis Depth | mm | 235 | 245 | 242 | Pass |
| 15 - Back of Buttocks to Hip Joint (bolt Center) | mm | 150 | 160 | 154 | Pass |
| 16 - Back of Buttocks to Front Knee | mm | 597 | 615 | 604 | Pass |
| Overall Test Results | | | | | Pass |

Technician:



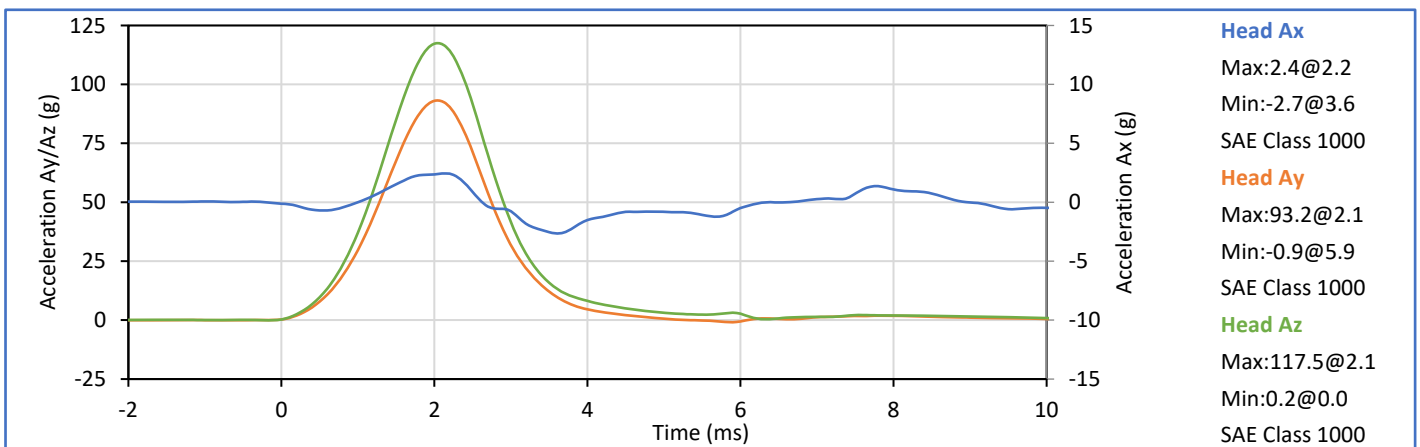
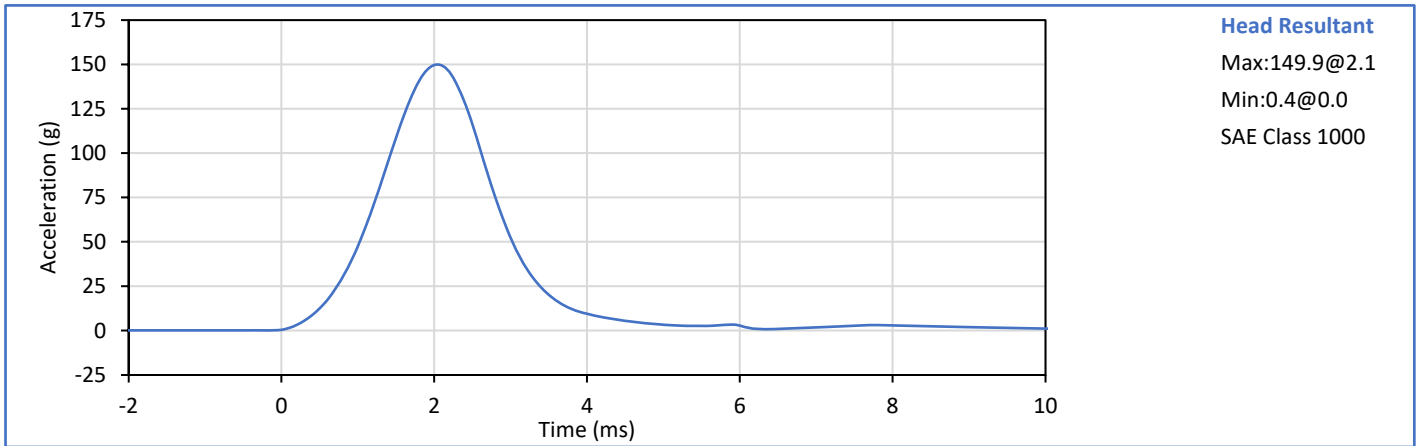
G. Fuentes

Approved By:



J. Hernandez

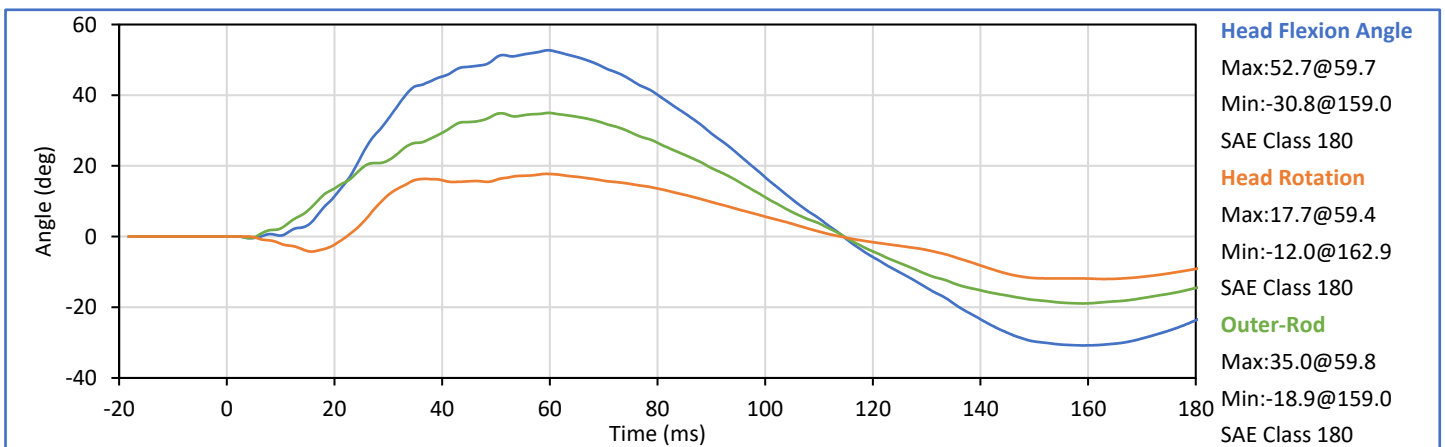
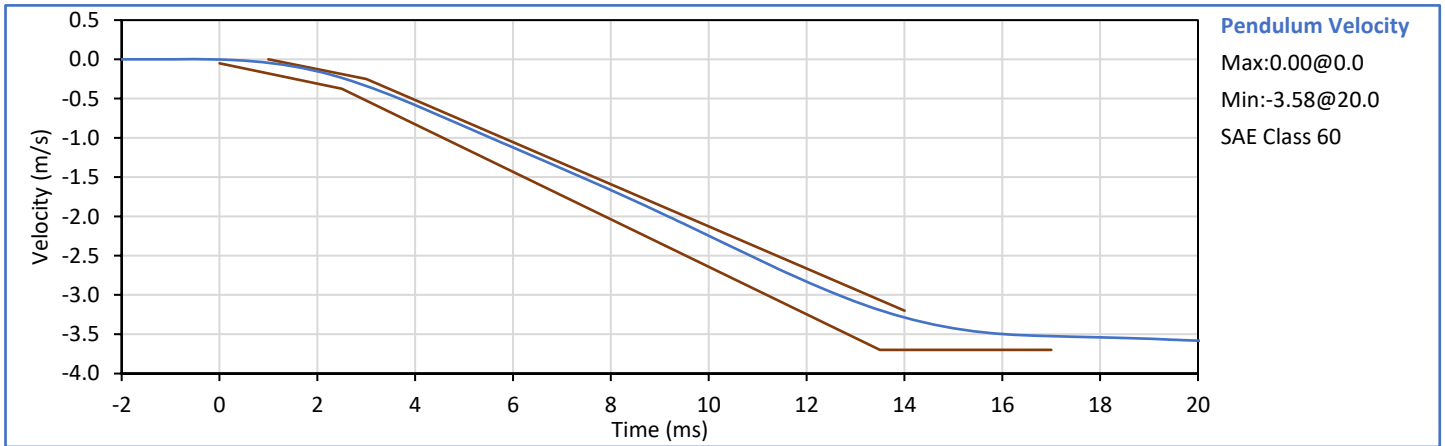
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|-------------------------------|--------|-----------|------------|--------|-------------|
| Laboratory Temperature | °C | 18.9 | 25.6 | 21.4 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 29 | Pass |
| Peak Resultant Acceleration | g | 125.0 | 155.0 | 149.9 | Pass |
| Peak Head Ax | g | -15.0 | 15.0 | 2.4 | Pass |
| Oscillations After Main Pulse | % | 0.0 | 15.0 | 2.0 | Pass |
| Is Acceleration Unimodal? | Yes/No | Yes | | Yes | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *Smith*
J. Hernandez

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|-------------------------------|-------|-----------|------------|--------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.4 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Pendulum Velocity | m/s | 3.30 | 3.50 | 3.47 | Pass |
| Peak Headform Flexion | deg | 49.0 | 59.0 | 52.7 | Pass |
| Time of Peak Headform Flexion | ms | 54.0 | 66.0 | 59.7 | Pass |
| Flexion Decay (Peak to zero) | ms | 53.0 | 88.0 | 54.9 | Pass |
| Overall Test Results | | | | | Pass |



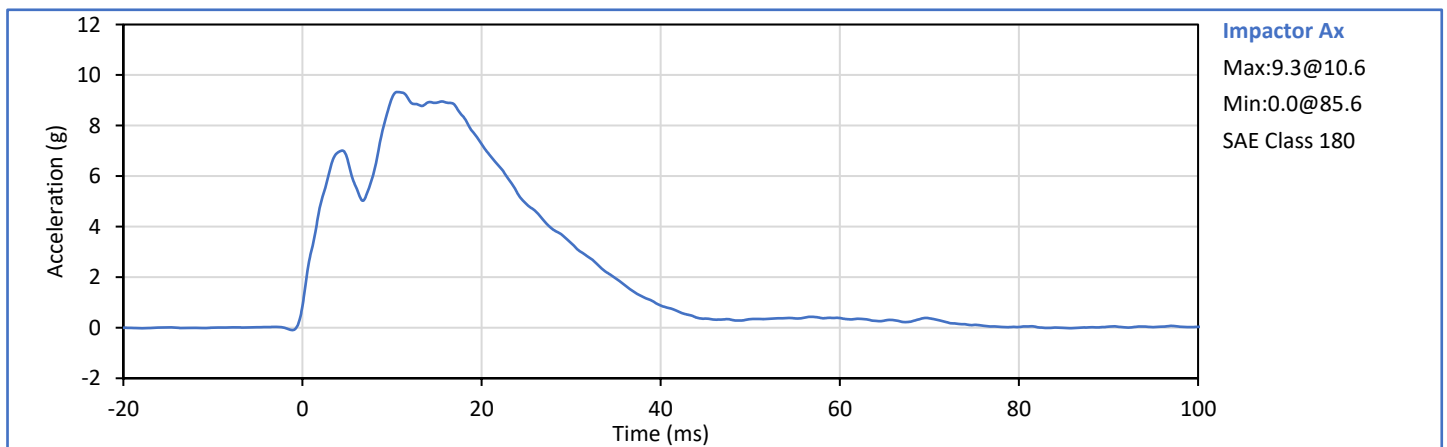
Technician: *Mill LGS III*
G. Fuentes

Approved By: *J. Hernandez*
J. Hernandez

ATD Serial No.: F037

Test Date: 2023-02-14

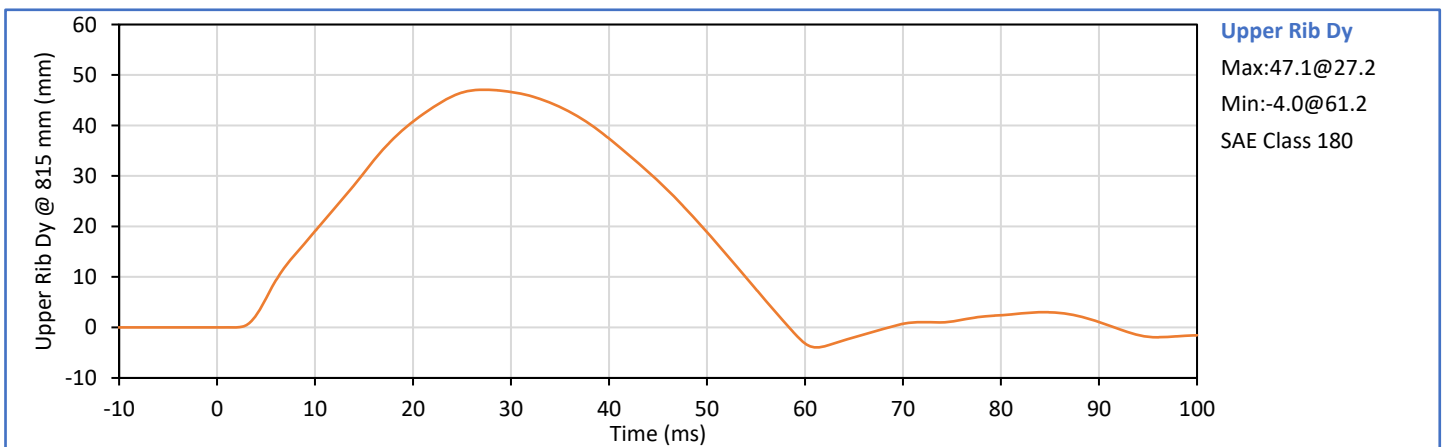
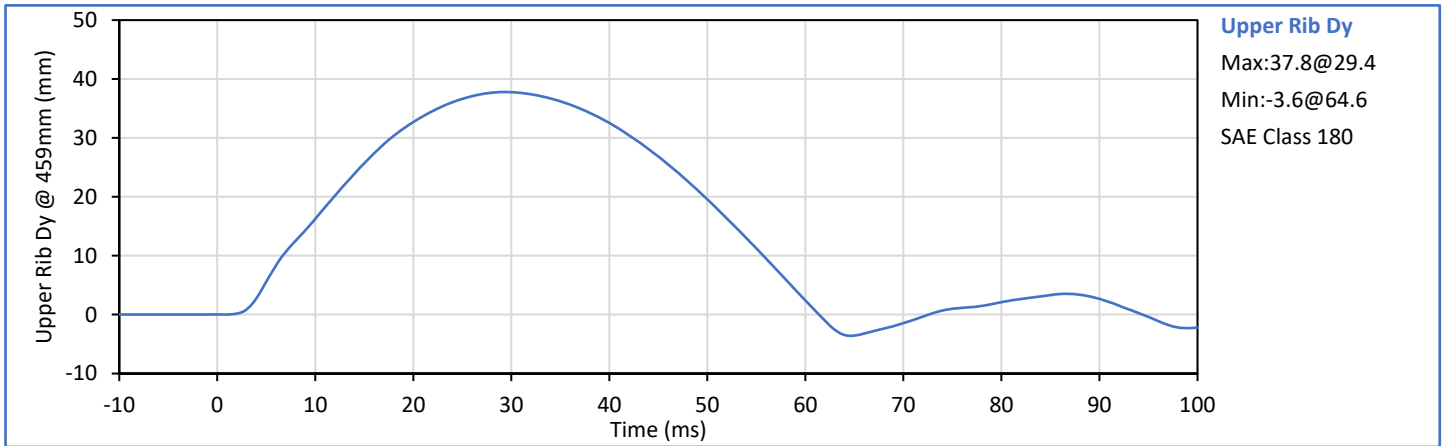
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|------------------------------|-------|-----------|------------|--------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.3 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 31 | Pass |
| Impactor Velocity | m/s | 4.20 | 4.40 | 4.31 | Pass |
| Peak Impactor Ax | g | 7.5 | 10.5 | 9.3 | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *Seath*
J. Hernandez

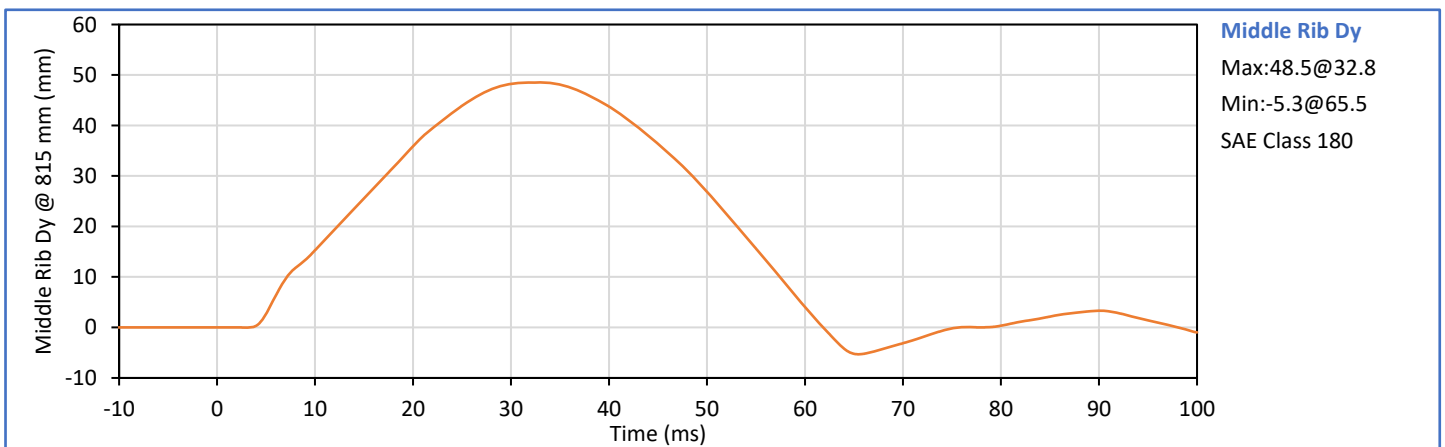
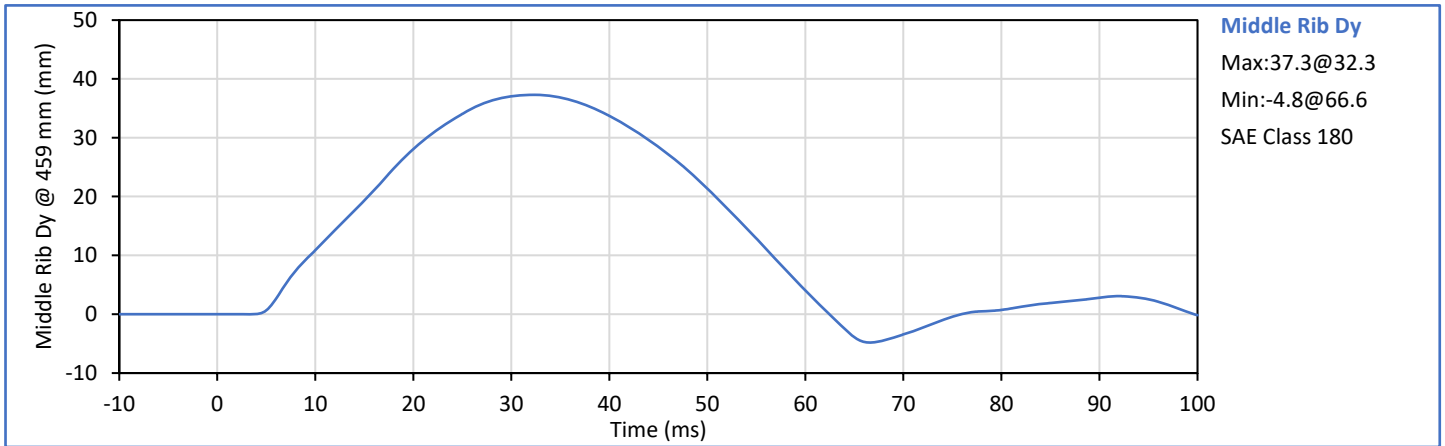
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|------------------------------|-------|-----------|------------|--------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Upper Rib Dy @ 459mm | mm | 36.0 | 40.0 | 37.8 | Pass |
| Upper Rib Dy @ 815mm | mm | 46.0 | 51.0 | 47.1 | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *Seath*
J. Hernandez

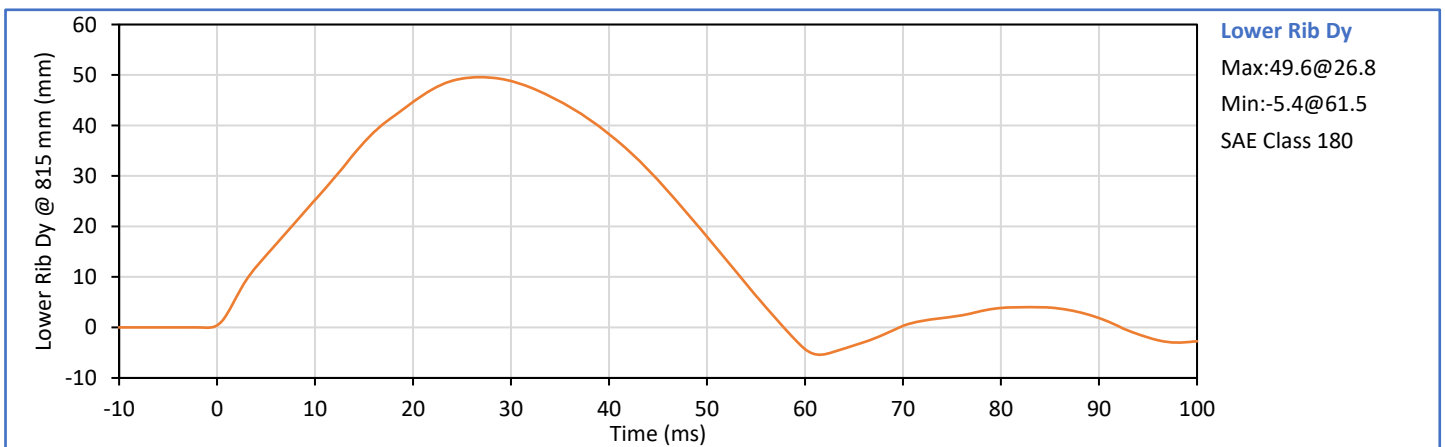
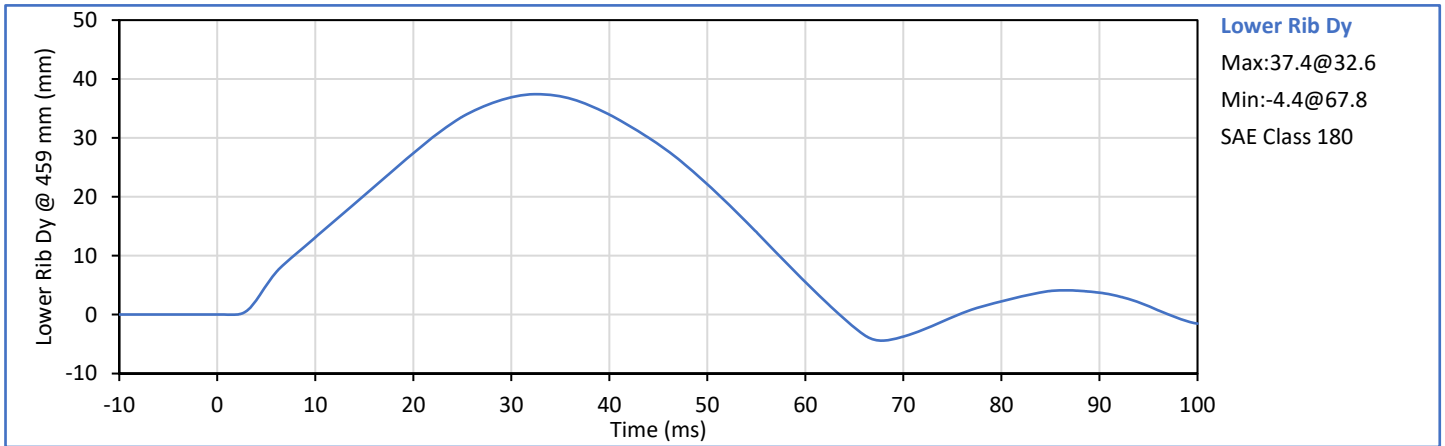
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|------------------------------|-------|-----------|------------|--------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Middle Rib Dy @ 459mm | mm | 36.0 | 40.0 | 37.3 | Pass |
| Middle Rib Dy @ 815mm | mm | 46.0 | 51.0 | 48.5 | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *Seath*
J. Hernandez

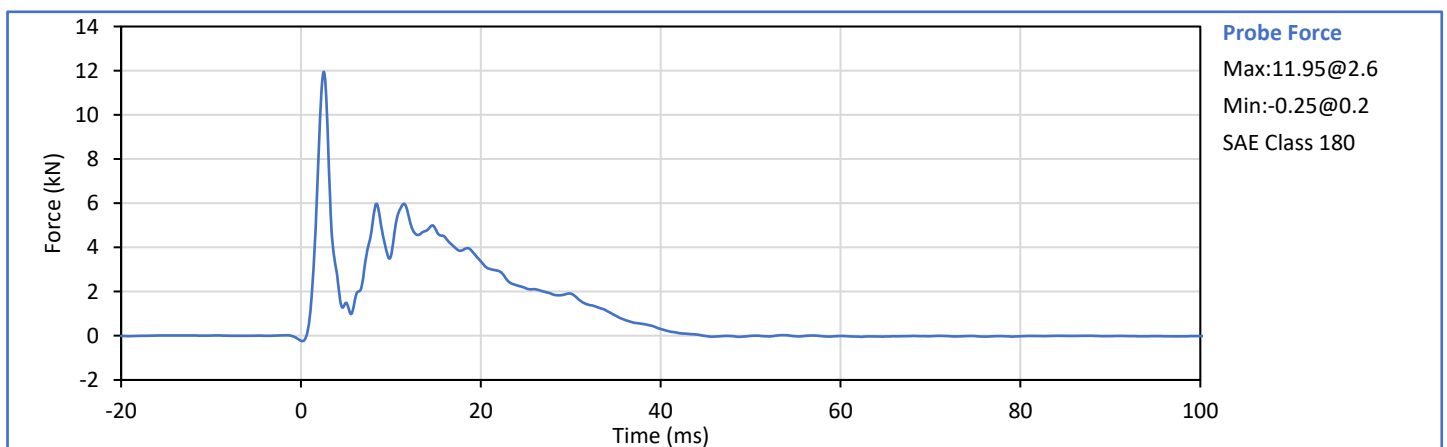
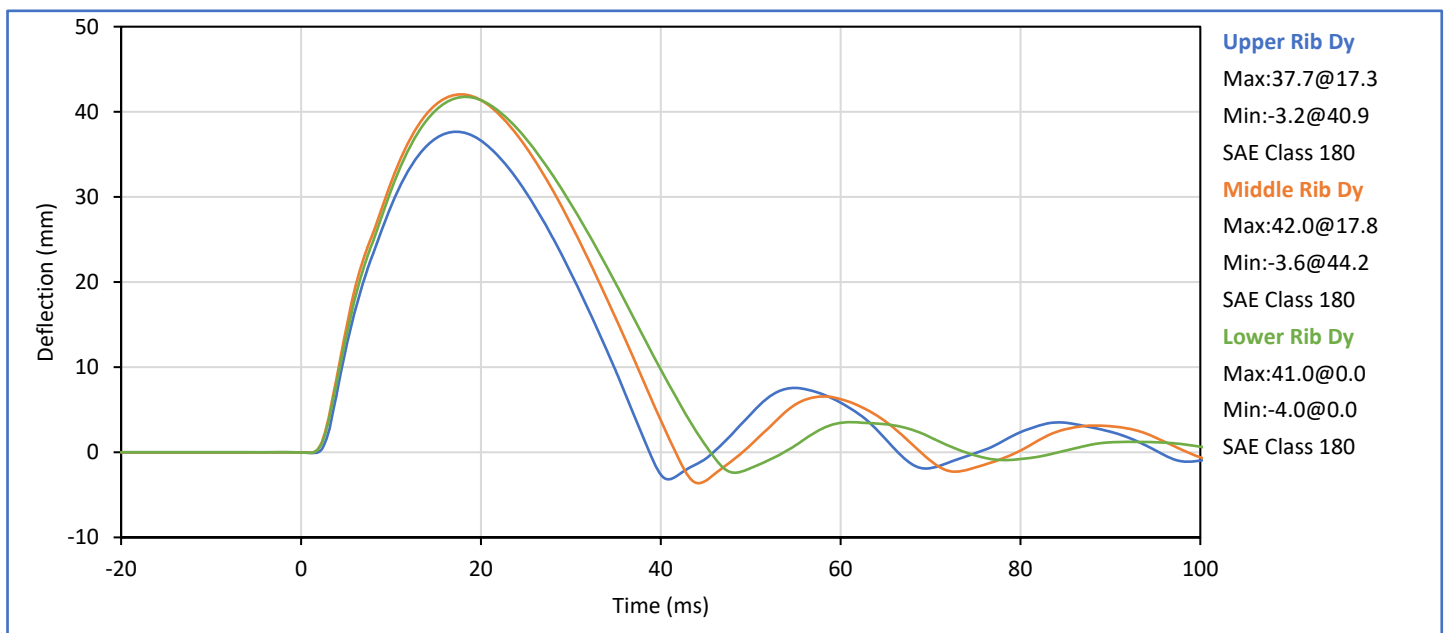
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|------------------------------|-------|-----------|------------|--------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Lower Rib Dy @ 459mm | mm | 36.0 | 40.0 | 37.4 | Pass |
| Lower Rib Dy @ 815mm | mm | 46.0 | 51.0 | 49.6 | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *Seath*
J. Hernandez

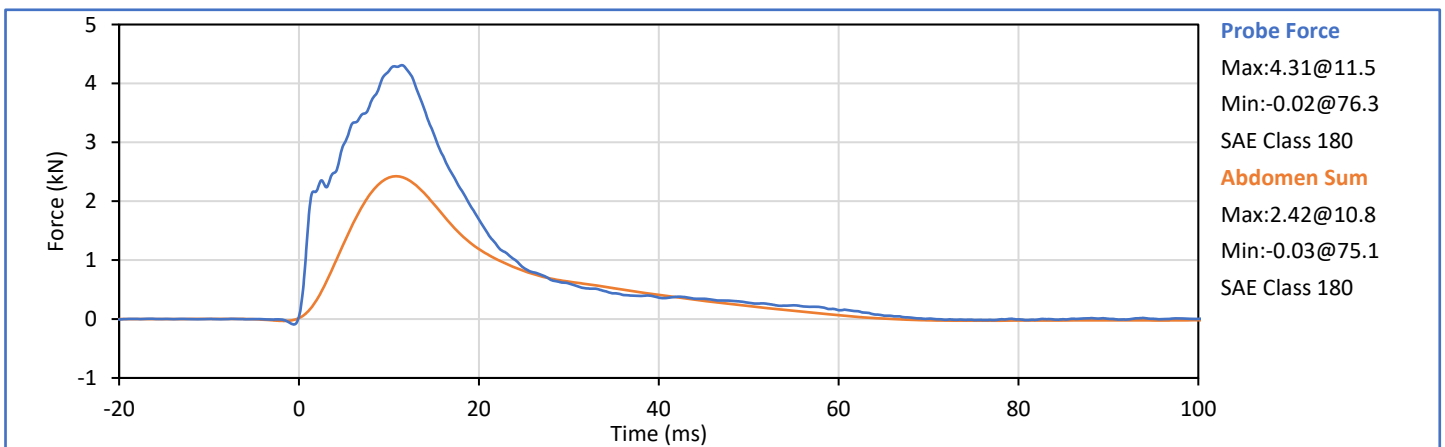
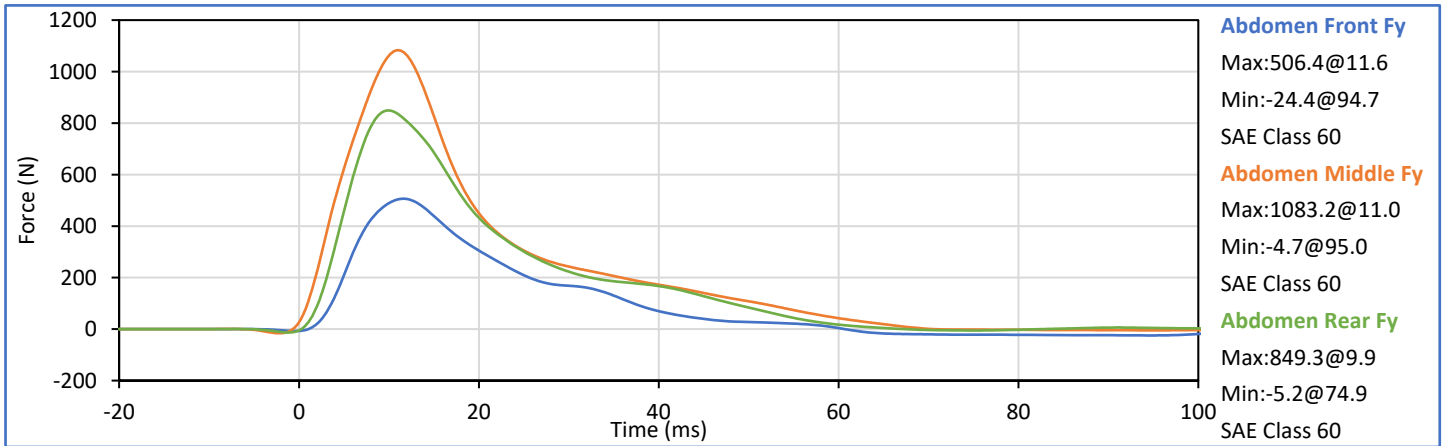
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|--------------------------------|-------|-----------|------------|--------|-------------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Impactor Velocity | m/s | 5.40 | 5.60 | 5.53 | Pass |
| Peak Upper Rib Dy | mm | 34.0 | 41.0 | 37.7 | Pass |
| Peak Middle Rib Dy | mm | 37.0 | 45.0 | 42.0 | Pass |
| Peak Lower Rib Dy | mm | 37.0 | 44.0 | 41.8 | Pass |
| Peak Impactor Force After 6 ms | kN | 5.10 | 6.20 | 5.97 | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *Santh*
J. Hernandez

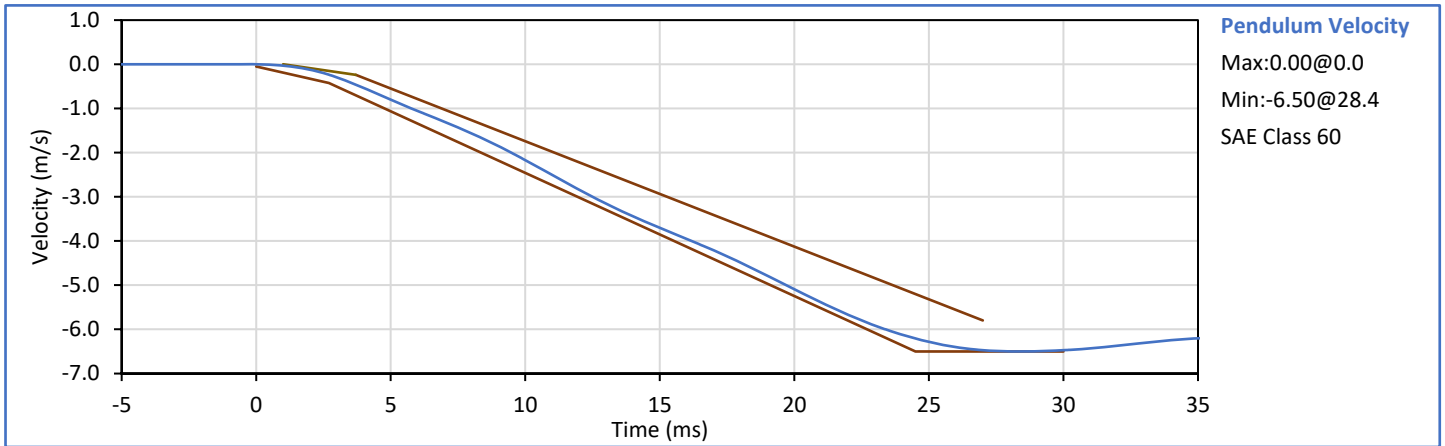
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|--------------------------------|-------|-----------|------------|--------|-------------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 31 | Pass |
| Impactor Velocity | m/s | 3.90 | 4.10 | 4.03 | Pass |
| Peak Impactor Force | kN | 4.00 | 4.80 | 4.31 | Pass |
| Time of Peak Impactor Force | ms | 10.6 | 13.0 | 11.5 | Pass |
| Sum of Abdomen Forces | kN | 2.20 | 2.70 | 2.42 | Pass |
| Time of Peak Sum Abdomen Force | ms | 10.0 | 12.3 | 10.8 | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *Seuthy*
J. Hernandez

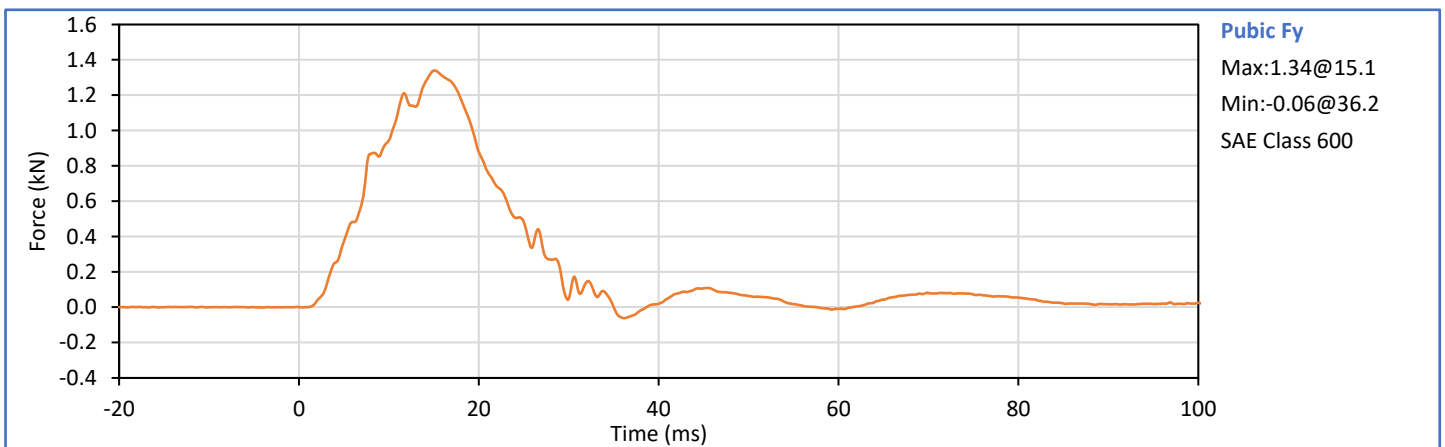
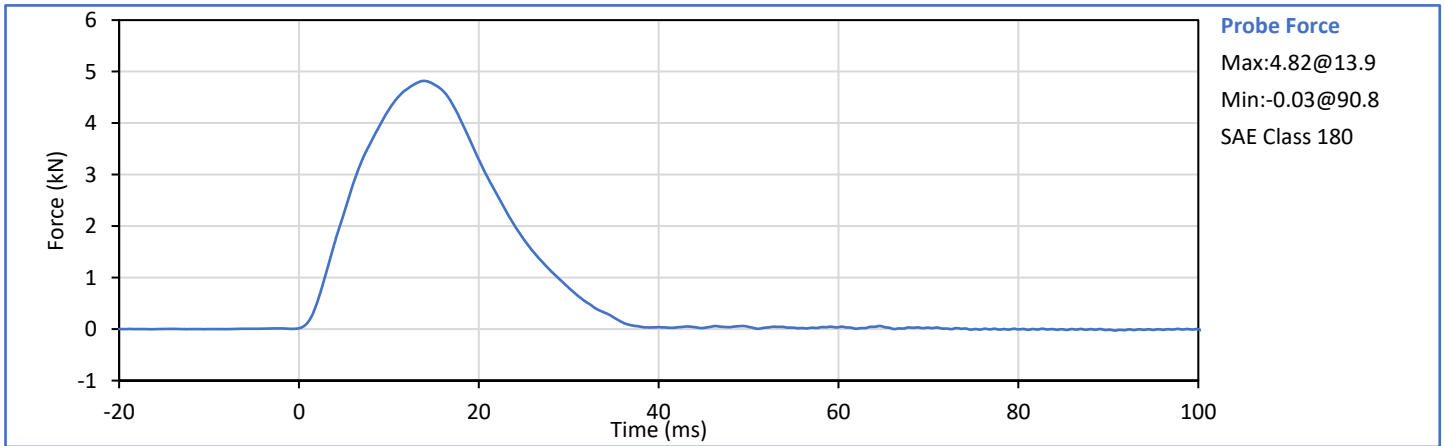
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|-------------------------------|-------|-----------|------------|--------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Pendulum Velocity | m/s | 5.95 | 6.15 | 6.10 | Pass |
| Peak Headform Flexion | deg | 45.0 | 55.0 | 46.5 | Pass |
| Time of Peak Headform Flexion | ms | 39.0 | 53.0 | 41.4 | Pass |
| Flexion Decay (Peak to zero) | ms | 37.0 | 57.0 | 38.3 | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *J. Hernandez*
J. Hernandez

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|---------------------------------|-------|-----------|------------|--------|-------------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Impactor Velocity | m/s | 4.20 | 4.40 | 4.32 | Pass |
| Peak Impactor Force | kN | 4.70 | 5.40 | 4.82 | Pass |
| Time of Peak Impactor Force | ms | 11.8 | 16.1 | 13.9 | Pass |
| Pubic Symphysis Fy | kN | 1.23 | 1.59 | 1.34 | Pass |
| Time of Peak Pubic Symphysis Fy | ms | 12.2 | 17.0 | 15.1 | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *Smith*
J. Hernandez

APPENDIX C
Pre-Test ATD Qualification and Performance Verification
SID-IIs Small Side Impact ATD, Left Side Configuration
S/N: 308

ATD Serial No.: 308

Test Date: 2023-02-13

| Tested Parameter | Units | Spec Low | Spec. High | Result | Pass/Fail |
|----------------------------------|-------|----------|------------|----------------------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.8 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| A - Sitting Height | mm | 772 | 788 | 782 | Pass |
| B - Shoulder Pivot Height | mm | 437 | 453 | 450 | Pass |
| C - Hpoint Height | mm | 79 | 89 | 85 | Pass |
| D - H Point From Seatback | mm | 141 | 151 | 146 | Pass |
| E - Shoulder Pivot From Backline | mm | 97 | 107 | 100 | Pass |
| F - Thigh Clearance | mm | 119 | 135 | 127 | Pass |
| G - Head Breadth | mm | 140 | 148 | 146 | Pass |
| H - Head Back From Backline | mm | 40 | 46 | 43 | Pass |
| I - Head Depth | mm | 178 | 188 | 185 | Pass |
| J - Head Circumference | mm | 541 | 551 | 544 | Pass |
| K - Buttock To Knee Length | mm | 514 | 540 | 523 | Pass |
| L - Popliteal Height | mm | 343 | 369 | 352 | Pass |
| K - Knee Pivot To Floor Height | mm | 392 | 409 | 404 | Pass |
| N - Buttock Popliteal Length | mm | 416 | 442 | 422 | Pass |
| O - Chest Depth W/O Jacket | mm | 195 | 211 | 205 | Pass |
| P - Foot Length | mm | 216 | 232 | 230 | Pass |
| Q - Hip Breadth (W/Pelvic Plugs) | mm | 313 | 323 | 317 | Pass |
| R - Arm Length | mm | 249 | 259 | 255 | Pass |
| S - Knee Joint To Seatback | mm | 477 | 493 | 484 | Pass |
| V - Shoulder Width | mm | 341 | 357 | 351 | Pass |
| W - Foot Width | mm | 78 | 94 | 87 | Pass |
| Y - Chest Circumference W/Jacket | mm | 851 | 881 | 862 | Pass |
| Z - Waist Circumference | mm | 761 | 791 | 779 | Pass |
| | | | | Overall Test Results | Pass |

Technician:



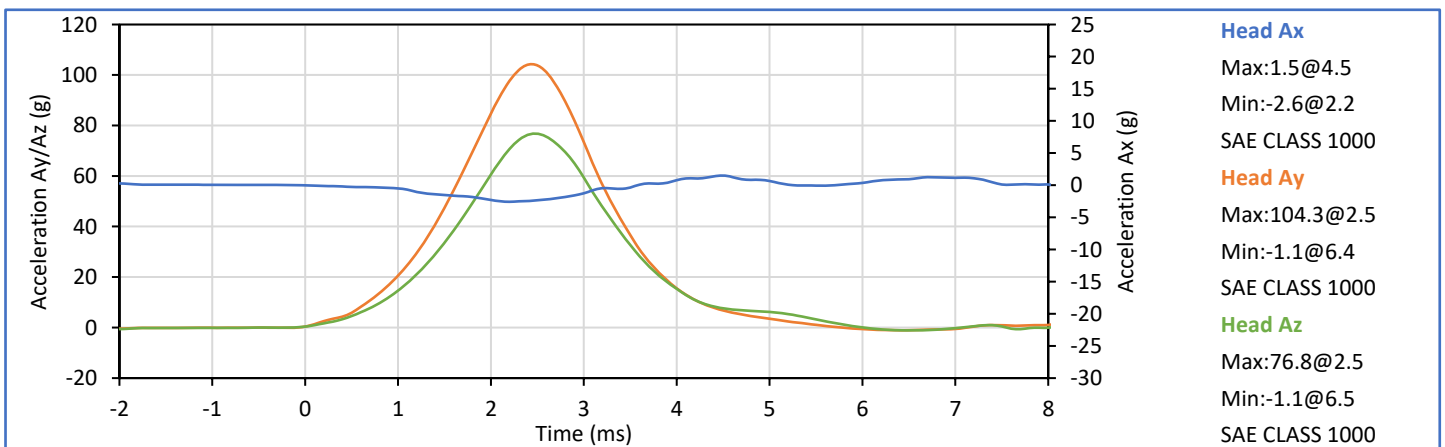
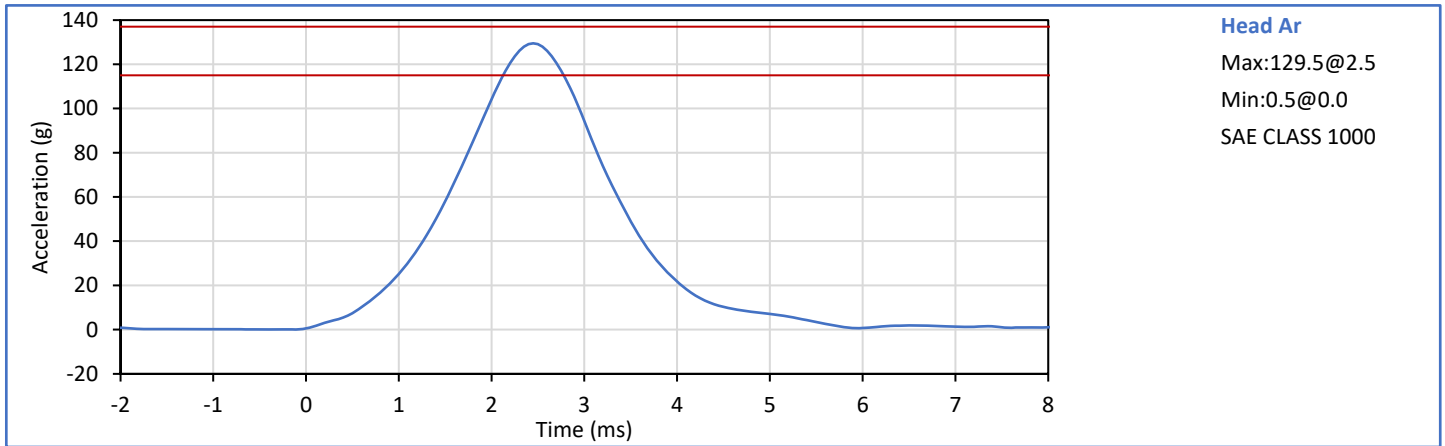
G. Fuentes

Approved By:



J. Hernandez

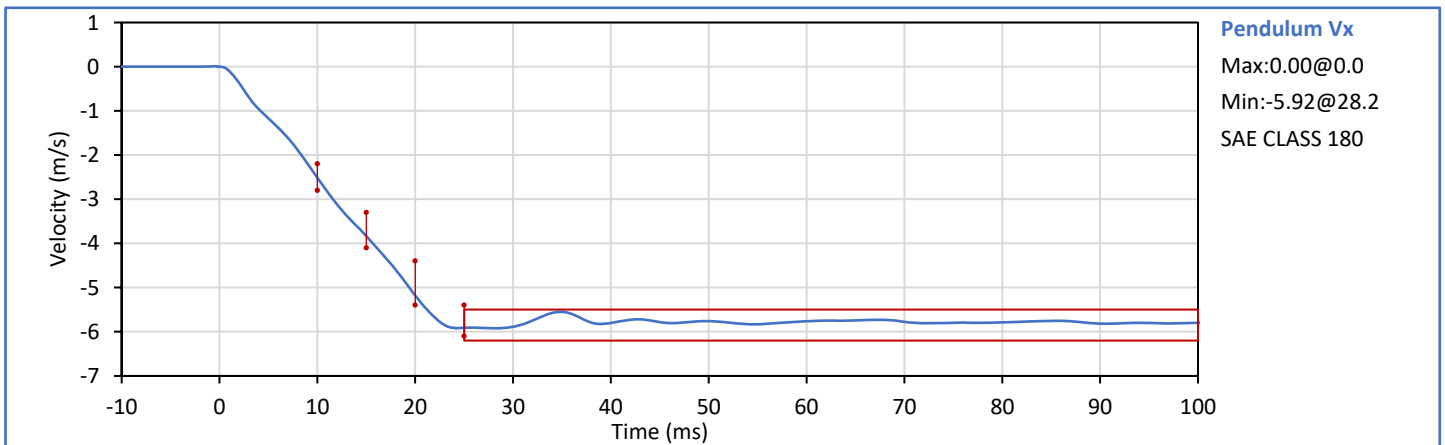
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|-------------------------------|--------|-----------|------------|--------|-------------|
| Laboratory Temperature | °C | 18.9 | 25.6 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Peak Resultant Acceleration | g | 115.0 | 137.0 | 129.5 | Pass |
| Peak Head Ax | g | -15.0 | 15.0 | -2.6 | Pass |
| Oscillations After Main Pulse | % | 0.0 | 15.0 | 2.1 | Pass |
| Is Acceleration Unimodal? | Yes/No | Yes | | Yes | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

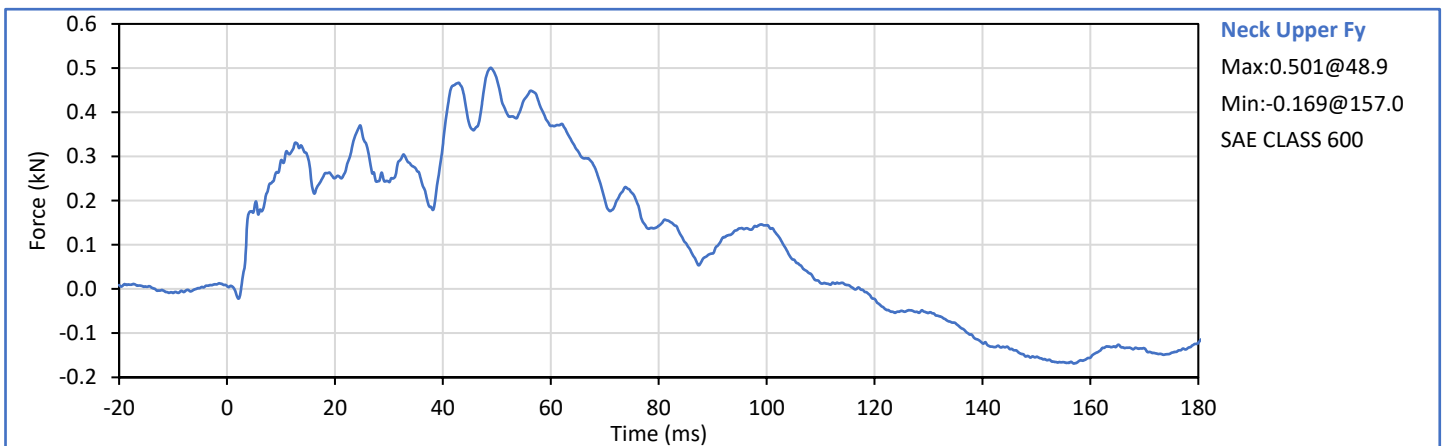
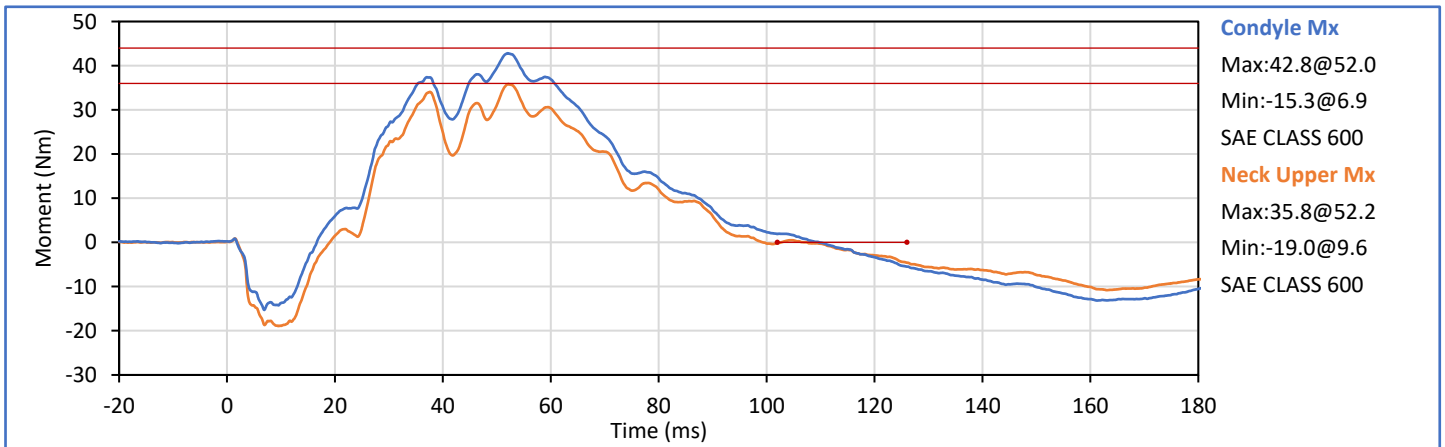
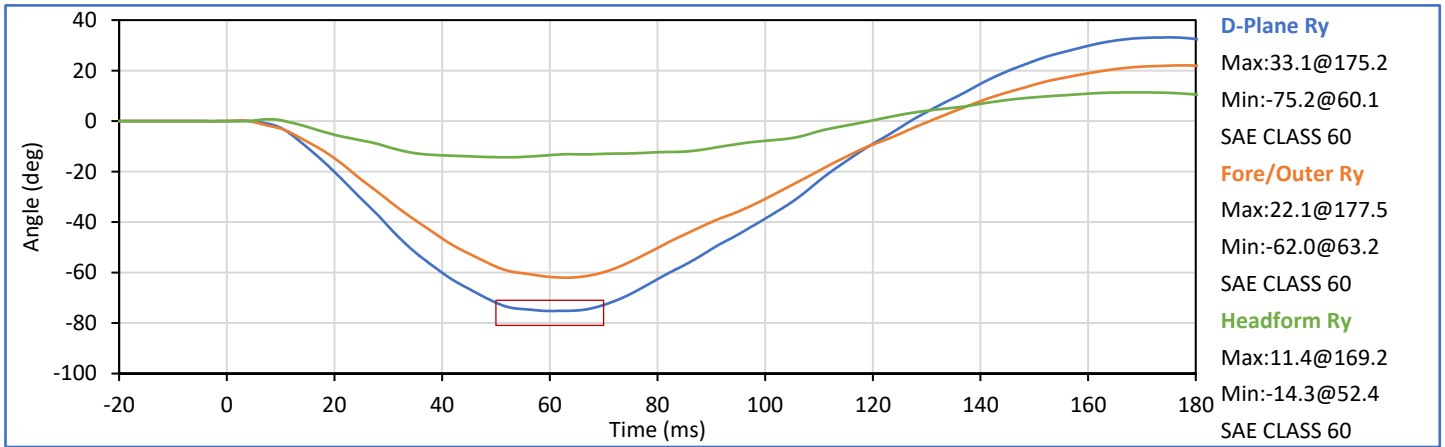
Approved By: *Smith*
J. Hernandez

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|---------------------------------|-------|-----------|------------|-------------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.4 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 31 | Pass |
| Pendulum Velocity | m/s | 5.51 | 5.63 | 5.56 | Pass |
| Pendulum Decel at 10 ms | m/s | -2.80 | -2.20 | -2.51 | Pass |
| Pendulum Decel at 15 ms | m/s | -4.10 | -3.30 | -3.83 | Pass |
| Pendulum Decel at 20 ms | m/s | -5.40 | -4.40 | -5.18 | Pass |
| Pendulum Decel at 25 ms | m/s | -6.10 | -5.40 | -5.91 | Pass |
| Pendulum Decel from 25-100 ms | m/s | -6.20 | -5.50 | -5.92/-5.55 | Pass |
| Peak "D" Plane Rotation | deg | -81.0 | -71.0 | -75.2 | Pass |
| Time of Peak "D" Plane Rotation | ms | 50.0 | 70.0 | 60.1 | Pass |
| Peak Occ. Condyle Moment | Nm | 36.0 | 44.0 | 42.8 | Pass |
| Time of Moment Decay to 0 Nm | ms | 102.0 | 126.0 | 109.8 | Pass |
| Overall Test Results | | | | | Pass |

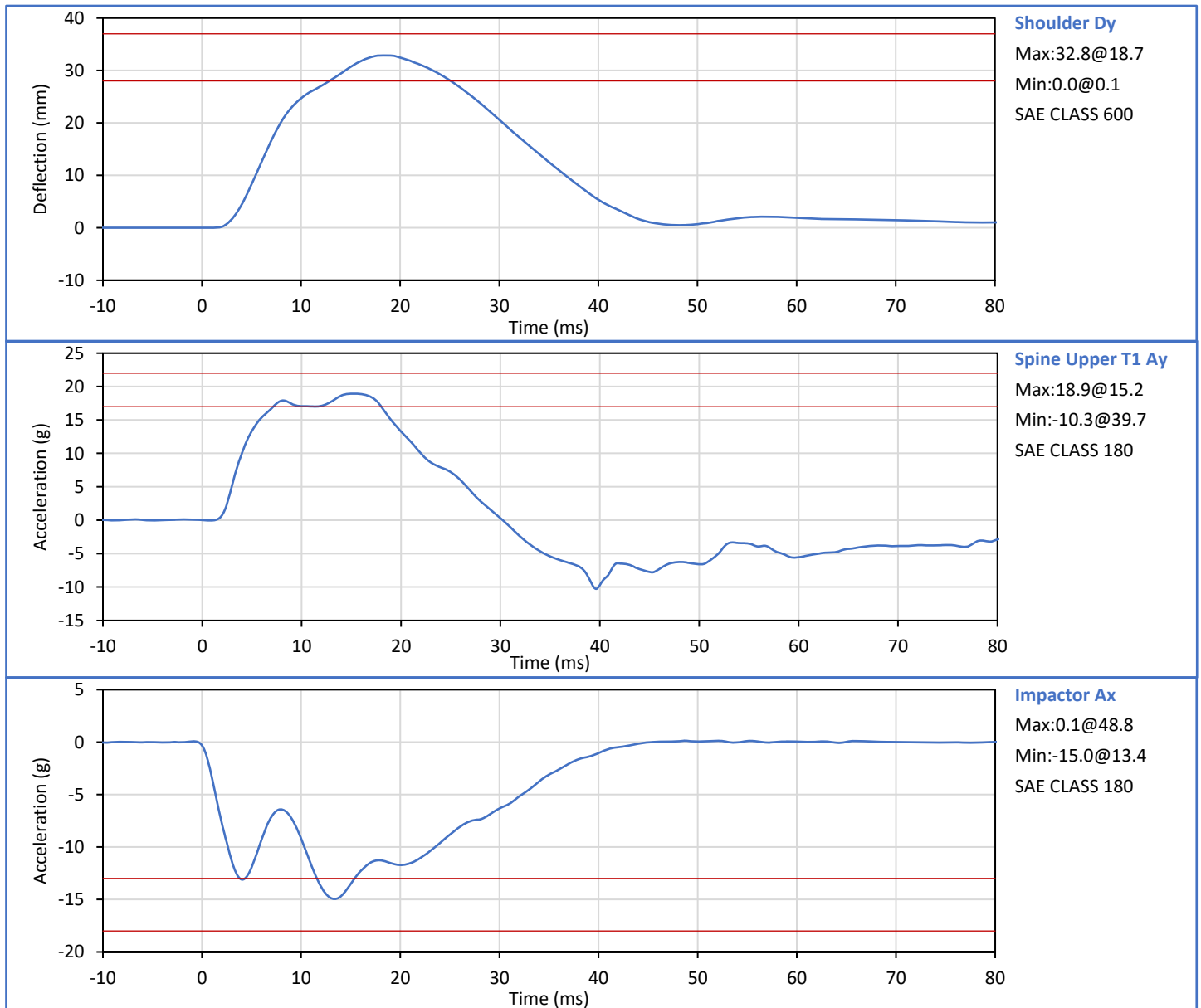


Technician: *Mill LGS III*
G. Fuentes

Approved By: *Smith*
J. Hernandez



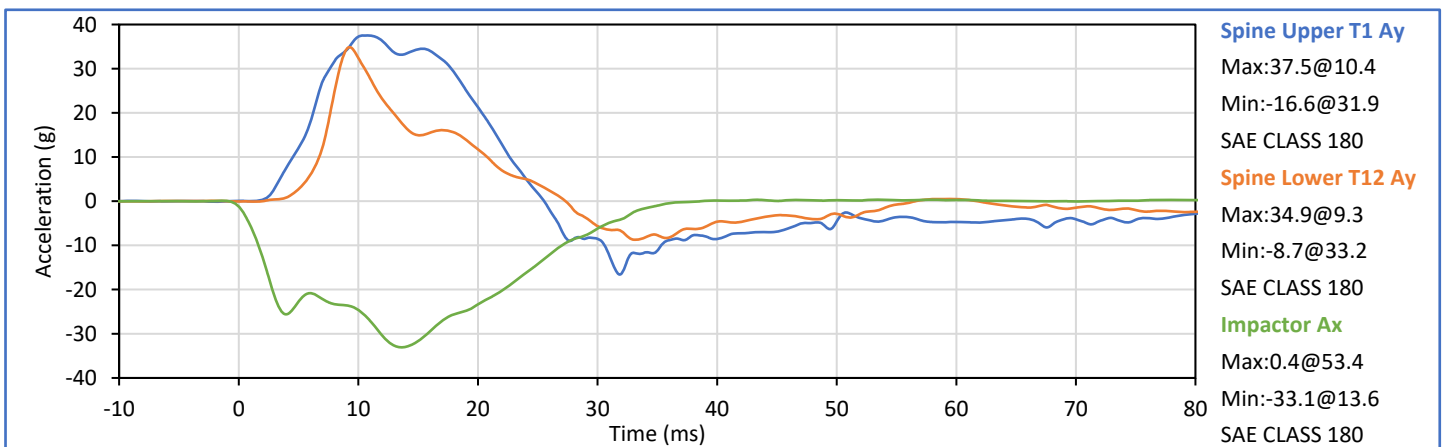
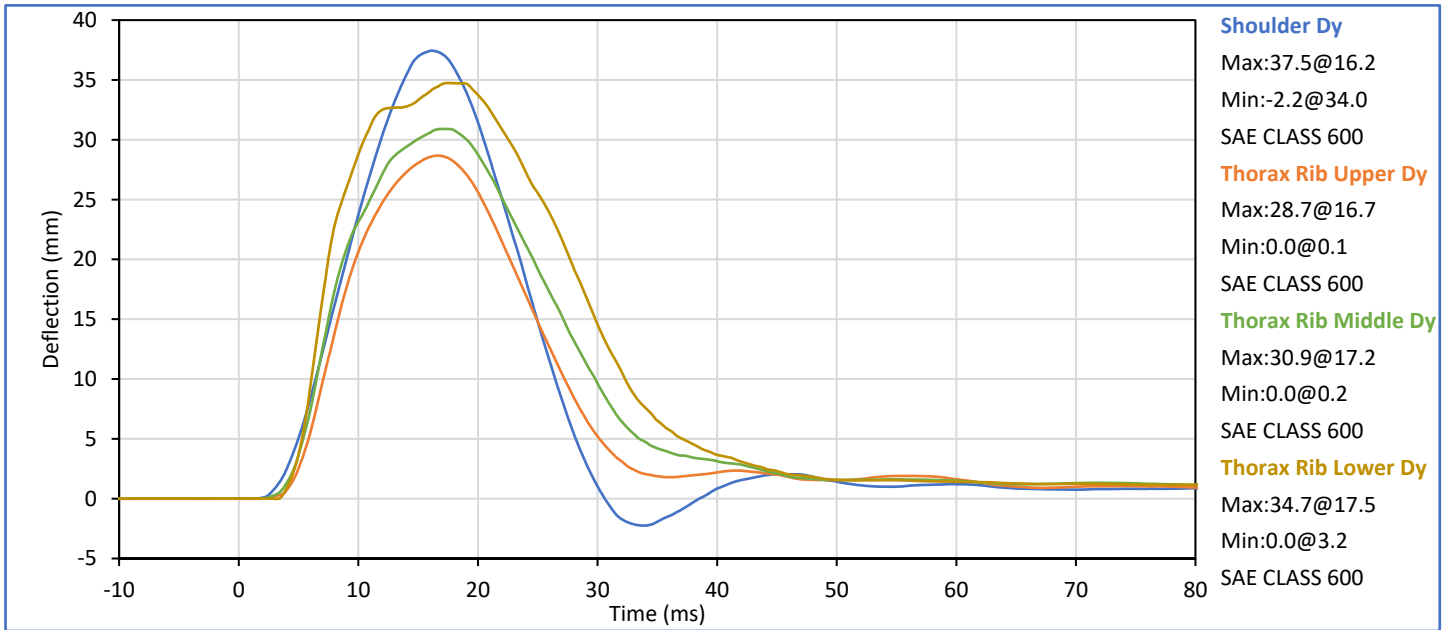
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|------------------------------|-------|-----------|------------|--------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Impactor Velocity | m/s | 4.20 | 4.40 | 4.32 | Pass |
| Peak Shoulder Dy | mm | 28.0 | 37.0 | 32.8 | Pass |
| Peak Upper Spine (T1) Ay | g | 17.0 | 22.0 | 18.9 | Pass |
| Peak Impactor Ax | g | -18.0 | -13.0 | -15.0 | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *J. Hernandez*
J. Hernandez

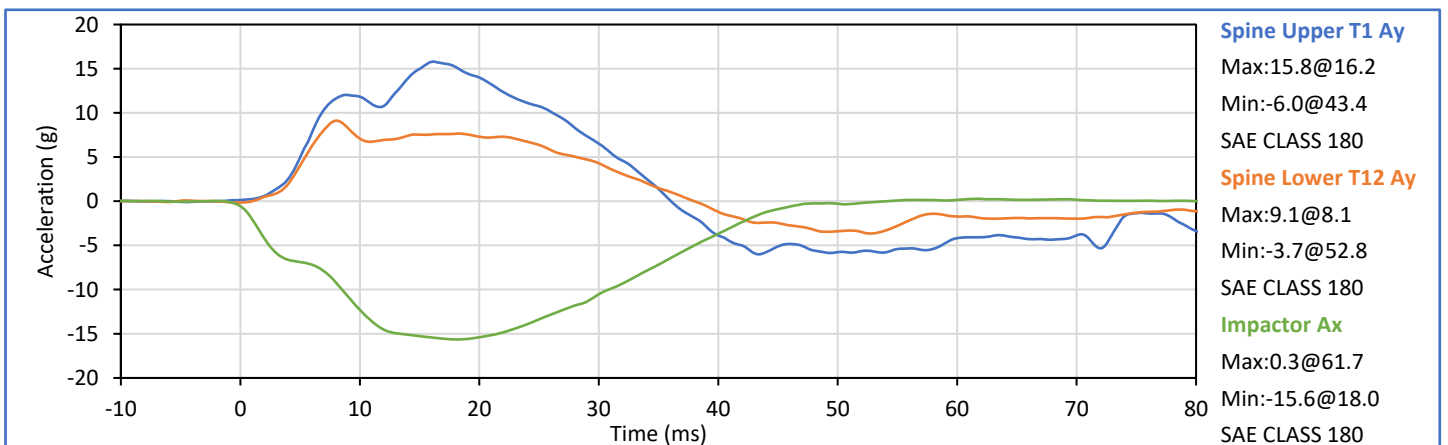
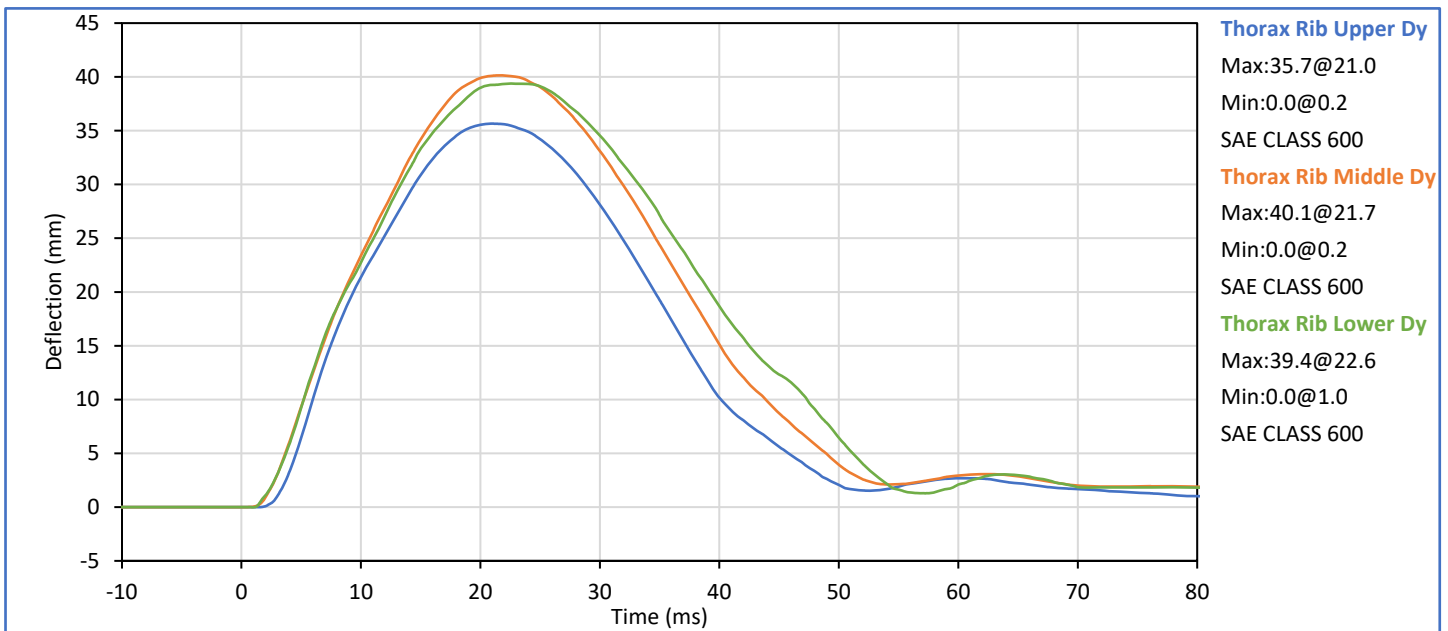
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|------------------------------|-------|-----------|------------|--------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.4 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Impactor Velocity | m/s | 6.60 | 6.80 | 6.71 | Pass |
| Peak Shoulder Dy | mm | 31.0 | 40.0 | 37.5 | Pass |
| Peak Upper Rib Dy | mm | 25.0 | 32.0 | 28.7 | Pass |
| Peak Middle Rib Dy | mm | 30.0 | 36.0 | 30.9 | Pass |
| Peak Lower Rib Dy | mm | 32.0 | 38.0 | 34.7 | Pass |
| Peak Upper Spine (T1) Ay | g | 34.0 | 43.0 | 37.5 | Pass |
| Peak Lower Spine (T12) Ay | g | 29.0 | 37.0 | 34.9 | Pass |
| Peak Impactor Ax | g | -36.0 | -30.0 | -33.1 | Pass |
| Overall Test Results | | | | | Pass |



Technician: Mill LGS III
G. Fuentes

Approved By: J. Hernandez
J. Hernandez

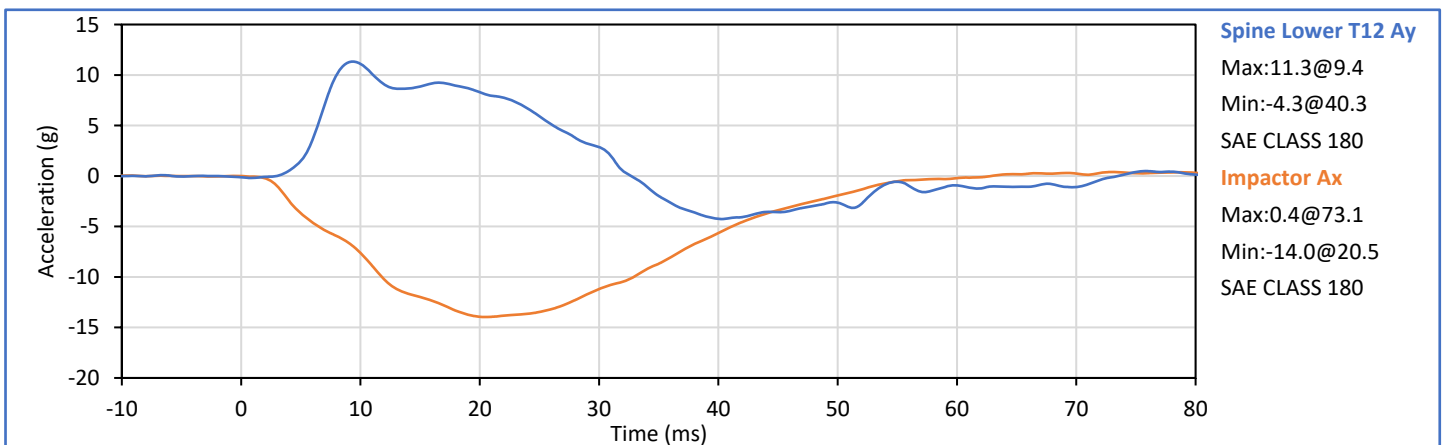
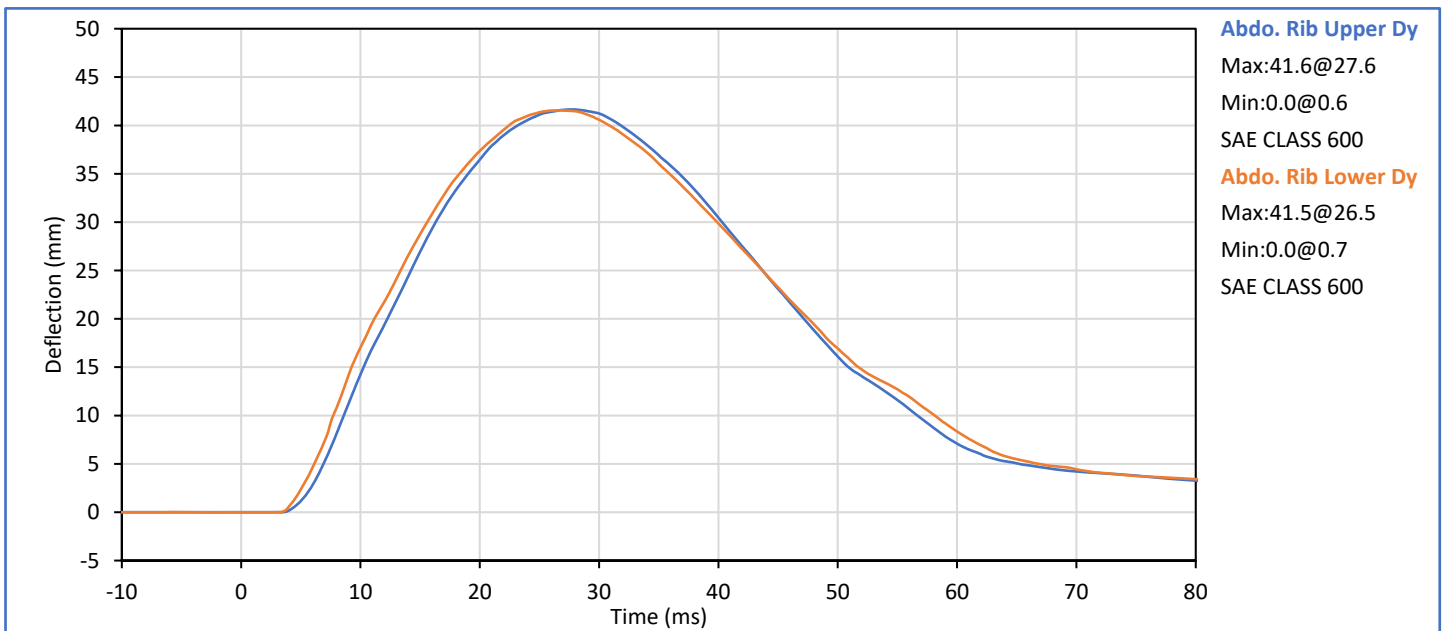
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|------------------------------|-------|-----------|------------|--------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.4 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Impactor Velocity | m/s | 4.20 | 4.40 | 4.32 | Pass |
| Peak Thorax Rib Upper Dy | mm | 32.0 | 40.0 | 35.7 | Pass |
| Peak Thorax Rib Middle Dy | mm | 39.0 | 45.0 | 40.1 | Pass |
| Peak Thorax Rib Lower Dy | mm | 35.0 | 43.0 | 39.4 | Pass |
| Peak Spine Upper T1 Ay | g | 13.0 | 17.0 | 15.8 | Pass |
| Peak Spine Lower T12 Ay | g | 7.0 | 11.0 | 9.1 | Pass |
| Peak Impactor Ax | g | -18.0 | -14.0 | -15.6 | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *Smith*
J. Hernandez

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|------------------------------|-------|-----------|------------|--------|-------------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Impactor Velocity | m/s | 4.20 | 4.40 | 4.34 | Pass |
| Peak Upper Abdomen Rib Dy | mm | 36.0 | 47.0 | 41.6 | Pass |
| Peak Lower Abdomen Rib Dy | mm | 33.0 | 44.0 | 41.5 | Pass |
| Peak Lower Spine T12 Ay | mm | 9.0 | 14.0 | 11.3 | Pass |
| Peak Impactor Ax | g | -16.0 | -12.0 | -14.0 | Pass |
| Overall Test Results | | | | | Pass |

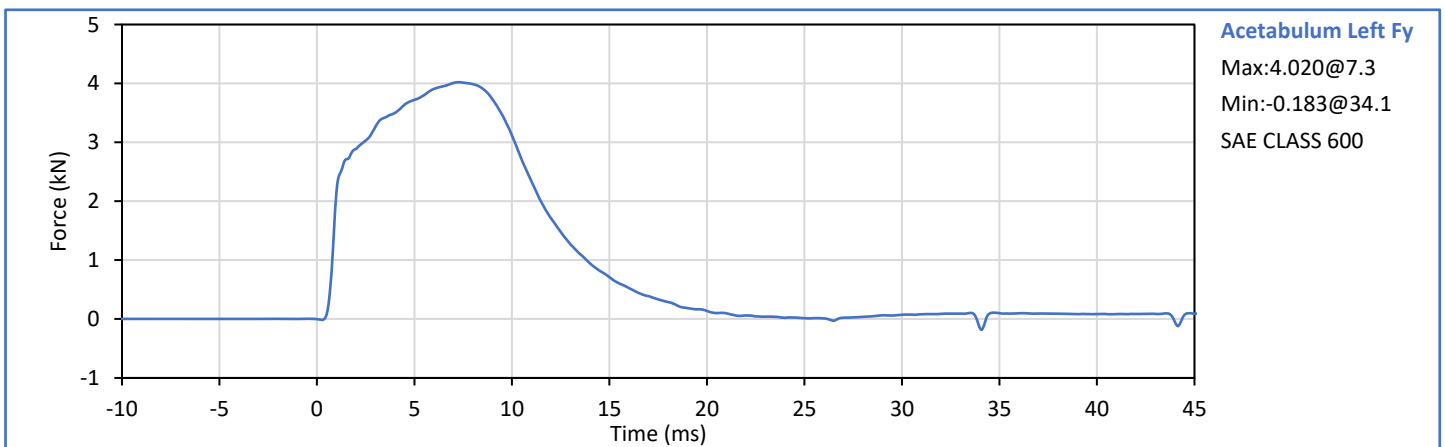
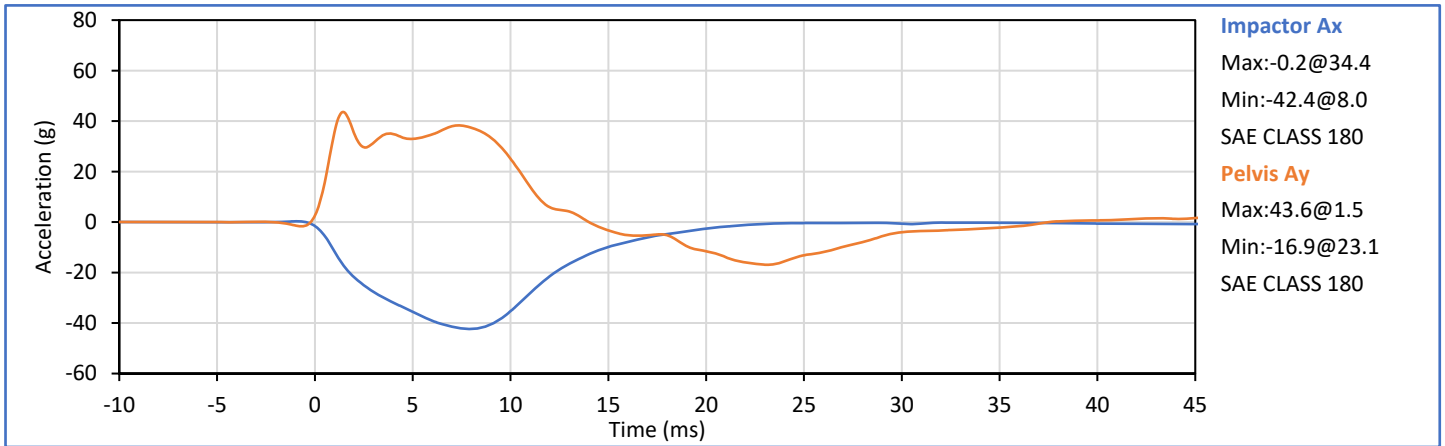


Technician: *Mill LGS III*
G. Fuentes

Approved By: *Seath*
J. Hernandez

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|------------------------------|-------|-----------|------------|--------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.4 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Impactor Velocity | m/s | 6.60 | 6.80 | 6.71 | Pass |
| Peak Acetabulum Fy | kN | 3.60 | 4.30 | 4.02 | Pass |
| Pelvis Ay after 6ms | g | 34.0 | 42.0 | 38.3 | Pass |
| Peak Impactor Ax | g | -47.0 | -38.0 | -42.4 | Pass |
| Overall Test Results | | | | | Pass |

Pelvis Plug S/N: 14719



Technician: *Mill LGS III*
G. Fuentes

Approved By: *Smith*
J. Hernandez

ATD Serial No.: 308

Test Date: 2023-02-14

Pelvis Plug S/N: 14719



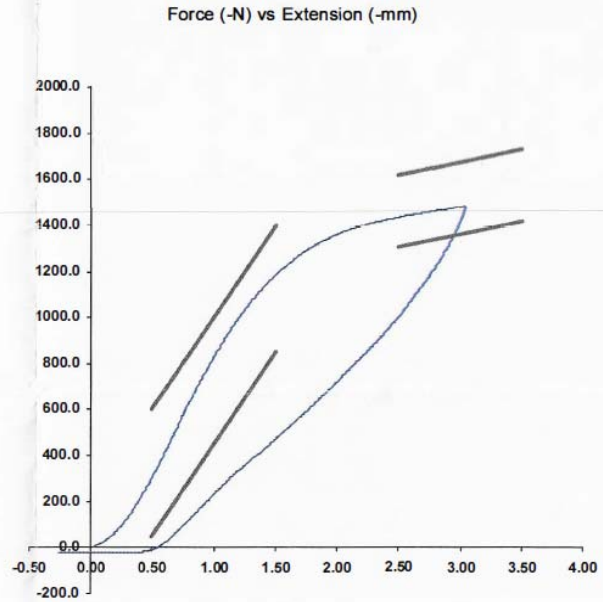
SID-IIs Pelvis Plug Certification Test

Plug S/N 14719
Test Number 16682
Report Number 16728
Test Date 12/22/2020 11:09:00 AM

| | Test Results | Spec Min | Spec Max |
|--------------------|--------------|----------|----------|
| Force @ 0.5 mm (N) | 308.22 | 50.00 | 600.00 |
| Force @ 1.5 mm (N) | 1,188.62 | 850.00 | 1,400.00 |
| Force @ 2.5 mm (N) | 1,437.00 | 1,306.00 | 1,618.00 |
| Force @ 3.0 mm (N) | 1,481.89 | 1,361.00 | 1,673.00 |

Testing Machine STM-20 5965542
Load Cell S/N (F1360947), Units (LBS) 1000
Preload Value (-N) 22.24
Crosshead Speed (mm / min) or Rate 12.7
Extension or Position Measured by XHD_100 (XHD100)

Notes:



Operator 146

Part Number 180-4450

Template No 107 22-Dec-20
SACO Research

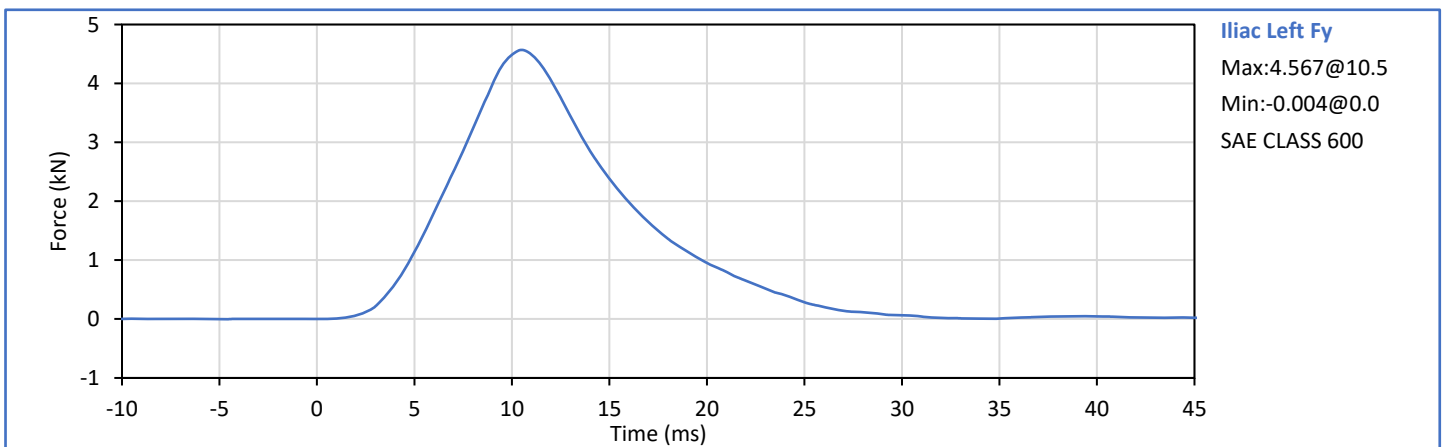
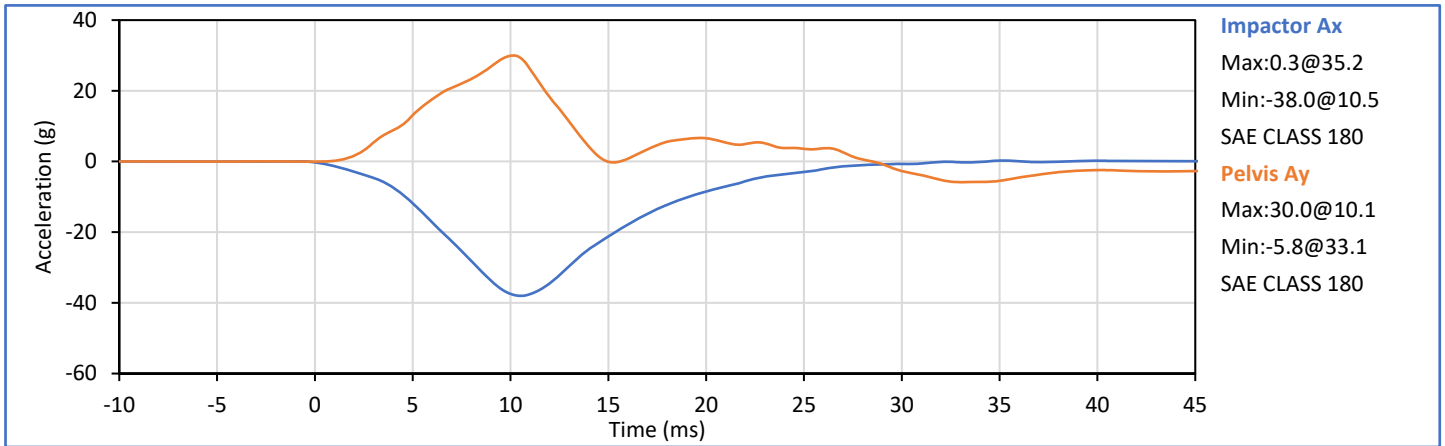
By: DC Date: 12/22/20

SACO Research 41735 Elm St, #401 Murrieta, CA 92562 Tel 310-694-2082 FAX

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|------------------------------|-------|-----------|------------|--------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.3 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Impactor Velocity | m/s | 4.20 | 4.40 | 4.34 | Pass |
| Peak Iliac Fy | kN | 4.10 | 5.10 | 4.57 | Pass |
| Peak Pelvis Ay | g | 28.0 | 39.0 | 34.7 | Pass |
| Peak Impactor Ax | g | -45.0 | -36.0 | -38.0 | Pass |
| Overall Test Results | | | | | Pass |

Pelvis Plug S/N: 12228 *

* Plug is not impacted and remains certified



Technician: *Mill LGS III*
G. Fuentes

Approved By: *Smith*
J. Hernandez

APPENDIX C
Post-Test ATD Qualification and Performance Verification
ES-2re 50th Male Side Impact ATD, Left Side Configuration
S/N: F037

| Tested Parameter | Units | Spec Low | Spec. High | Result | Pass/Fail |
|--|-------|----------|------------|--------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| 1 - Sitting Height | mm | 900 | 918 | 909 | Pass |
| 2 - Seat to Shoulder Joint | mm | 558 | 572 | 562 | Pass |
| 3 - Seat to Lower Face of Thoracic Spine Box | mm | 346 | 356 | 352 | Pass |
| 4 - Seat to Hip Joint (bolt center) | mm | 97 | 103 | 100 | Pass |
| 5 - Sole to Seat, Sitting | mm | 433 | 451 | 437 | Pass |
| 6 - Head Width | mm | 152 | 158 | 155 | Pass |
| 7 - Shoulder/Arm Width | mm | 461 | 479 | 469 | Pass |
| 8 - Thorax Width | mm | 322 | 332 | 327 | Pass |
| 9 - Abdomen Width | mm | 273 | 287 | 284 | Pass |
| 10 - Pelvis Lap Width | mm | 359 | 373 | 368 | Pass |
| 11 - Head Depth | mm | 196 | 206 | 199 | Pass |
| 12 - Thorax Depth | mm | 262 | 272 | 269 | Pass |
| 13 - Abdomen Depth | mm | 194 | 204 | 198 | Pass |
| 14 - Pelvis Depth | mm | 235 | 245 | 242 | Pass |
| 15 - Back of Buttocks to Hip Joint (bolt Center) | mm | 150 | 160 | 154 | Pass |
| 16 - Back of Buttocks to Front Knee | mm | 597 | 615 | 607 | Pass |
| Overall Test Results | | | | | Pass |

Technician: _____



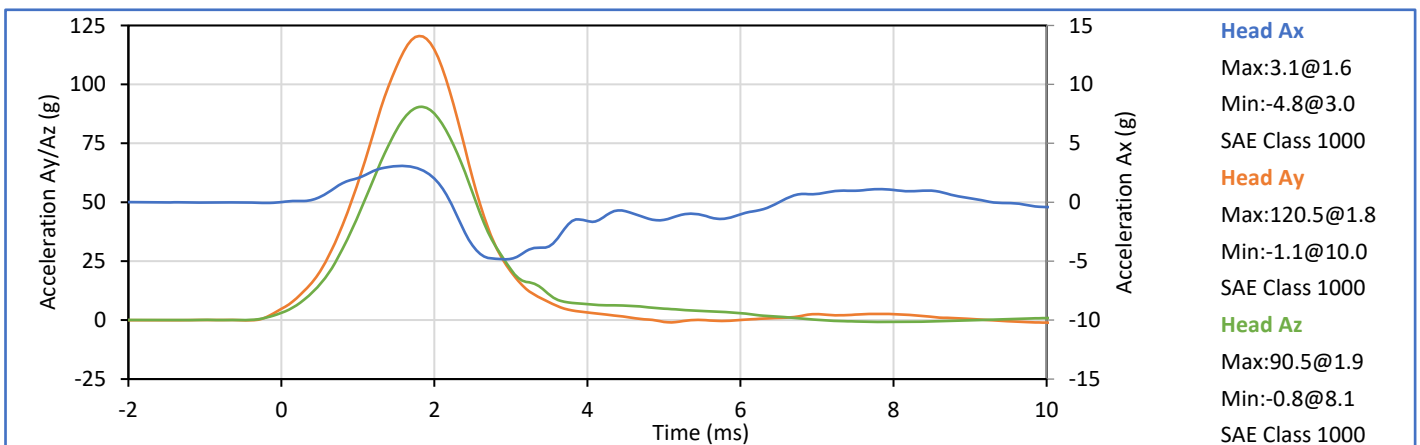
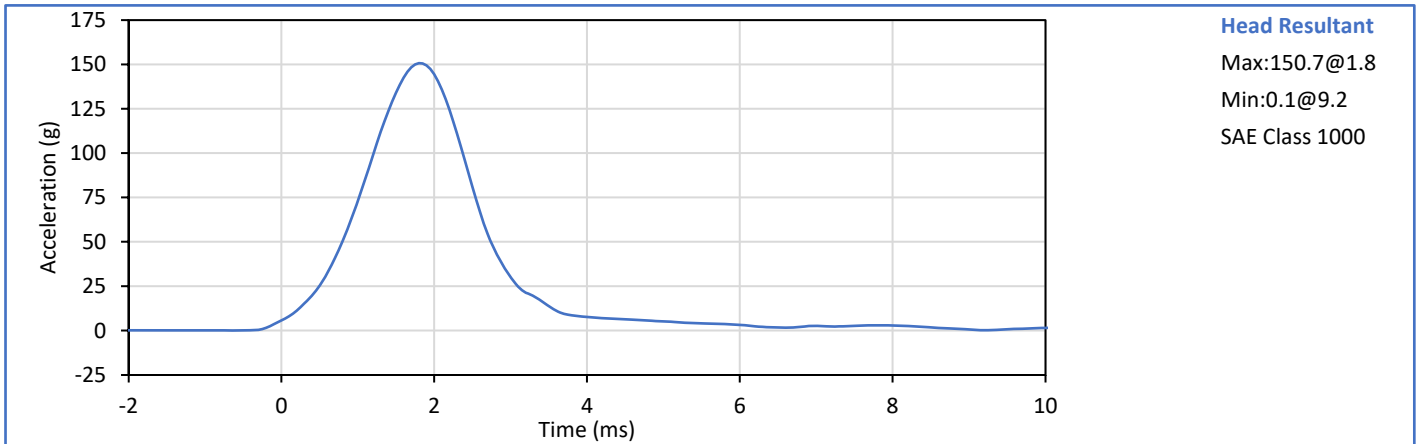
G. Fuentes

Approved By: _____



J. Hernandez

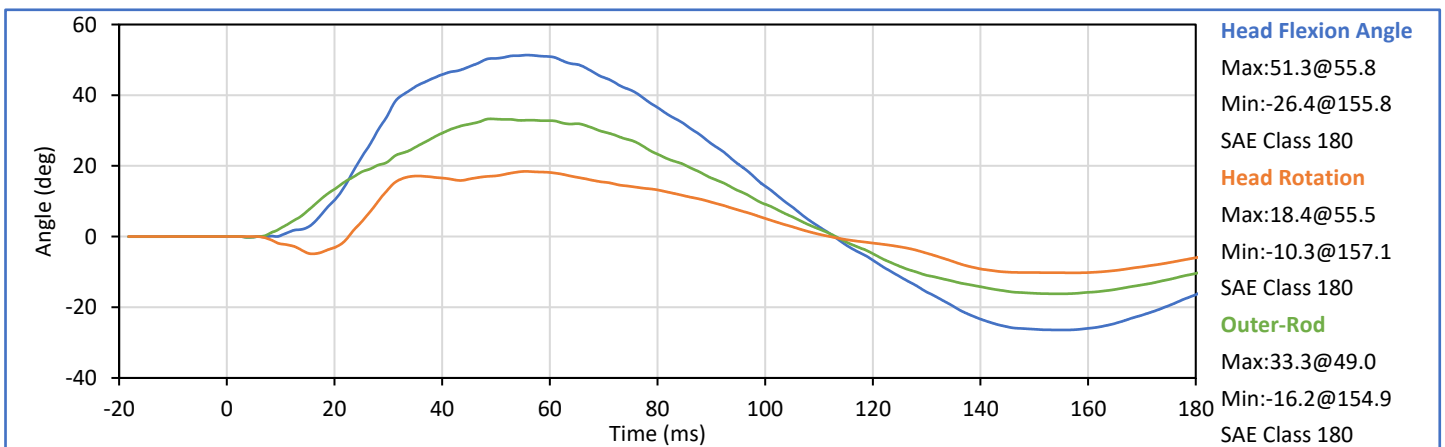
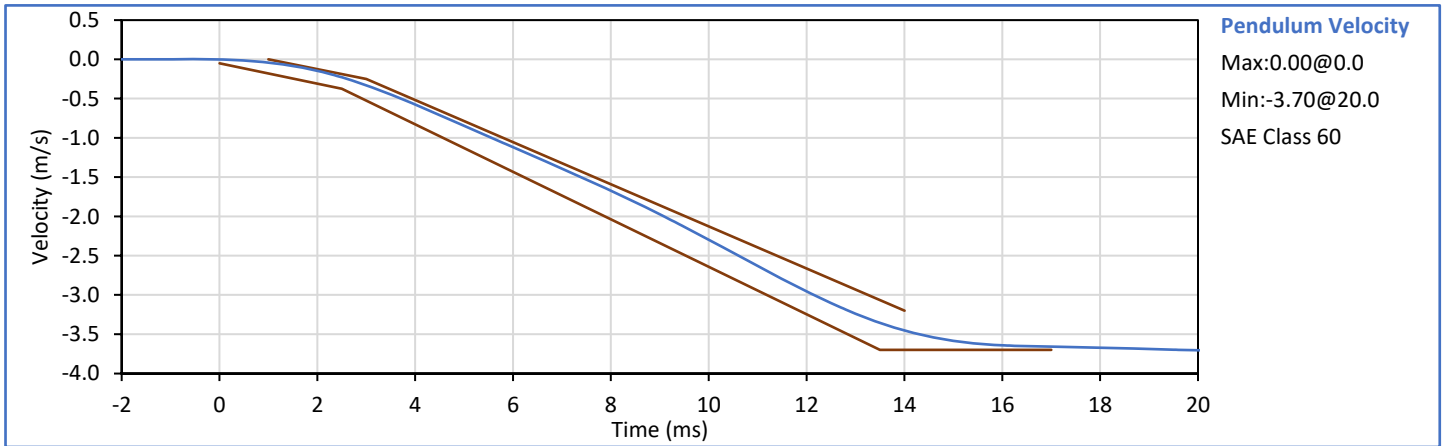
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|-------------------------------|--------|-----------|------------|----------------------|-----------|
| Laboratory Temperature | °C | 18.9 | 25.6 | 21.3 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 31 | Pass |
| Peak Resultant Acceleration | g | 125.0 | 155.0 | 150.7 | Pass |
| Peak Head Ax | g | -15.0 | 15.0 | 3.1 | Pass |
| Oscillations After Main Pulse | % | 0.0 | 15.0 | 2.5 | Pass |
| Is Acceleration Unimodal? | Yes/No | Yes | | Yes | Pass |
| | | | | Overall Test Results | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *Smith*
J. Hernandez

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|-------------------------------|-------|-----------|------------|--------|-------------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.4 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Pendulum Velocity | m/s | 3.30 | 3.50 | 3.47 | Pass |
| Peak Headform Flexion | deg | 49.0 | 59.0 | 51.3 | Pass |
| Time of Peak Headform Flexion | ms | 54.0 | 66.0 | 55.8 | Pass |
| Flexion Decay (Peak to zero) | ms | 53.0 | 88.0 | 57.1 | Pass |
| Overall Test Results | | | | | Pass |



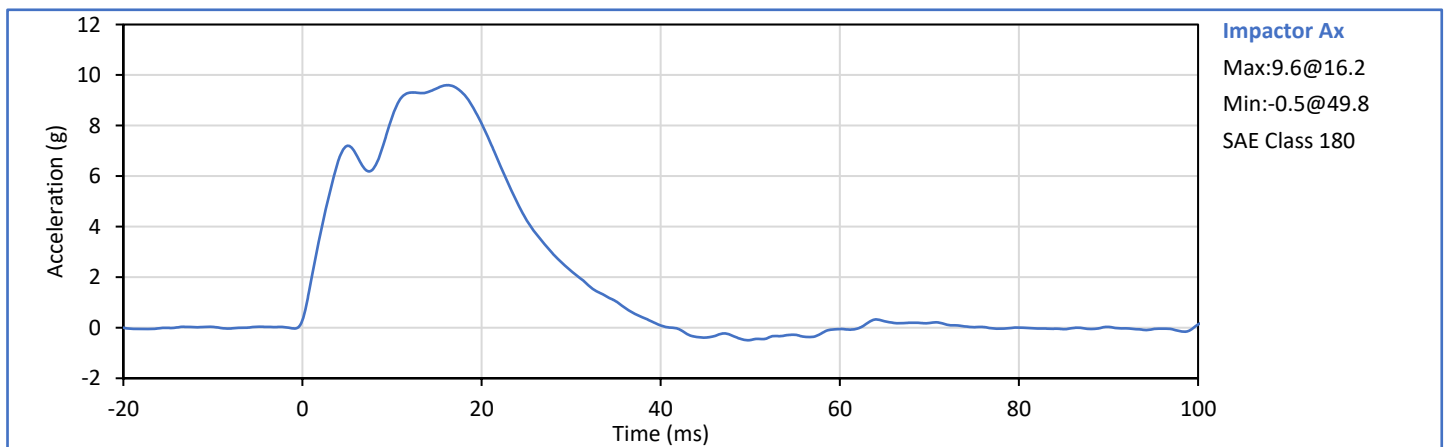
Technician: *Mill LGS III*
G. Fuentes

Approved By: *J. Hernandez*
J. Hernandez

ATD Serial No.: F037

Test Date: 2023-02-27

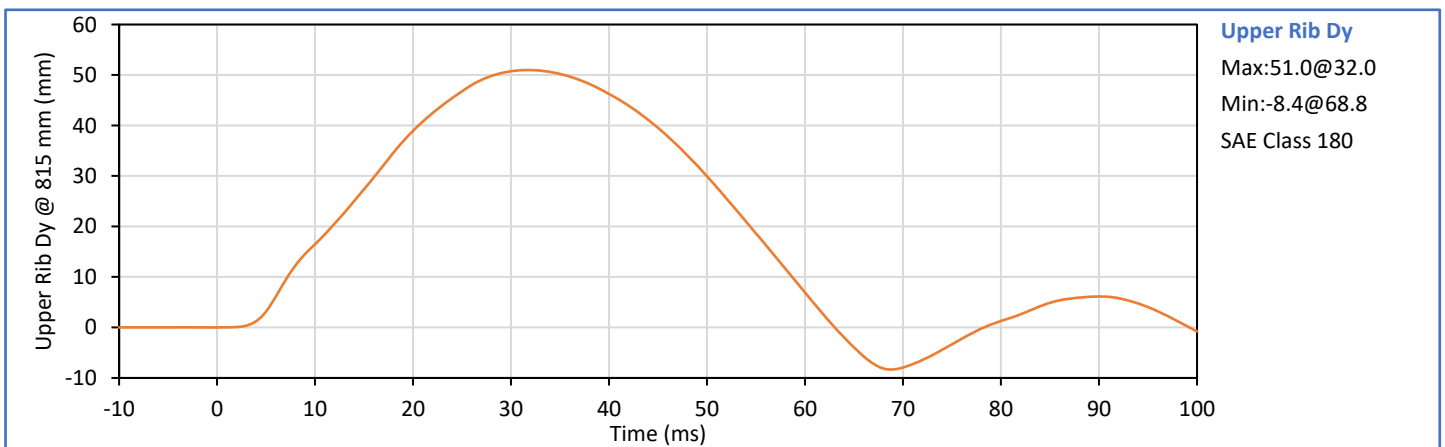
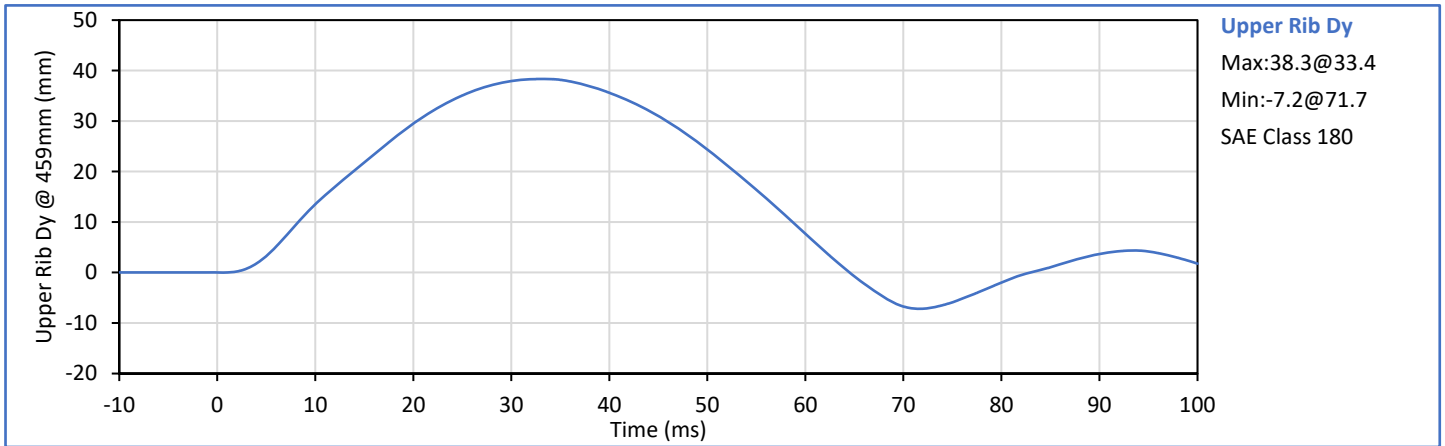
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|------------------------------|-------|-----------|------------|--------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Impactor Velocity | m/s | 4.20 | 4.40 | 4.31 | Pass |
| Peak Impactor Ax | g | 7.5 | 10.5 | 9.6 | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *Seath*
J. Hernandez

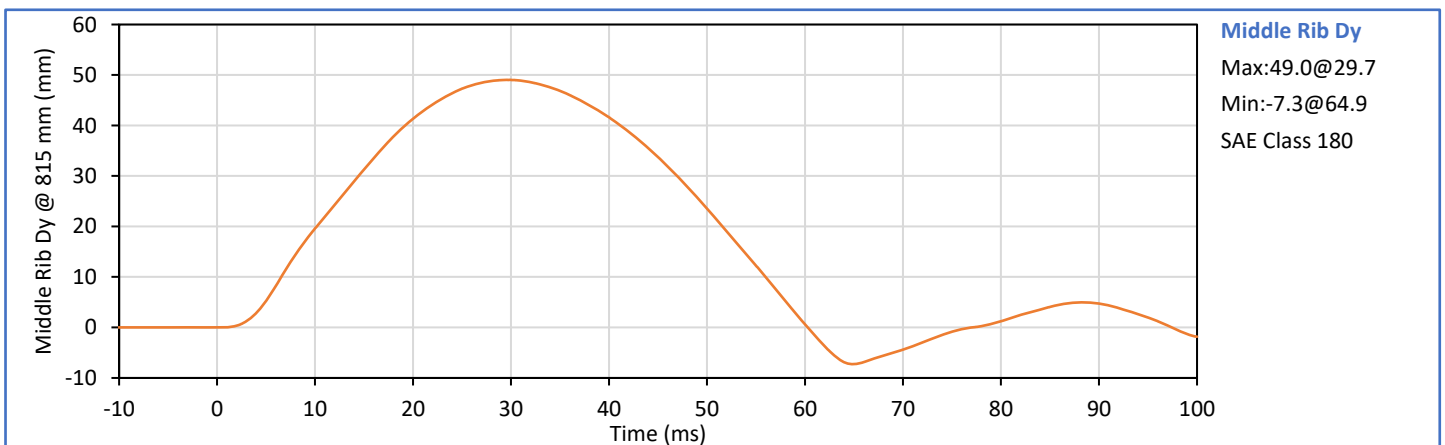
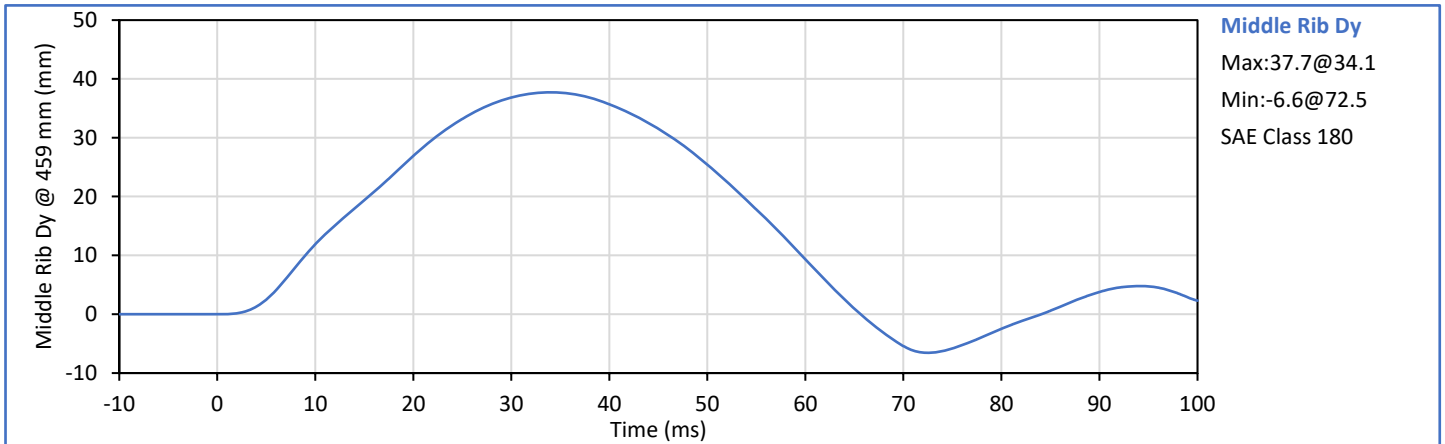
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|------------------------------|-------|-----------|------------|--------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.4 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 31 | Pass |
| Upper Rib Dy @ 459mm | mm | 36.0 | 40.0 | 38.3 | Pass |
| Upper Rib Dy @ 815mm | mm | 46.0 | 51.0 | 51.0 | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *Smith*
J. Hernandez

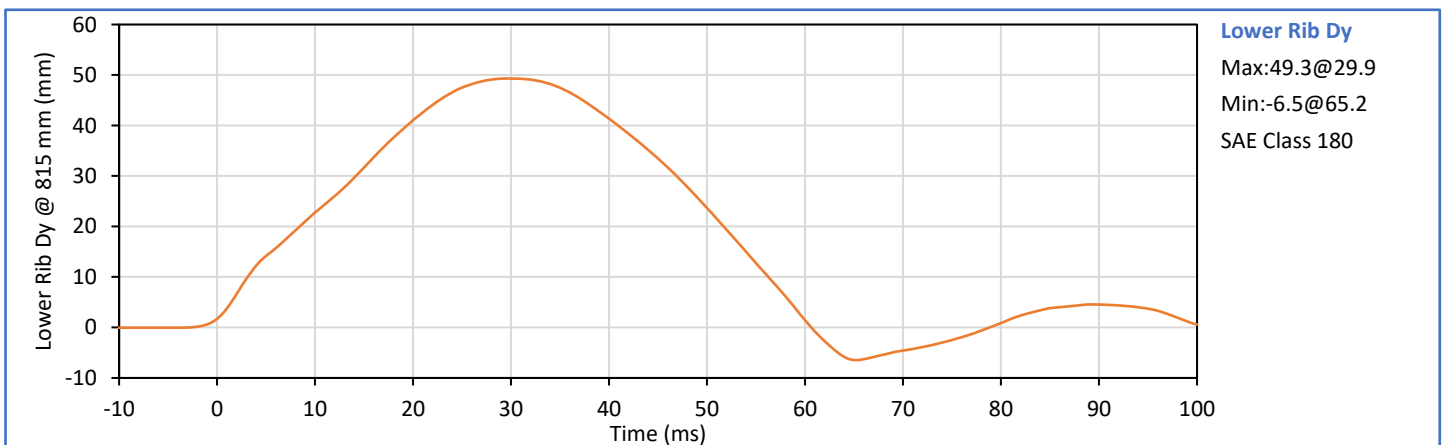
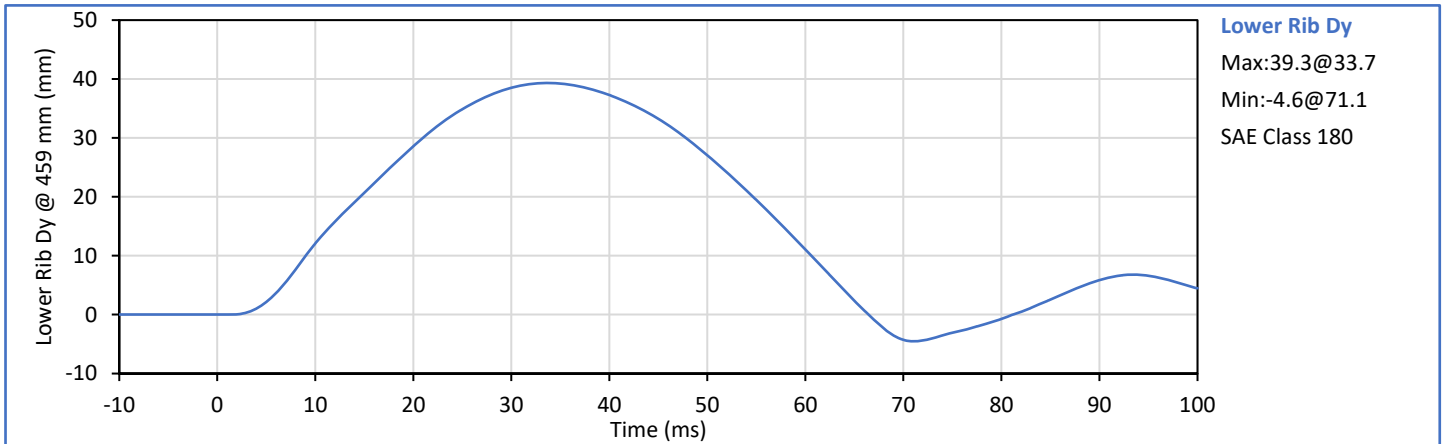
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|------------------------------|-------|-----------|------------|--------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Middle Rib Dy @ 459mm | mm | 36.0 | 40.0 | 37.7 | Pass |
| Middle Rib Dy @ 815mm | mm | 46.0 | 51.0 | 49.0 | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *Seath*
J. Hernandez

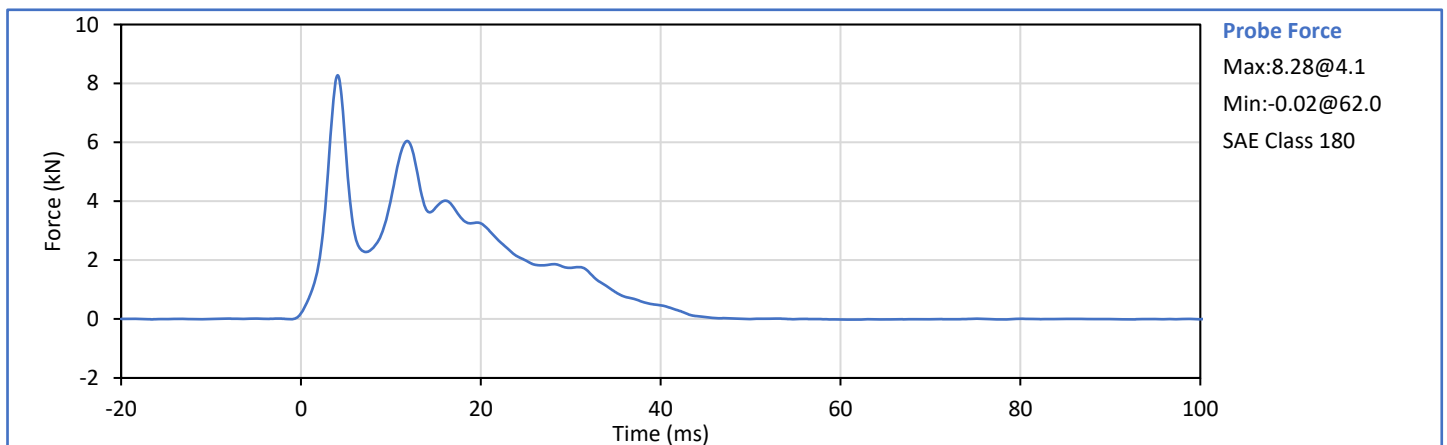
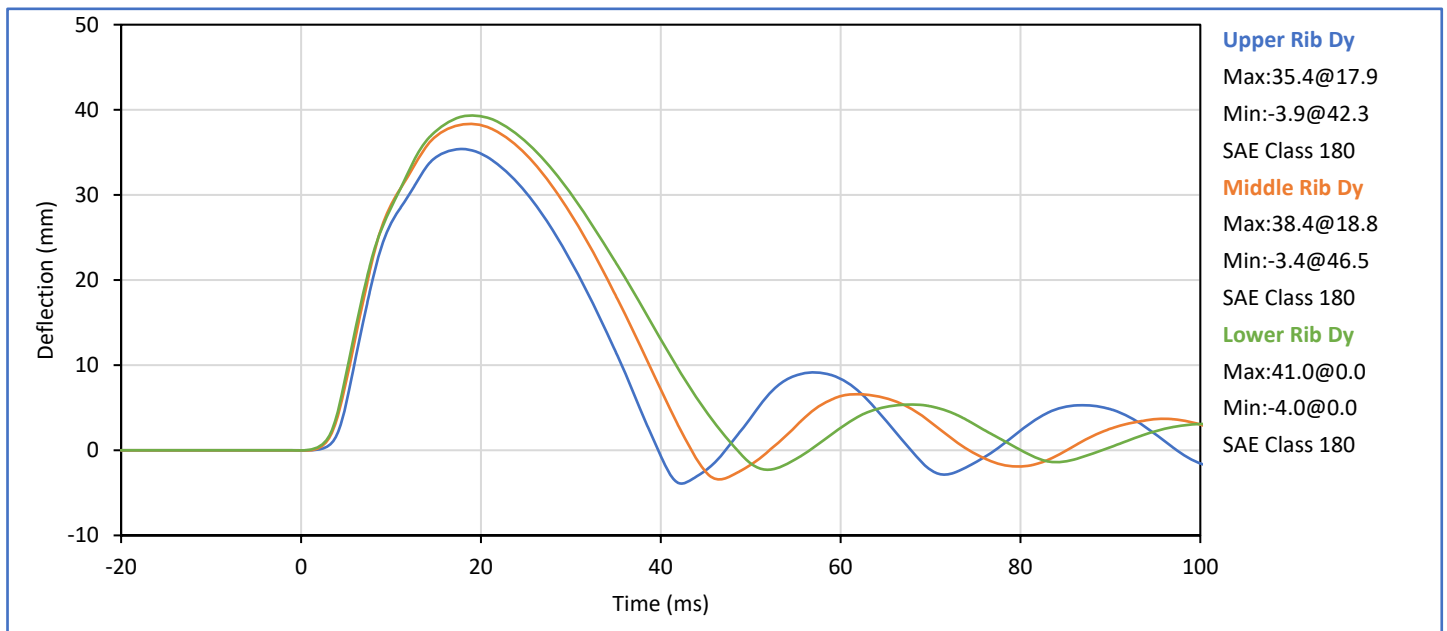
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|------------------------------|-------|-----------|------------|--------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Lower Rib Dy @ 459mm | mm | 36.0 | 40.0 | 39.3 | Pass |
| Lower Rib Dy @ 815mm | mm | 46.0 | 51.0 | 49.3 | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *Seuth*
J. Hernandez

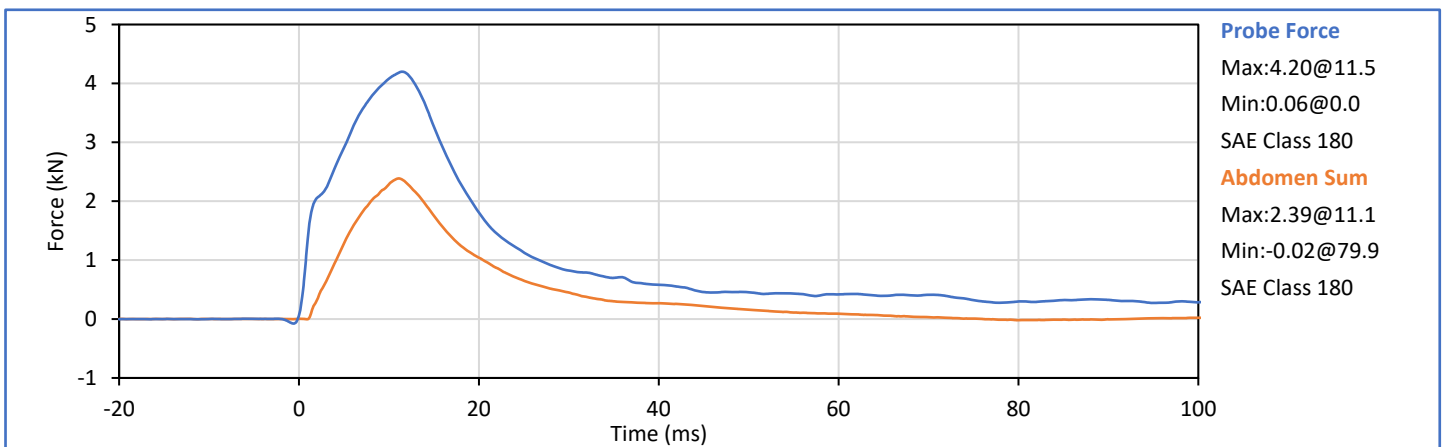
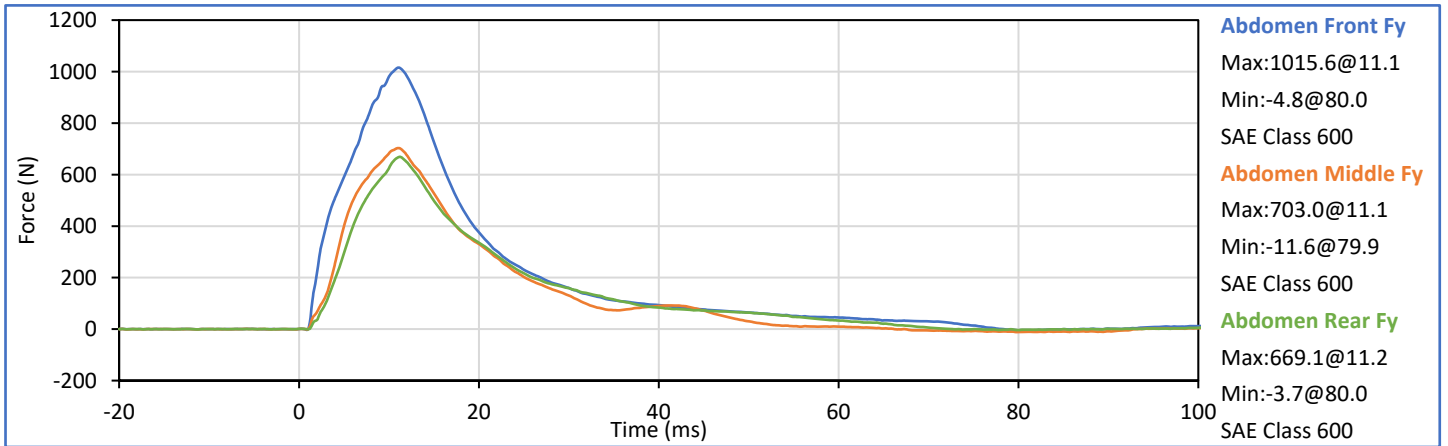
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|--------------------------------|-------|-----------|------------|--------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.5 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 28 | Pass |
| Impactor Velocity | m/s | 5.40 | 5.60 | 5.50 | Pass |
| Peak Upper Rib Dy | mm | 34.0 | 41.0 | 35.4 | Pass |
| Peak Middle Rib Dy | mm | 37.0 | 45.0 | 38.4 | Pass |
| Peak Lower Rib Dy | mm | 37.0 | 44.0 | 39.3 | Pass |
| Peak Impactor Force After 6 ms | kN | 5.10 | 6.20 | 6.04 | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *J. Hernandez*
J. Hernandez

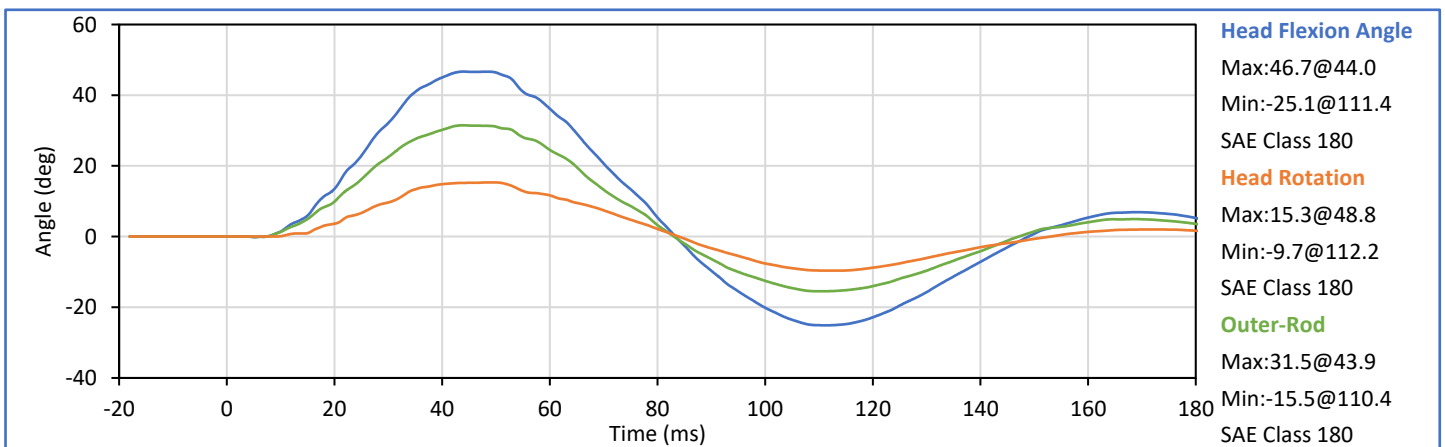
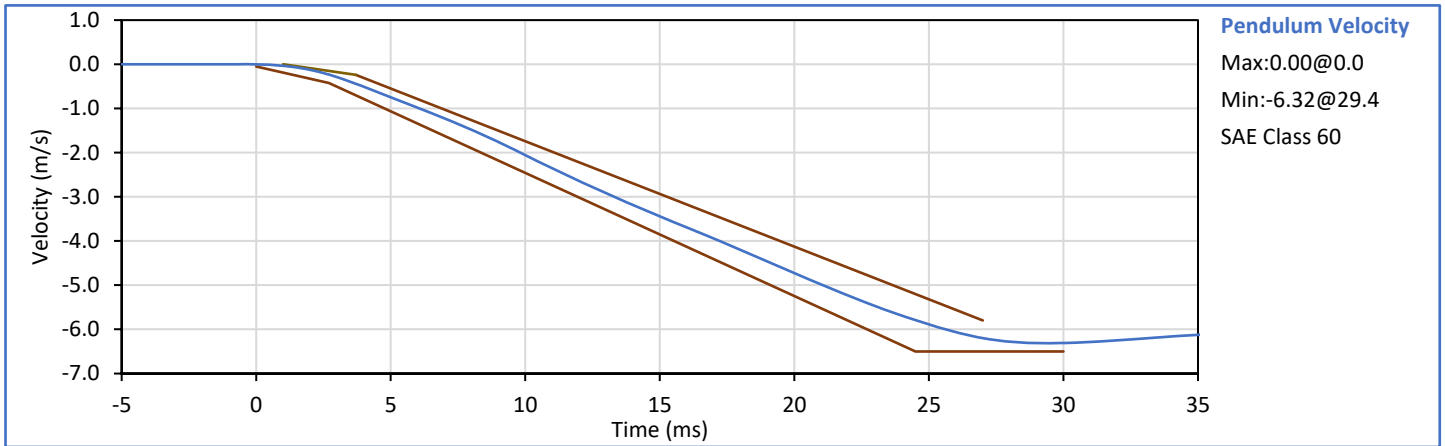
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|--------------------------------|-------|-----------|------------|--------|-------------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 31 | Pass |
| Impactor Velocity | m/s | 3.90 | 4.10 | 4.03 | Pass |
| Peak Impactor Force | kN | 4.00 | 4.80 | 4.20 | Pass |
| Time of Peak Impactor Force | ms | 10.6 | 13.0 | 11.5 | Pass |
| Sum of Abdomen Forces | kN | 2.20 | 2.70 | 2.39 | Pass |
| Time of Peak Sum Abdomen Force | ms | 10.0 | 12.3 | 11.1 | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *Seuth*
J. Hernandez

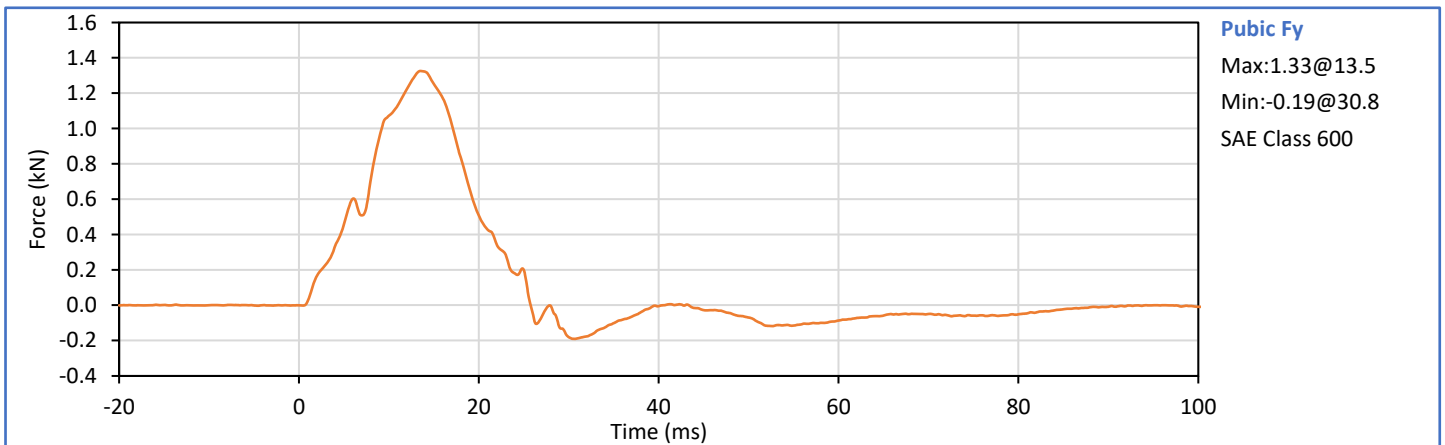
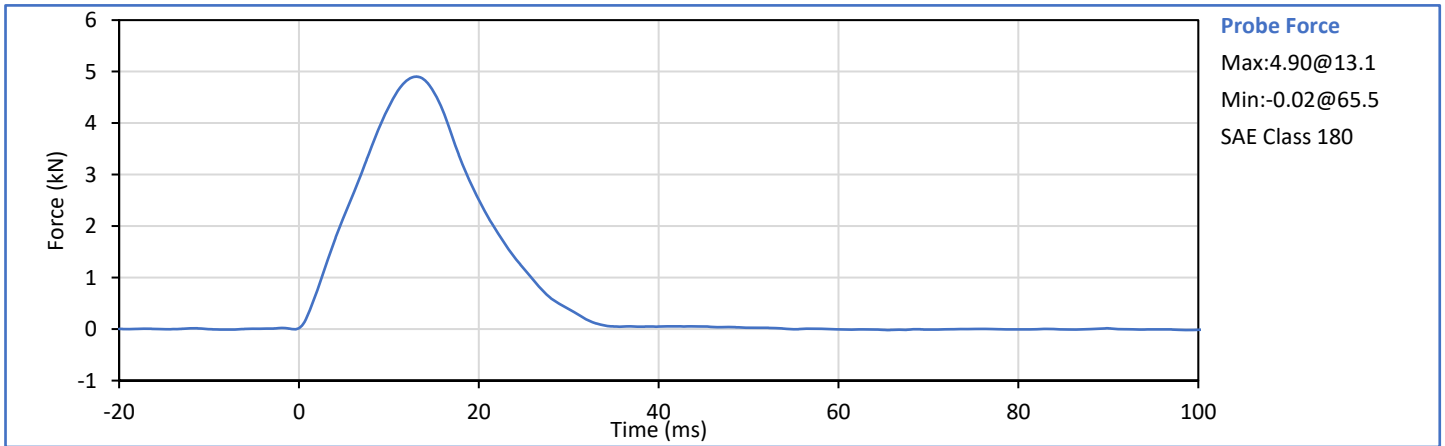
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|-------------------------------|-------|-----------|------------|--------|-------------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Pendulum Velocity | m/s | 5.95 | 6.15 | 6.10 | Pass |
| Peak Headform Flexion | deg | 45.0 | 55.0 | 46.7 | Pass |
| Time of Peak Headform Flexion | ms | 39.0 | 53.0 | 44.0 | Pass |
| Flexion Decay (Peak to zero) | ms | 37.0 | 57.0 | 39.4 | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *Smith*
J. Hernandez

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|---------------------------------|-------|-----------|------------|--------|-------------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Impactor Velocity | m/s | 4.20 | 4.40 | 4.30 | Pass |
| Peak Impactor Force | kN | 4.70 | 5.40 | 4.90 | Pass |
| Time of Peak Impactor Force | ms | 11.8 | 16.1 | 13.1 | Pass |
| Pubic Symphysis Fy | kN | 1.23 | 1.59 | 1.33 | Pass |
| Time of Peak Pubic Symphysis Fy | ms | 12.2 | 17.0 | 13.5 | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *Seath*
J. Hernandez

APPENDIX C
Post-Test ATD Qualification and Performance Verification
SID-IIs Small Side Impact ATD, Left Side Configuration
S/N: 308

ATD Serial No.: 308

Test Date: 2023-02-24

| Tested Parameter | Units | Spec Low | Spec. High | Result | Pass/Fail |
|----------------------------------|-------|----------|------------|----------------------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.4 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 29 | Pass |
| A - Sitting Height | mm | 772 | 788 | 779 | Pass |
| B - Shoulder Pivot Height | mm | 437 | 453 | 450 | Pass |
| C - Hpoint Height | mm | 79 | 89 | 85 | Pass |
| D - H Point From Seatback | mm | 141 | 151 | 144 | Pass |
| E - Shoulder Pivot From Backline | mm | 97 | 107 | 102 | Pass |
| F - Thigh Clearance | mm | 119 | 135 | 125 | Pass |
| G - Head Breadth | mm | 140 | 148 | 147 | Pass |
| H - Head Back From Backline | mm | 40 | 46 | 44 | Pass |
| I - Head Depth | mm | 178 | 188 | 186 | Pass |
| J - Head Circumference | mm | 541 | 551 | 547 | Pass |
| K - Buttock To Knee Length | mm | 514 | 540 | 521 | Pass |
| L - Popliteal Height | mm | 343 | 369 | 359 | Pass |
| K - Knee Pivot To Floor Height | mm | 392 | 409 | 405 | Pass |
| N - Buttock Popliteal Length | mm | 416 | 442 | 430 | Pass |
| O - Chest Depth W/O Jacket | mm | 195 | 211 | 201 | Pass |
| P - Foot Length | mm | 216 | 232 | 230 | Pass |
| Q - Hip Breadth (W/Pelvic Plugs) | mm | 313 | 323 | 315 | Pass |
| R - Arm Length | mm | 249 | 259 | 257 | Pass |
| S - Knee Joint To Seatback | mm | 477 | 493 | 488 | Pass |
| V - Shoulder Width | mm | 341 | 357 | 349 | Pass |
| W - Foot Width | mm | 78 | 94 | 89 | Pass |
| Y - Chest Circumference W/Jacket | mm | 851 | 881 | 869 | Pass |
| Z - Waist Circumference | mm | 761 | 791 | 776 | Pass |
| | | | | Overall Test Results | Pass |

Technician:



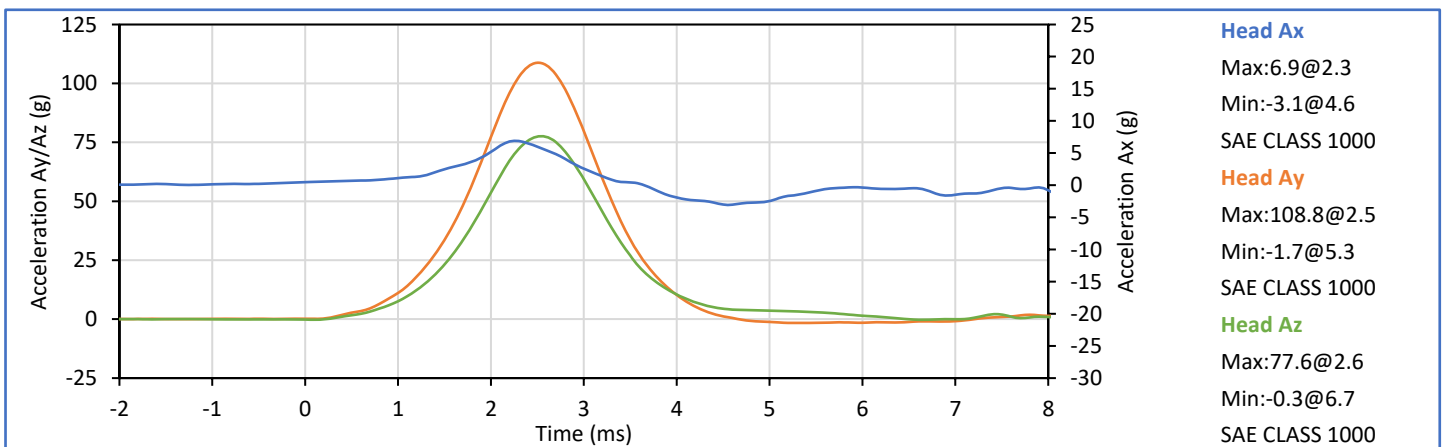
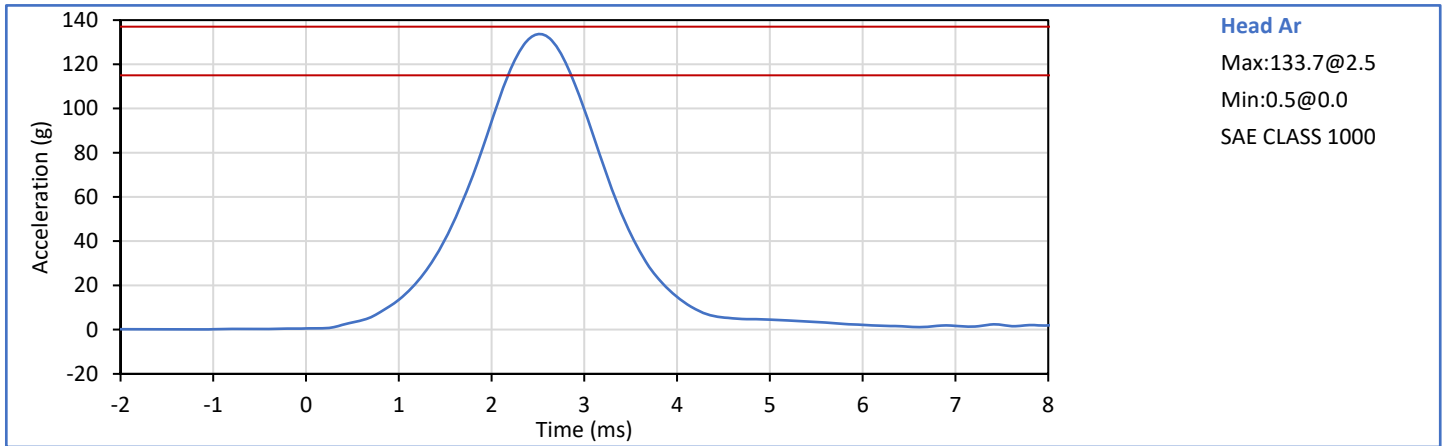
G. Fuentes

Approved By:



J. Hernandez

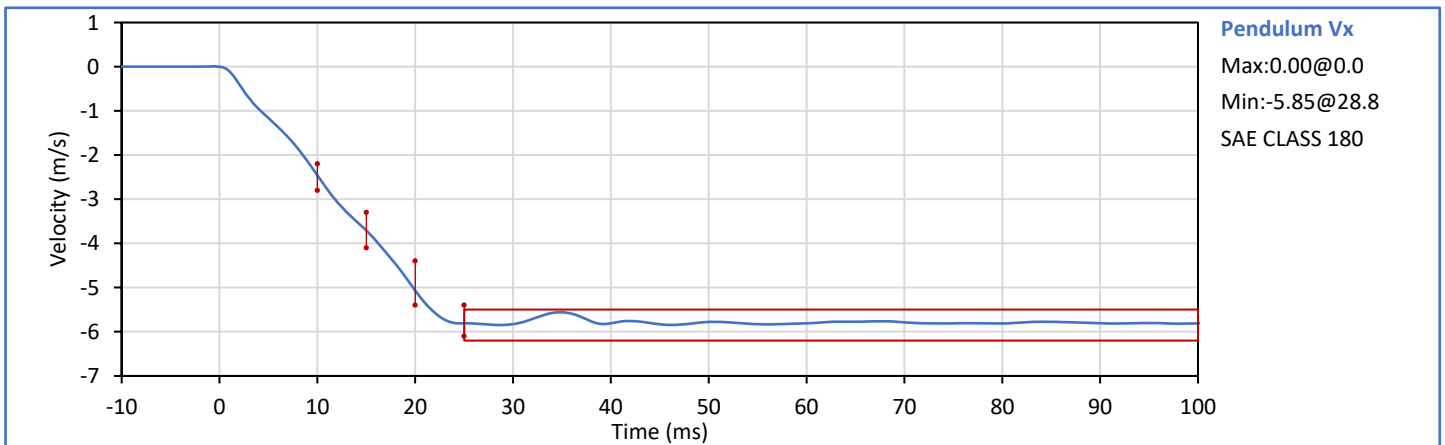
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|-------------------------------|--------|-----------|------------|--------|-------------|
| Laboratory Temperature | °C | 18.9 | 25.6 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Peak Resultant Acceleration | g | 115.0 | 137.0 | 133.7 | Pass |
| Peak Head Ax | g | -15.0 | 15.0 | 6.9 | Pass |
| Oscillations After Main Pulse | % | 0.0 | 15.0 | 1.9 | Pass |
| Is Acceleration Unimodal? | Yes/No | Yes | | Yes | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

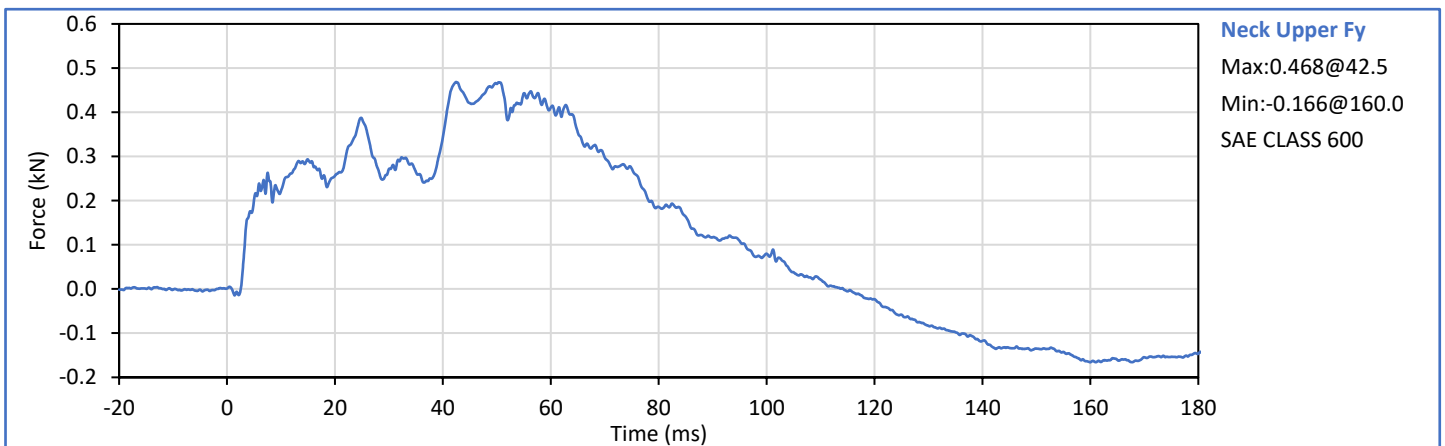
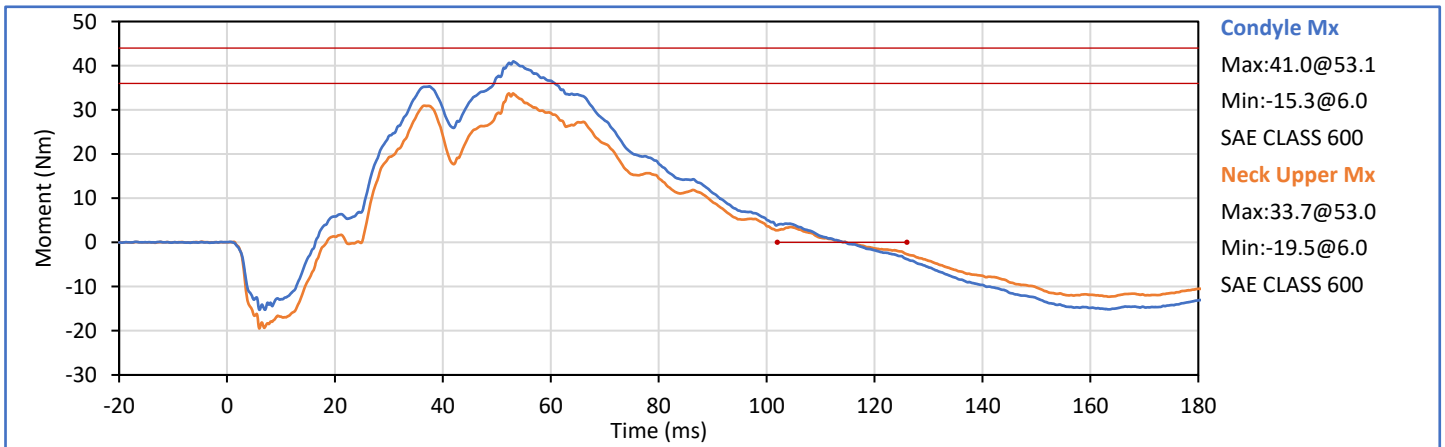
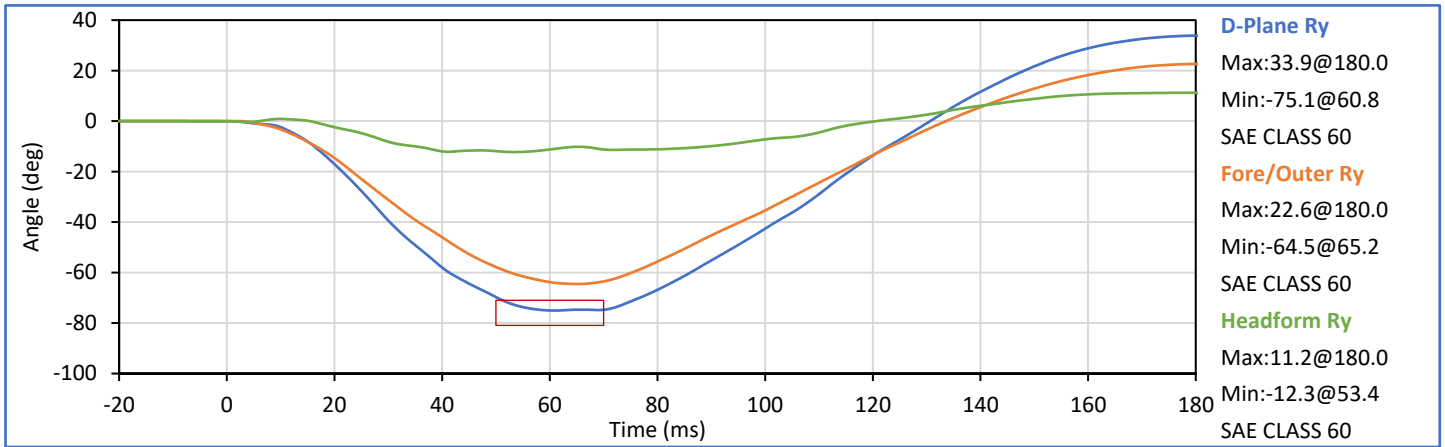
Approved By: *Smith*
J. Hernandez

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|---------------------------------|-------|-----------|------------|-------------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.2 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Pendulum Velocity | m/s | 5.51 | 5.63 | 5.60 | Pass |
| Pendulum Decel at 10 ms | m/s | -2.80 | -2.20 | -2.46 | Pass |
| Pendulum Decel at 15 ms | m/s | -4.10 | -3.30 | -3.71 | Pass |
| Pendulum Decel at 20 ms | m/s | -5.40 | -4.40 | -5.07 | Pass |
| Pendulum Decel at 25 ms | m/s | -6.10 | -5.40 | -5.81 | Pass |
| Pendulum Decel from 25-100 ms | m/s | -6.20 | -5.50 | -5.85/-5.56 | Pass |
| Peak "D" Plane Rotation | deg | -81.0 | -71.0 | -75.1 | Pass |
| Time of Peak "D" Plane Rotation | ms | 50.0 | 70.0 | 60.8 | Pass |
| Peak Occ. Condyle Moment | Nm | 36.0 | 44.0 | 41.0 | Pass |
| Time of Moment Decay to 0 Nm | ms | 102.0 | 126.0 | 114.7 | Pass |
| Overall Test Results | | | | | Pass |

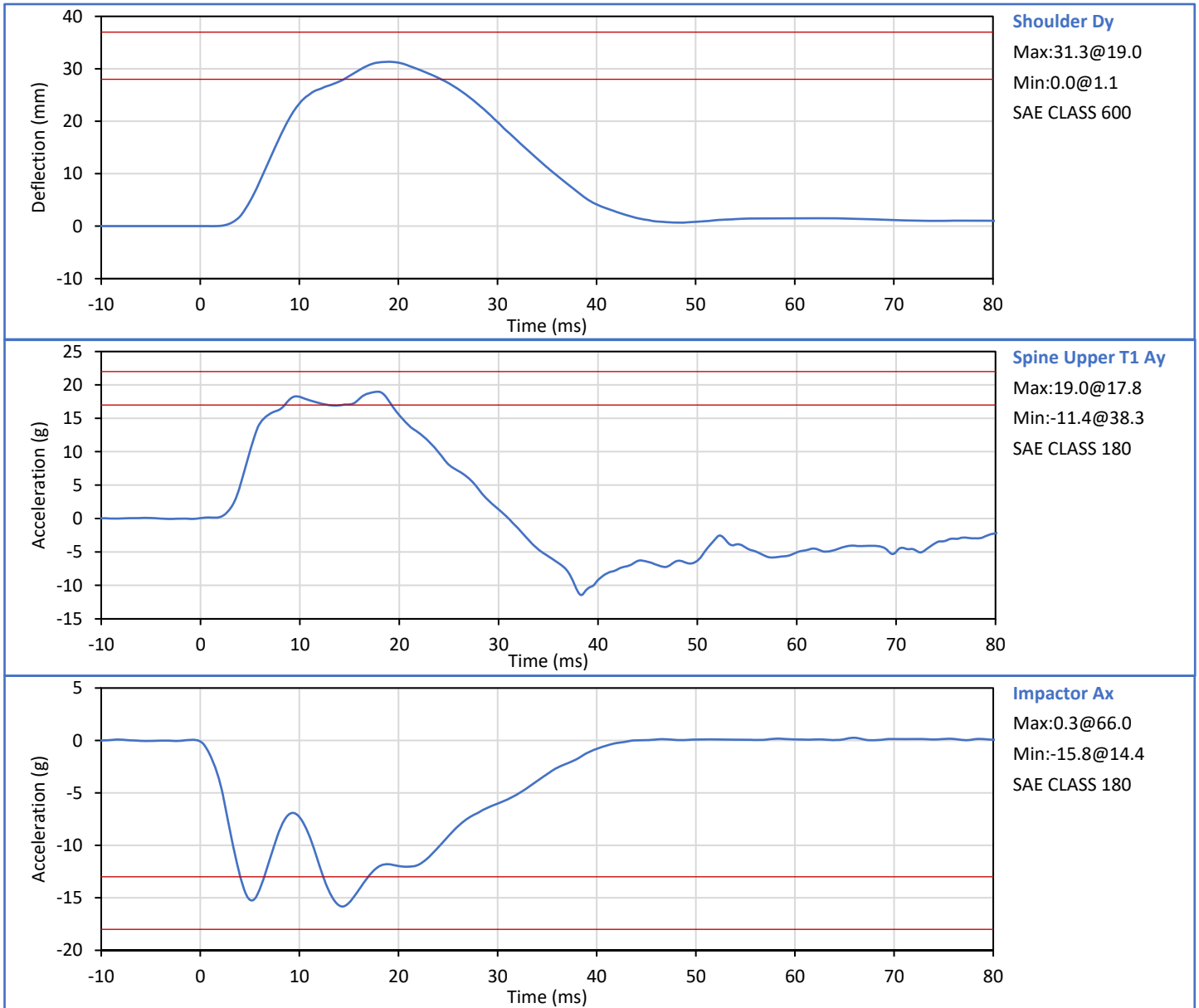


Technician: *Mill LGS III*
G. Fuentes

Approved By: *Seath*
J. Hernandez



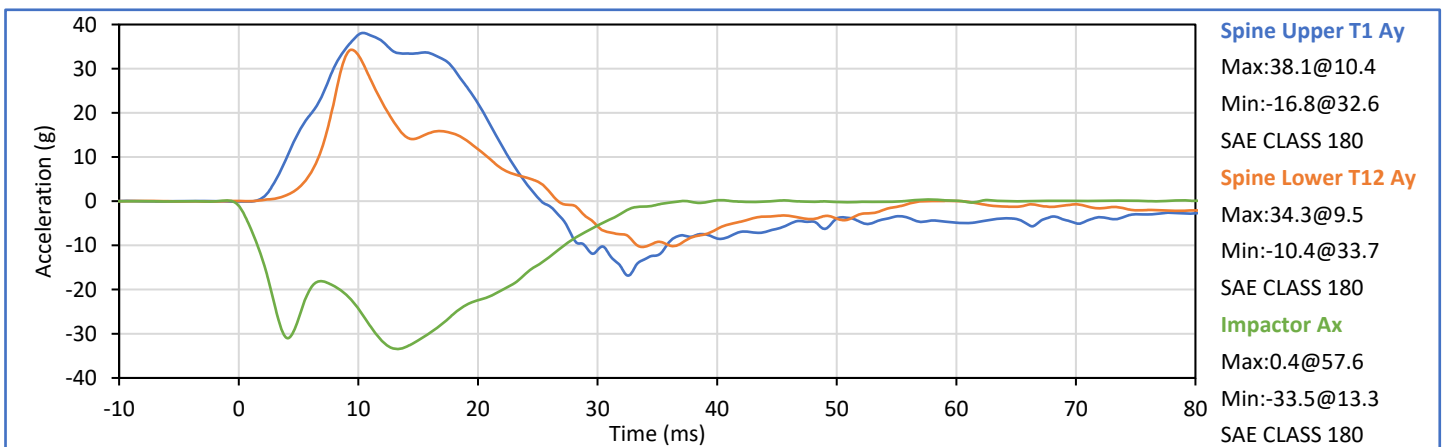
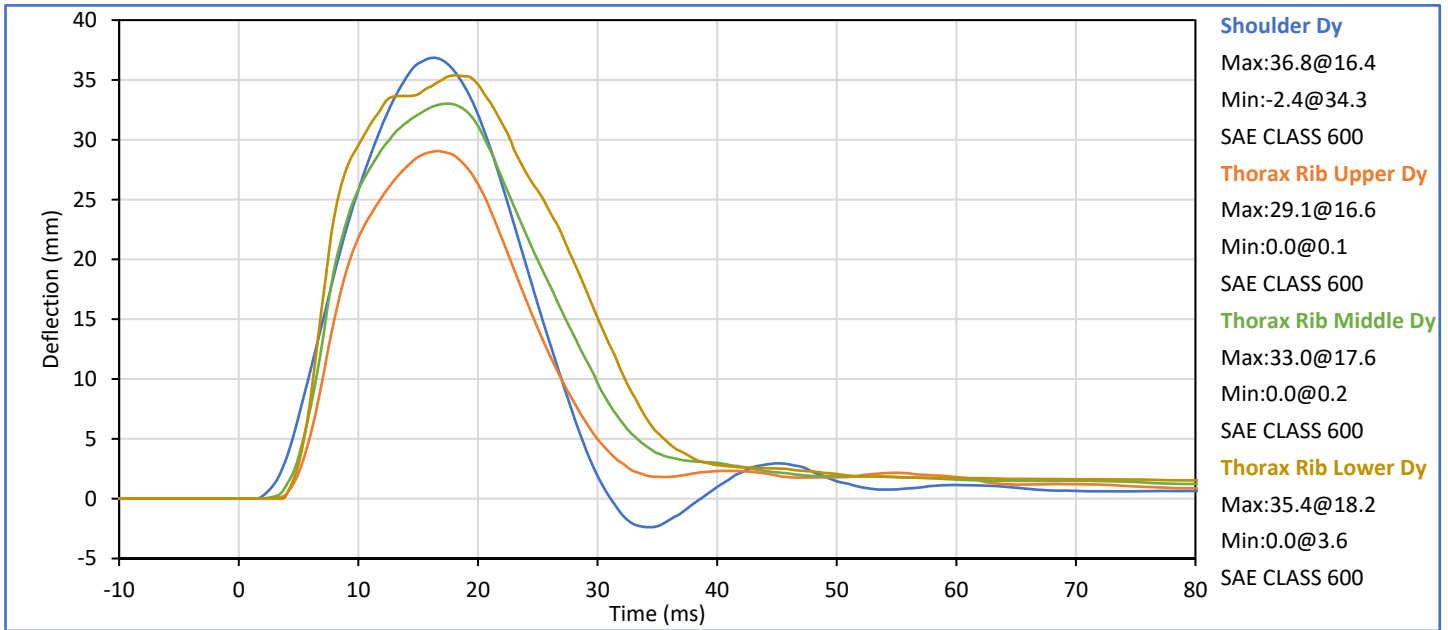
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|------------------------------|-------|-----------|------------|--------|-------------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.7 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 26 | Pass |
| Impactor Velocity | m/s | 4.20 | 4.40 | 4.30 | Pass |
| Peak Shoulder Dy | mm | 28.0 | 37.0 | 31.3 | Pass |
| Peak Upper Spine (T1) Ay | g | 17.0 | 22.0 | 19.0 | Pass |
| Peak Impactor Ax | g | -18.0 | -13.0 | -15.8 | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *Smith*
J. Hernandez

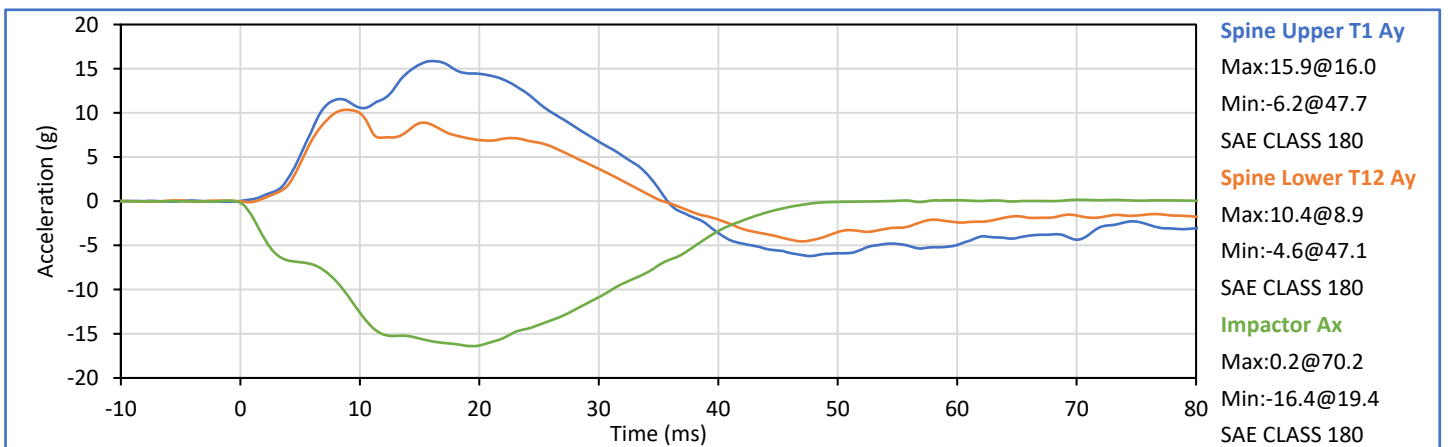
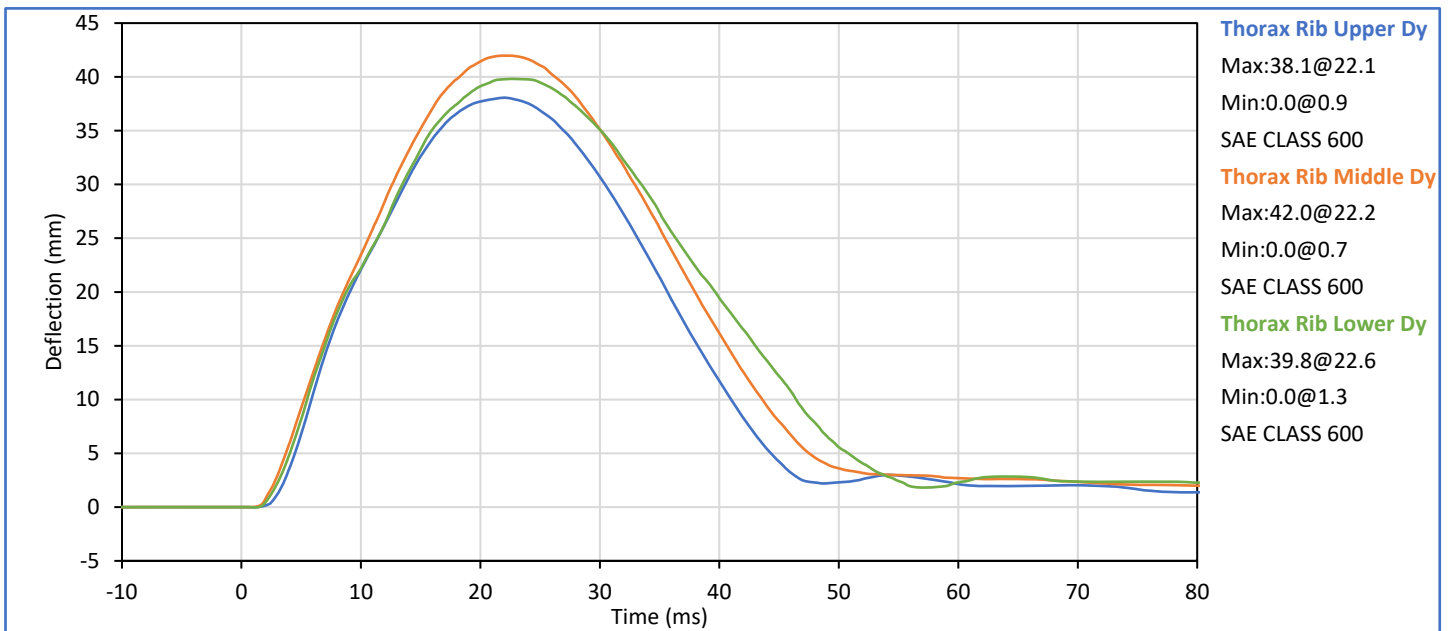
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|------------------------------|-------|-----------|------------|--------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 20.9 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 29 | Pass |
| Impactor Velocity | m/s | 6.60 | 6.80 | 6.70 | Pass |
| Peak Shoulder Dy | mm | 31.0 | 40.0 | 36.8 | Pass |
| Peak Upper Rib Dy | mm | 25.0 | 32.0 | 29.1 | Pass |
| Peak Middle Rib Dy | mm | 30.0 | 36.0 | 33.0 | Pass |
| Peak Lower Rib Dy | mm | 32.0 | 38.0 | 35.4 | Pass |
| Peak Upper Spine (T1) Ay | g | 34.0 | 43.0 | 38.1 | Pass |
| Peak Lower Spine (T12) Ay | g | 29.0 | 37.0 | 34.3 | Pass |
| Peak Impactor Ax | g | -36.0 | -30.0 | -33.5 | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *J. Hernandez*
J. Hernandez

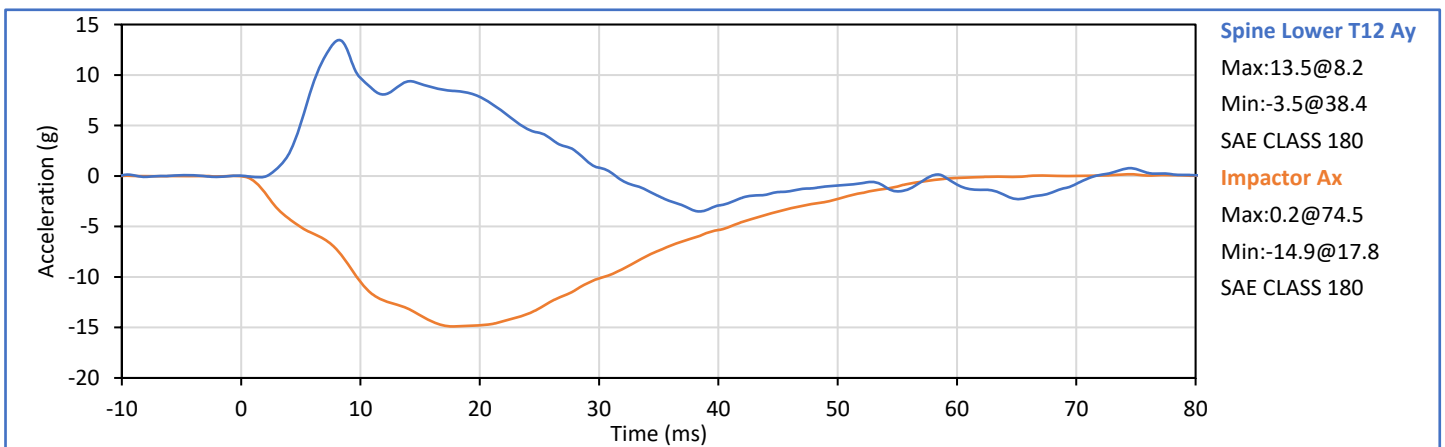
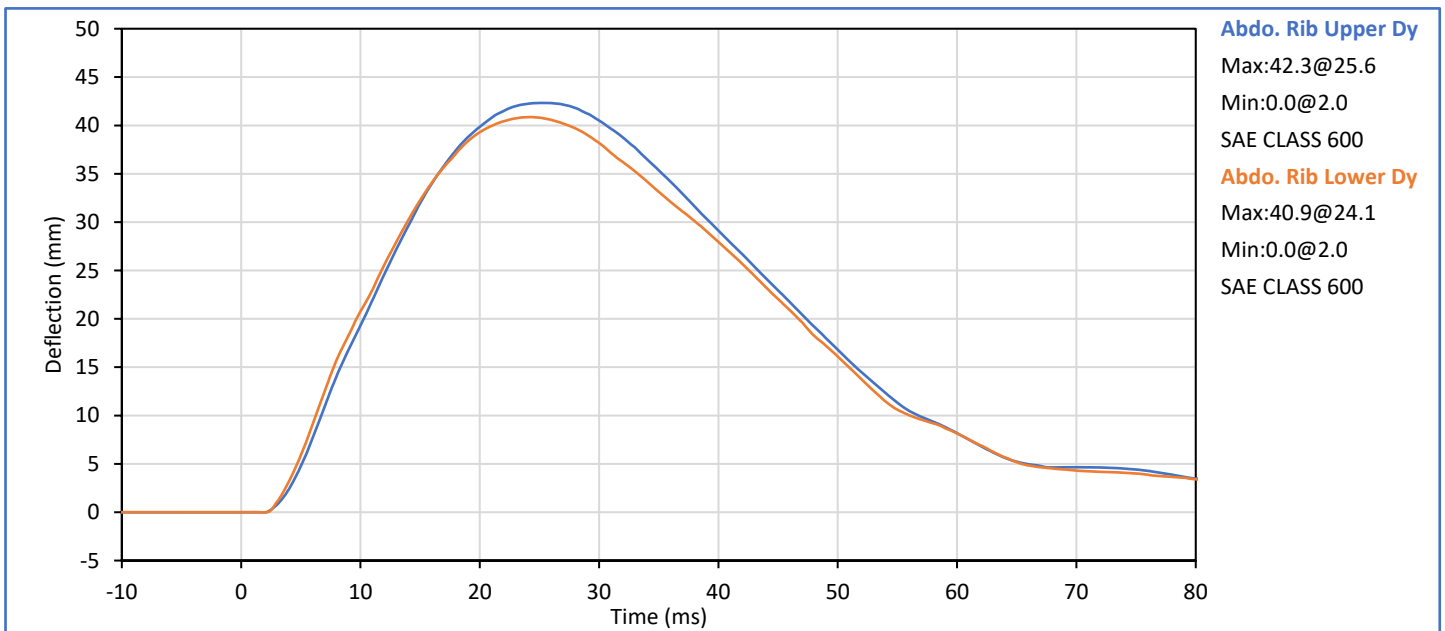
| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|------------------------------|-------|-----------|------------|--------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.1 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 28 | Pass |
| Impactor Velocity | m/s | 4.20 | 4.40 | 4.32 | Pass |
| Peak Thorax Rib Upper Dy | mm | 32.0 | 40.0 | 38.1 | Pass |
| Peak Thorax Rib Middle Dy | mm | 39.0 | 45.0 | 42.0 | Pass |
| Peak Thorax Rib Lower Dy | mm | 35.0 | 43.0 | 39.8 | Pass |
| Peak Spine Upper T1 Ay | g | 13.0 | 17.0 | 15.9 | Pass |
| Peak Spine Lower T12 Ay | g | 7.0 | 11.0 | 10.4 | Pass |
| Peak Impactor Ax | g | -18.0 | -14.0 | -16.4 | Pass |
| Overall Test Results | | | | | Pass |



Technician: *Mill LGS III*
G. Fuentes

Approved By: *J. Hernandez*
J. Hernandez

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|------------------------------|-------|-----------|------------|--------|-------------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.9 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 27 | Pass |
| Impactor Velocity | m/s | 4.20 | 4.40 | 4.29 | Pass |
| Peak Upper Abdomen Rib Dy | mm | 36.0 | 47.0 | 42.3 | Pass |
| Peak Lower Abdomen Rib Dy | mm | 33.0 | 44.0 | 40.9 | Pass |
| Peak Lower Spine T12 Ay | mm | 9.0 | 14.0 | 13.5 | Pass |
| Peak Impactor Ax | g | -16.0 | -12.0 | -14.9 | Pass |
| Overall Test Results | | | | | Pass |

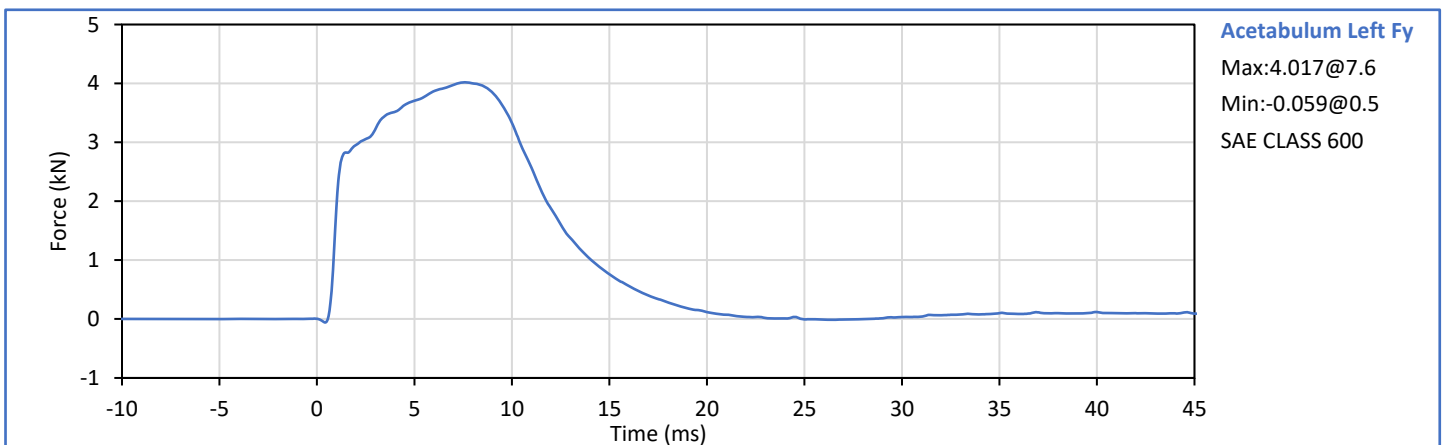
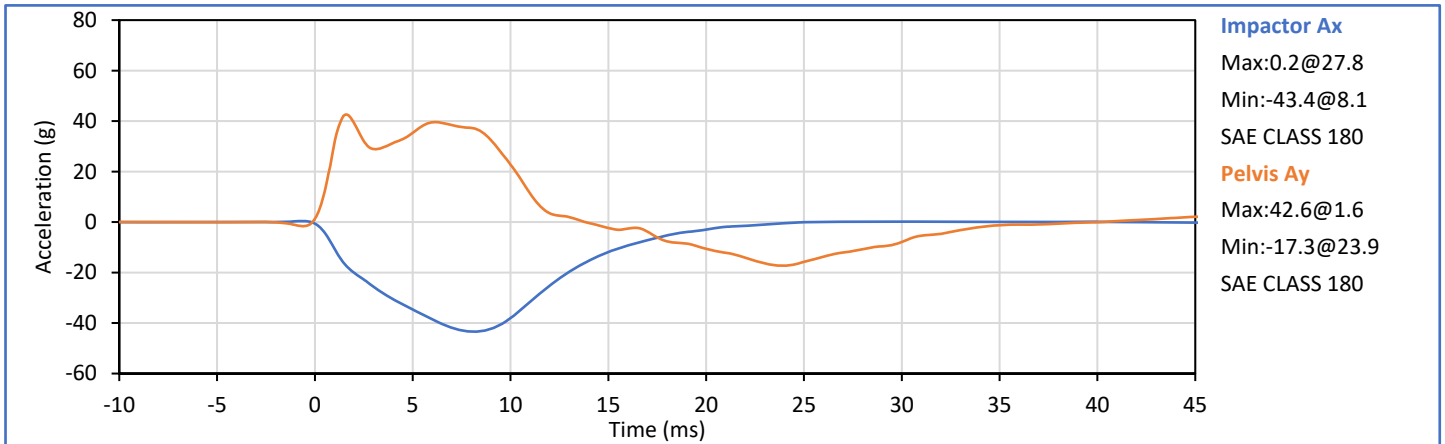


Technician: *Mill LGS III*
G. Fuentes

Approved By: *Smith*
J. Hernandez

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|------------------------------|-------|-----------|------------|--------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.4 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Impactor Velocity | m/s | 6.60 | 6.80 | 6.71 | Pass |
| Peak Acetabulum Fy | kN | 3.60 | 4.30 | 4.10 | Pass |
| Pelvis Ay after 6ms | g | 34.0 | 42.0 | 39.6 | Pass |
| Peak Impactor Ax | g | -47.0 | -38.0 | -43.4 | Pass |
| Overall Test Results | | | | | Pass |

Pelvis Plug S/N: 14793



Technician: *Mill LGS III*
G. Fuentes

Approved By: *Smith*
J. Hernandez

ATD Serial No.: 308

Test Date: 2023-02-24

Pelvis Plug S/N: 14793

SID-IIs Small Side Impact ATD
Pelvis Acetabulum Impact



SID-IIs Pelvis Plug Certification Test

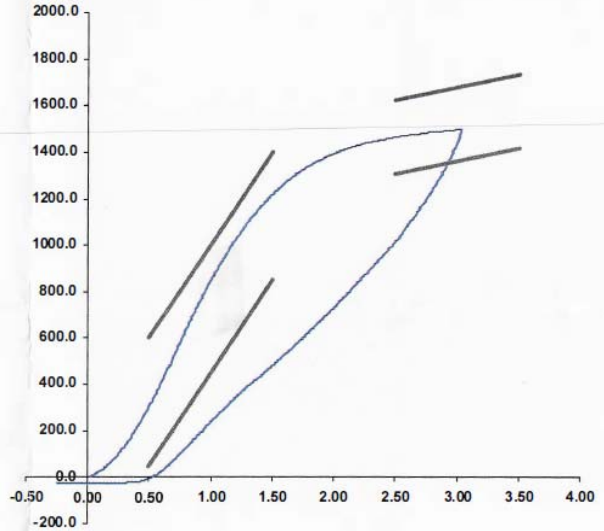
Plug S/N 14793
Test Number 16766
Report Number 16812
Test Date 12/29/2020 11:49:49 AM

| | Test Results | Spec Min | Spec Max |
|--------------------|--------------|----------|----------|
| Force @ 0.5 mm (N) | 302.81 | 50.00 | 600.00 |
| Force @ 1.5 mm (N) | 1,220.89 | 850.00 | 1,400.00 |
| Force @ 2.5 mm (N) | 1,464.56 | 1,306.00 | 1,618.00 |
| Force @ 3.0 mm (N) | 1,496.22 | 1,361.00 | 1,673.00 |

Testing Machine STM-20 5965542
Load Cell S/N (F1360947), Units (LBS) 1000
Preload Value (-N) 22.24
Crosshead Speed (mm / min) or Rate 12.7
Extension or Position Measured by XHD_100 (XHD100)

Notes:

Force (-N) vs Extension (-mm)



Operator

Part Number 180-4450

Template No 107 29-Dec-20
SACO Research

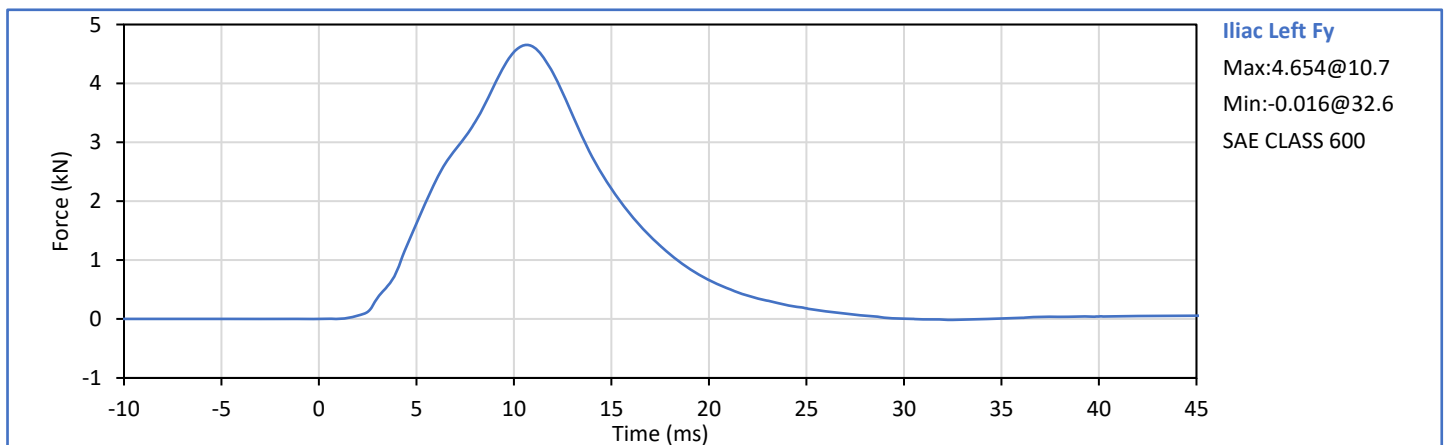
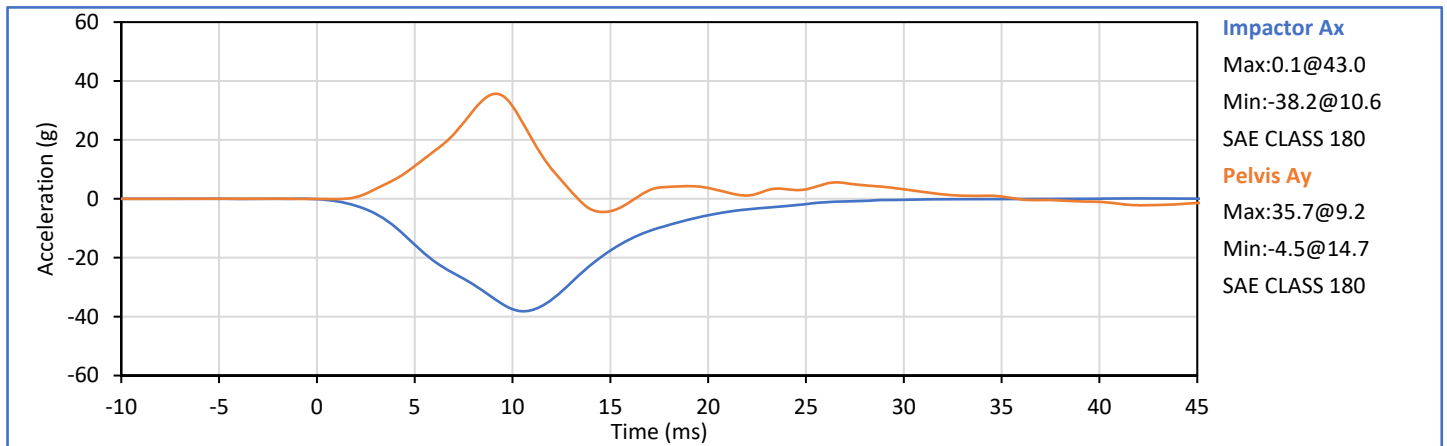
By: DC Date: 12/29/2020

SACO Research 41735 Elm St, #401 Murrieta, CA 92562 Tel 310-694-2082 FAX

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|------------------------------|-------|-----------|------------|--------|-----------|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.3 | Pass |
| Laboratory Relative Humidity | % | 10 | 70 | 30 | Pass |
| Impactor Velocity | m/s | 4.20 | 4.40 | 4.35 | Pass |
| Peak Iliac Fy | kN | 4.10 | 5.10 | 4.65 | Pass |
| Peak Pelvis Ay | g | 28.0 | 39.0 | 34.7 | Pass |
| Peak Impactor Ax | g | -45.0 | -36.0 | -38.2 | Pass |
| Overall Test Results | | | | | Pass |

Pelvis Plug S/N: 12228 *

* Plug is not impacted and remains certified



Technician: *Mill LGS III*
G. Fuentes

Approved By: *Seath*
J. Hernandez

APPENDIX D
TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

Table 1 - Driver ATD Instrumentation

| Sensor Location | Sensor S\N | Mfr | Model | Cal Date |
|--------------------------------|----------------|-------------|-----------|------------|
| Head Acceleration X Primary | P58858 | Endevco | 7264C-2k | 2022-10-19 |
| Head Acceleration Y Primary | P58865 | Endevco | 7264C-2k | 2022-10-19 |
| Head Acceleration Z Primary | P58867 | Endevco | 7264C-2k | 2022-10-19 |
| Head Acceleration X Redundant | P58859 | Endevco | 7264C-2k | 2022-10-19 |
| Head Acceleration Y Redundant | P58866 | Endevco | 7264C-2k | 2022-10-19 |
| Head Acceleration Z Redundant | P58873 | Endevco | 7264C-2k | 2022-10-19 |
| Upper Thorax Rib Deflection Y | 209 (ES-2 Rib) | Honeywell | F38000203 | 2022-10-18 |
| Middle Thorax Rib Deflection Y | 210 (ES-2 Rib) | Honeywell | F38000203 | 2022-10-18 |
| Lower Thorax Rib Deflection Y | 207 (ES-2 Rib) | Honeywell | F38000203 | 2022-10-18 |
| Anterior Abdominal Force Y | 1514 Fy | R.A. Denton | 2631J | 2022-03-30 |
| Middle Abdominal Force Y | 1510 Fy | R.A. Denton | 2631J | 2022-03-30 |
| Posterior Abdominal Force Y | 1515 Fy | R.A. Denton | 2631J | 2022-03-30 |
| Lower Spine T12 Acceleration X | P63856 | Endevco | 7264C-2k | 2022-10-19 |
| Lower Spine T12 Acceleration Y | P50063 | Endevco | 7264C-2k | 2022-10-19 |
| Lower Spine T12 Acceleration Z | P51880 | Endevco | 7264C-2k | 2022-10-19 |
| Pubic Symphysis Force Y | 506 (Pubic) | R.A. Denton | 3096JFL | 2022-03-30 |

Table 2 - Left Rear Passenger ATD Instrumentation

| Sensor Location | Sensor S\N | Mfr | Model | Cal Date |
|--------------------------------|------------------|-------------|-------------------|------------|
| Head Acceleration X Primary | P63980 | Endevco | 7264C-2k | 2022-11-14 |
| Head Acceleration Y Primary | P58861 | Endevco | 7264C-2k | 2022-11-14 |
| Head Acceleration Z Primary | P51261 | Endevco | 7264C-2k | 2022-11-14 |
| Head Acceleration X Redundant | P58808 | Endevco | 7264C-2k | 2022-11-14 |
| Head Acceleration Y Redundant | P63310 | Endevco | 7264C-2k | 2022-11-14 |
| Head Acceleration Z Redundant | P49189 | Endevco | 7264C-2k | 2022-11-14 |
| Head Rotation Rate X | ARS7449 | DTS | ARS PRO-8k (2kHz) | 2022-03-15 |
| Head Rotation Rate Y | ARS7510 | DTS | ARS PRO-8k (2kHz) | 2022-03-10 |
| Head Rotation Rate Z | ARS7573 | DTS | ARS PRO-8k (2kHz) | 2022-03-15 |
| Upper Thorax Rib Deflection Y | 1249 | Servo | 08TCI-3725 | 2022-11-13 |
| Middle Thorax Rib Deflection Y | 1219 | Servo | 08TCI-3725 | 2022-11-13 |
| Lower Thorax Rib Deflection Y | 1221 | Servo | 08TCI-3725 | 2022-11-13 |
| Upper Abdomen Rib Deflection Y | 1252 | Servo | 08TCI-3725 | 2022-11-13 |
| Lower Abdomen Rib Deflection Y | 1233 | Servo | 08TCI-3725 | 2022-11-14 |
| Lower Spine T12 Acceleration X | P52108 | Endevco | 7264C-2k | 2022-11-14 |
| Lower Spine T12 Acceleration Y | P63970 | Endevco | 7264C-2k | 2022-11-14 |
| Lower Spine T12 Acceleration Z | P51712 | Endevco | 7264C-2k | 2022-11-14 |
| Iliac Wing Impact Side Force Y | 289 (Iliac) | R.A. Denton | 3228J | 2022-04-29 |
| Acetabulum Impact Side Force Y | 277 (Acetabulum) | R.A. Denton | 3249J | 2022-04-29 |

Table 3 - Vehicle Instrumentation

| Sensor Location | Sensor S\N | Mfr | Model | Cal Date |
|----------------------------------|------------|---------|---------|------------|
| Vehicle CG Ax | M11113 | Endevco | 758H-2k | 2022-12-13 |
| Vehicle CG Ay | M11117 | Endevco | 758H-2k | 2022-12-03 |
| Vehicle CG Az | M11085 | Endevco | 758H-2k | 2022-11-07 |
| Right Side Sill at Front Seat Ax | M11102 | Endevco | 758H-2k | 2022-11-10 |
| Right Side Sill at Front Seat Ay | M11242 | Endevco | 758H-2k | 2022-10-06 |
| Right Side Sill at Front Seat Az | M11244 | Endevco | 758H-2k | 2022-12-26 |
| Right Side Sill at Rear Seat Ax | M11235 | Endevco | 758H-2k | 2022-12-25 |
| Right Side Sill at Rear Seat Ay | M11053 | Endevco | 758H-2k | 2022-12-10 |
| Right Side Sill at Rear Seat Az | M11268 | Endevco | 758H-2k | 2022-12-26 |
| Left Side Sill at Front Seat Ay | M11250 | Endevco | 758H-2k | 2022-12-16 |
| Left Side Sill at Rear Seat Ay | M11290 | Endevco | 758H-2k | 2022-12-28 |
| Left Lower A-Pillar Ay | M11248 | Endevco | 758H-2k | 2022-10-04 |
| Left Middle A-Pillar Ay | M11236 | Endevco | 758H-2k | 2022-11-05 |
| Left Lower B-Pillar Ay | M11191 | Endevco | 758H-2k | 2022-11-09 |
| Left Middle B-Pillar Ay | M11052 | Endevco | 758H-2k | 2022-11-05 |
| Driver Seat Track at H-Point Ay | M11294 | Endevco | 758H-2k | 2022-12-18 |
| Rear Seat Structure Ay | M10905 | Endevco | 758H-2k | 2022-12-07 |
| Right Rear Occupant Comp. Ay | M11136 | Endevco | 758H-2k | 2022-12-03 |
| Engine Block Top Ax | M11140 | Endevco | 758H-2k | 2022-12-13 |
| Engine Block Top Ay | M11204 | Endevco | 758H-2k | 2022-12-15 |
| Rear Floopan Above Axle Ax | M11132 | Endevco | 758H-2k | 2022-12-13 |
| Rear Floopan Above Axle Ay | M11090 | Endevco | 758H-2k | 2022-12-10 |
| Rear Floopan Above Axle Az | M11129 | Endevco | 758H-2k | 2022-12-13 |

Table 4 - Moving Deformable Barrier (MDB) Instrumentation

| Sensor Location | Sensor S\N | Mfr | Model | Cal Date |
|-------------------------------|------------|-----|---------|------------|
| MDB CG Ax | 220335 | BST | 11CF-2k | 2022-12-12 |
| MDB CG Ay | 220307 | BST | 11CF-2k | 2022-12-12 |
| MDB CG Az | 220273 | BST | 11CF-2k | 2022-12-12 |
| MDB Left Side at Rear Axle Ax | 220330 | BST | 11CF-2k | 2022-12-12 |
| MDB Left Side at Rear Axle Ay | 220308 | BST | 11CF-2k | 2022-12-12 |