**REPORT NUMBER: SPNCAP-KAR-20-015**

**NEW CAR ASSESSMENT PROGRAM (NCAP)**

**SIDE IMPACT POLE TEST**

**HYUNDAI MOTOR COMPANY**

**2020 HYUNDAI PALISADE 5-DOOR MPV**

**NHTSA No: M20204204**

**PREPARED BY:**

**APPLUS IDIADA KARCO ENGINEERING, LLC.**

**9270 HOLLY ROAD**

**ADELANTO, CA 92301**

**MARCH 4, 2020**

**FINAL REPORT**

**PREPARED FOR:**

**U.S. DEPARTMENT OF TRANSPORTATION**

**NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION**

**OFFICE OF CRASHWORTHINESS STANDARDS**

**MAIL CODE: NRM-110**

**1200 NEW JERSEY AVE, SE, ROOM W43-410**

**WASHINGTON, D.C. 20590**

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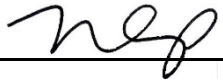
Reviewed By: 

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Approval Date: March 4, 2020

FINAL REPORT ACCEPTANCE BY OCWS:

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

Date:

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

Date:

# TECHNICAL REPORT DOCUMENTATION PAGE

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|---|---|---|
| SPNCAP-KAR-20-015 | | |

| 4. Title and Subtitle | 5. Report Date |
|---|---|
| Final Report of New Car Assessment Program<br>Side Impact Pole Testing of a 2020 Hyundai Palisade 5-Door MPV<br>NHTSA No. M20204204 | March 4, 2020 |
| | **6. Performing Organization Code**<br>KAR |
| **7. Authors**<br>Mr. Robert S. Ramos, Program Manager, Applus IDIADA KARCO<br>Mr. Steven D. Matsusaka, Engineering Manager, Applus IDIADA KARCO | **8. Performing Organization Report No.**<br>TR-P40047-01-NC |
| **9. Performing Organization Name and Address**<br>Applus IDIADA KARCO Engineering, LLC.<br>9270 Holly Rd.<br>Adelanto, CA 92301 | **10. Work Unit No.** |
| | **11. Contract or Grant No.**<br>DTNH22-14-D-00355L |
| **12. Sponsoring Agency Name and Address**<br>U. S. Department of Transportation<br>National Highway Traffic Safety Administration<br>Office of Crashworthiness Standards (NRM-110)<br>1200 New Jersey Ave., SE, Room W43-410<br>Washington, D.C. 20590 | **13. Type of Report and Period Covered**<br>Final Test Report, February 19 - March 4, 2020 |
| | **14. Sponsoring Agency Code**<br>NRM-110 |

**15. Supplementary Notes**

**16. Abstract**


A 32.20 km/h 75° rigid pole side NCAP impact test was conducted on the subject 2020 Hyundai Palisade 5-door MPV in accordance with the specifications of the Office of Crashworthiness Standards Side NCAP Pole Laboratory Test Procedure for the generation of consumer information on vehicle side pole crash protection. The test was conducted at the Applus IDIADA KARCO Engineering, LLC. facility in Adelanto, California on February 19, 2020.

The impact velocity was 31.70 km/h and the outside ambient temperature at the struck (driver's) side of the vehicle was 26.1°C. The target vehicle's maximum post-test static crush was 349 mm located at level 3. The test vehicle's occupant performance data is as follows:

| Measurement Description | Driver ATD (SID-IIs) | | |
|---|---|---|---|
| | Units | Threshold | Result |
| Head Injury Criteria ($HIC_{36}$) | | 1000 | 222.9 |
| Resultant Lower Spine Acceleration | g | 82 | 45 |
| Total Pelvic Force (Sum of Acetabular and Iliac Forces) | N | 5525 | 3221 |
| Maximum Thoracic Rib Deflection | mm | 38 | 20 |
| Maximum Abdominal Rib Deflection | mm | 45 | 21 |

The struck side doors of the vehicle were jammed shut and did not separate from the body at the hinges or latches. The remaining doors did not open during the side impact event.


| 17. Key Words | 18. Distribution Statement |
|---|---|
| New Car Assessment Program (NCAP)<br>Side Impact<br>Pole<br>Part 572V<br>SID-IIs | Copies of this report are available from:<br>National Highway Traffic Safety Admin.<br>Technical Information Services Division<br>1200 New Jersey Ave., SE<br>Washington, DC 20590 |

| 19. Security Classification of this report | 20. Security Classification of this page | 21. No. of Pages | 22. Price |
|---|---|---|---|
| UNCLASSIFIED | UNCLASSIFIED | 105 | |

## TABLE OF CONTENTS

## SECTION 1
## TEST PURPOSE AND PROCEDURE

This side impact test is part of the MY 2020 New Car Assessment Program Side Impact Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under contract number DTNH22-14-D-00355L. The purpose of this test is to generate comparative side impact performance in a 2020 Hyundai Palisade 5-door MPV. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Laboratory Test Procedure date October 2015.

## SECTION 2
## SUMMARY OF TEST RESULTS

A rigid pole side impact test was conducted on a 2020 Hyundai Palisade 5-door MPV. The subject vehicle was towed into the rigid pole at an angle of 76.3° and a velocity of 31.70 km/h. The test was conducted by Applus IDIADA KARCO Engineering, LLC. in Adelanto, California on February 19, 2020. Pre- and post-test photographs of the test vehicle and side impact dummy (SID-IIs) are included in Appendix A of this report.

One Part 572V (SID-IIs) dummy was placed in the driver designated seating position according to instructions specified in the OCWS Side NCAP Pole Laboratory Test Procedure, dated October 2015. Camera locations and other pertinent camera information are included in this report.

The Part 572V (SID-IIs) was instrumented accordingly:

Primary and Redundant Head CG tri-axial accelerometers
Thorax upper, middle and lower rib displacement potentiometers
Abdomen upper and lower rib displacement potentiometers
Lower spine (12) tri-axial accelerometers
Iliac load cell
Acetabulum load cell

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 contains the test equipment and instrumentation calibration data.

Injury readings for the SID-IIs dummy were recorded as follows:

| Measurement Description | Units | Driver ATD (SID-IIs) | |
|---|---|---|---|
| | | IARV | Result |
| Head Injury Criteria ($HIC_{36}$) | | 1000 | 222.9 |
| Lower Spine (T12) Resultant Acceleration | g | 82 | 45 |
| Total Pelvic Force (sum of acetabular and iliac forces) | N | 5525 | 3221 |
| Maximum Thoracic Rib Deflection | mm | 38* | 20 |
| Maximum Abdominal Rib Deflection | mm | 45* | 21 |

**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 | No | |
| Knee Airbag | Yes | No | 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**

The struck side doors of the vehicle were jammed shut. There was no separation at the hinges or latches. The remaining doors remained closed and latched. There were no ATD values that exceeded limits. The Left Lower A-Post Acceleration Y channel failed at 25.5 milliseconds. The Vehicle CG Acceleration X channel failed and no data was collected. The Left Front Sill Y channel failed and no data was collected.

## SECTION 3

## OCCUPANT AND VEHICLE INFORMATION/DATA SHEETS

Test Vehicle: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20

### 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 | $^oF$ | $^oC$ | =(Tf -32)/1.8 |
| Force | Dynamic Forces | lbf | N | 4.448 |
| Moment | Torque | lbf-ft | N•m | 1.355 |

## DATA SHEET NO. 1

## GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20

### TEST VEHICLE INFORMATION AND OPTIONS

| | |
|---|---|
| NHTSA Number | M20204204 |
| Model Year | 2020 |
| Make | Hyundai |
| Model | Palisade |
| Body Style | 5-Door MPV |
| VIN | KM8R14HEXLU068651 |
| Body Color | Moonlight Cloud |
| Odometer Reading (km / mi) | 150 / 93 |
| Engine Displacement (L) | 3.8 |
| Type / No. of Cylinders | V6 |
| Engine Placement | Transverse |
| Transmission Type | Automatic |
| Transmission Speeds | 8 |
| Overdrive | Yes |
| Final Drive | FWD |
| Roof Rack | No |
| Sunroof / T-Top | No |
| Running Boards | No |
| Tilt Steering Wheel | Yes |
| Power Seats | No |
| 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 | No |
| Driver Front Airbag | Yes |
| Driver Curtain Airbag | Yes |
| Driver Head/Torso Airbag | No |
| Driver Torso Airbag | No |
| Driver Torso/Pelvis Airbag | Yes |
| Driver Pelvis Airbag | No |
| Driver Knee Airbag | Yes |
| Rear Pass. Curtain Airbag | 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 | No |

| | |
|---|---|
| Does Owner's Manual provide instructions to turn off automatic door locks? | No |

### DATA FROM CERTIFICATION LABEL

| | |
|---|---|
| Manufactured By | Hyundai Motor Company |
| Date of Manufacture | Sep-19 |
| Vehicle Type | MPV |

| | |
|---|---|
| GVWR (kg) | 2600 |
| GAWR Front (kg) | 1340 |
| GAWR Rear (kg) | 1450 |

### VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

| Measured Parameter | Front | Rear | Third | Total | |
|---|---|---|---|---|---|
| Designated Seating Capacity | 2 | 3 | 3 | 8 | |
| Capacity Weight (VCW) (kg) | | | | 600.0 | *A* |
| DSC x 68.04 (kg) | | | | 544.3 | *B* |
| Cargo Weight (RCLW) (kg) | | | | 55.7 | *A-B* |

### VEHICLE SEAT TYPE

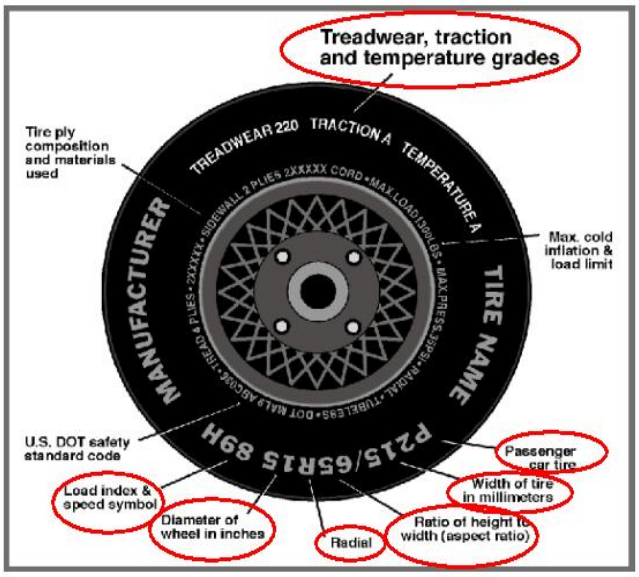
| Seating Location | Type of Seat Pan | | | | Type of Seat Back | | |
|---|---|---|---|---|---|---|---|
| | Bucket | Bench | Split Bench | Contoured | Fixed | Adjustable w/ Lever | Adjustable w/ Knob |
| Front Seat | Yes | | | | | Yes | |
| Rear or Second Row Seat | | | Yes | | | | Yes |
| Third Row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

**DATA SHEET NO. 1 … (CONTINUED)**

**GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20




| Measured Parameter | Front | Rear |
|---|---|---|
| Max. Tire Pressure (kPa) | 275 | 275 |
| Cold Pressure (kPa) | 240 | 240 |
| Recommended Tire Size | 245/60 R18 | 245/60 R18 |
| Tire Size on Vehicle | 245/60 R18 | 245/60 R18 |
| Tire Manufacturer | Bridgestone | Bridgestone |
| Tire Model | Dueler H/P | Dueler H/P |
| Treadware | 400 | 400 |
| Traction Grade | A | A |
| Temperature Grade | B | B |
| Tire Plies Sidewall | 2 Polyester | 2 Polyester |
| Tire Plies Body | 1 Polyester, 2 Steel, 1 Nylon | 1 Polyester, 2 Steel, 1 Nylon |
| Load Index/Speed Symbol | 105H | 105H |
| Tire Material | Polyester, Steel, Nylon | Polyester, Steel, Nylon |
| DOT Safety Code Left | EJL2 CEC 2019 | EJL2 CEC 2019 |
| DOT Safety Code Right | EJL2 CEC 2019 | EJL2 CEC 2019 |

## DATA SHEET NO. 1 … (CONTINUED)

## GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20

### 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 |

### TEST VEHICLE AXLE WEIGHTS

| | Units | As Delivered (UVW) | | | As Tested (ATW) | | | Fully Loaded | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Front | Rear | Total | Front | Rear | Total | Front | Rear | Total |
| Left | kg | 535.0 | 418.5 | | 566.5 | 451.0 | | 557.5 | 456.0 | |
| Right | kg | 538.5 | 403.0 | | 527.0 | 449.5 | | 532.0 | 452.0 | |
| Ratio | % | 56.6% | 43.4% | 100.0% | 54.8% | 45.2% | 100.0% | 54.5% | 45.5% | 100.0% |
| Total | kg | 1073.5 | 821.5 | 1895.0 | 1093.5 | 900.5 | 1994.0 | 1089.5 | 908.0 | 1997.5 |

### TARGET TEST WEIGHT CALCULATION

| Measured Parameter | Units | Value | |
|---|---|---|---|
| Total Delivered Weight (UVW) | kg | 1895.0 | A |
| Actual Weight of 1 P572V ATD Used | kg | 49.0 | B |
| Rated Cargo/Luggage Wt (RCLW) | kg | 55.7 | C |
| Calculated Vehicle Target Wt (TVTW) | kg | 1999.7 | 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 | As Delivered | As Tested | Fully Loaded | Meets Requirement*** |
|---|---|---|---|---|---|
| Driver Door Sill Angle (front-to-rear)* | ° | -1.1 | -0.8 | -0.9 | Yes |
| Front Passenger Sill Angle (front-to-rear)* | ° | -0.2 | 0.3 | 0.5 | Yes |
| Front Bumper-Line Angle (left-to-right)** | ° | 0.9 | 0.9 | 0.8 | Yes |
| Rear Bumper-Line Angle (left-to-right)** | ° | -0.7 | -0.8 | -0.9 | Yes |
| Vehicle CG (Aft of Front Axle) | mm | 1259 | 1311 | 1320 | |
| Vehicle CG (Left (+)/Right (-) from Longitudinal Centerline) | mm | 5 | 18 | 13 | |

*ND=Nose Down (-), NU=Nose Up (+) **LD=Left Down (-), LU=Left Up (+)

***The "As Tested" vehicle attitude angle measurements must be within "As Delivered" and the "Fully Loaded" vehicle attitude measurements at each location. Indicate "Yes" or "No" for "Meets Requirement"

**DATA SHEET NO. 1 … (CONTINUED)**

**GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20

**WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW**

| Component Description | Weight (kg) |
|---|---|
| Spare Tire and Tools | 18.0 |
| Trunk Trim | 2.0 |
| | |
| Ballast / Equipment Added | 70.0 |

| | |
|---|---|
| Test Height Adjustable Setting (If Applicable) | N/A |

**DATA SHEET NO. 2**

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

Test Vehicle: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20

**SEAT POSITIONING**

The driver's seat, front center seat (if applicable), and front passenger's seat should be set to the forward most, mid-height, mid-angle position. The struck side rear passenger's seat, rear center seat, and non-struck side rear passenger's seat should be set to the rear most, lowest, mid-angle position.

**SCRL ANGLE RANGE**

| Seat | SCRL (°) | | |
|---|---|---|---|
| | Max | Min | Mid |
| Driver Seat | 2.6 | 0.0 | 1.3 |
| 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 | 1.3 | 293 | Max | | | |
| | | | Mid | 282 | 288 | 293 |
| | | | Min | | | |
| Front Passenger Seat | Fixed | 310 | Max | | | |
| | | | Mid | 299 | 305 | 310 |
| | | | Min | | | |
| Front Center Seat | | | Max | | | |
| | | | Mid | | | |
| | | | Min | | | |
| Struck Side Rear Seat | Fixed | 265 | Max | | | |
| | | | Mid | 265 | 265 | 263 |
| | | | Min | | | |
| Non-Struck Side Rear Seat | Fixed | 265 | Max | | | |
| | | | Mid | 265 | 265 | 263 |
| | | | Min | | | |
| Rear Center Seat | Fixed | 265 | Max | | | |
| | | | Mid | 265 | 265 | 263 |
| | | | Min | | | |

**DATA SHEET NO. 2 … (CONTINUED)**

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

Test Vehicle: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20

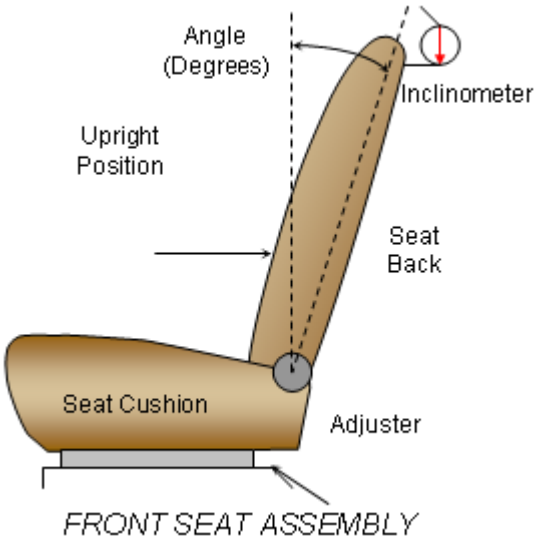
**SEAT FORE/AFT POSITION**

| Seat | Total Fore/Aft Travel | | Test Position From Forwardmost Position | |
|---|---|---|---|---|
| | mm | Detents* | mm | Detent* |
| Driver Seat | 240 | 38 | 0 | 0 |
| Front Passenger Seat | 240 | 38 | 0 | 0 |
| Front Center Seat | | | | |
| Struck Side Rear Seat | 135 | 10 | 135 | 9 |
| Non-Struck Side Rear Seat | 135 | 10 | 135 | 9 |
| Rear Center Seat | 135 | 10 | 135 | 9 |

*Detent zero (0) is the forward most detent

**SEAT BACK ADJUSTMENT**

The driver's seat back is positioned such that the dummy's head is level. The front passenger's seat back is positioned in a similar manner to the driver's seat. The struck side rear passenger seat back is positioned in accordance with the information provided by the manufacturer in Form 1 for the 5th percentile female dummy in a Side NCAP MDB Test. The rear center and non-struck side rear passenger's seat back is set to match the struck side rear seat back. Seat back angle is measured from the headrest post.




| Seat | Total Seat Back Angle Range | | Test Position from Most Upright | |
|---|---|---|---|---|
| | Degrees | Detents* | Degree | Detent* |
| Driver Seat w/Seated Dummy | 62.1 | 32 | 6.6 | 0 |
| Front Passenger Seat | 63.9 | 32 | 6.6 | 0 |
| Front Center Seat | | | | |
| Struck Side Rear Seat w/Seated Dummy | 22.0 | 11 | 4.8 | 1 |
| Non-Struck Side Rear Seat | 22.0 | 11 | 4.8 | 1 |
| Rear Center Seat | 22.0 | 11 | 4.8 | 1 |

*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: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20

**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 |

**HEAD RESTRAINT ADJUSTMENT**

The driver'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 | Lowest |

## DATA SHEET NO. 2 … (CONTINUED)

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

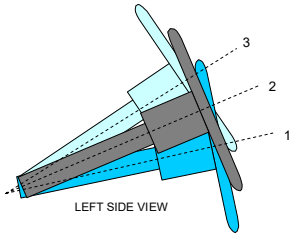
Test Vehicle: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20

### 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.

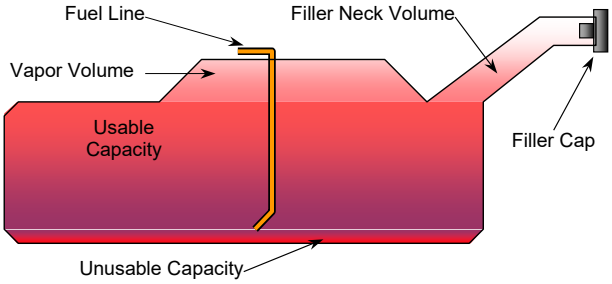
| | Degrees | Fore-Aft Position (mm) |
|---|---|---|
| Lowermost - Position 1 | 24.4 | 100 |
| Geometric Center - Position 2 | 26.9 | 125 |
| Uppermost - Position 3 | 29.4 | 150 |
| Telescoping Steering Wheel Travel | | 50 |
| Test Position | 26.9 | 125 |




*STEERING COLUMN ASSEMBLY*

### FUEL PUMP

The vehicle is equipped with an electronic fuel pump. The fuel pump normally operates when the vehicle's electrical system is activated. The fuel pump operates when the engine is running.




*VEHICLE FUEL TANK ASSEMBLY*

### FUEL TANK CAPACITY

| Description | Liters |
|---|---|
| Usable Capacity of "Standard Tank" (see Form No. 1) | 71.01 |
| Usable Capacity of "Optional Tank" (see Form No. 1) | |
| Usable Capacity of "Standard Tank" (see Owner's Manual) | 70.01 |
| Usable Capacity of "Optional Tank" (see Owner's Manual) | |
| 93% of Usable Capacity | 66.04 |
| Actual amount of Solvent Used in Test | 66.01 |
| 1/3 of Usable Capacity | 23.67 |

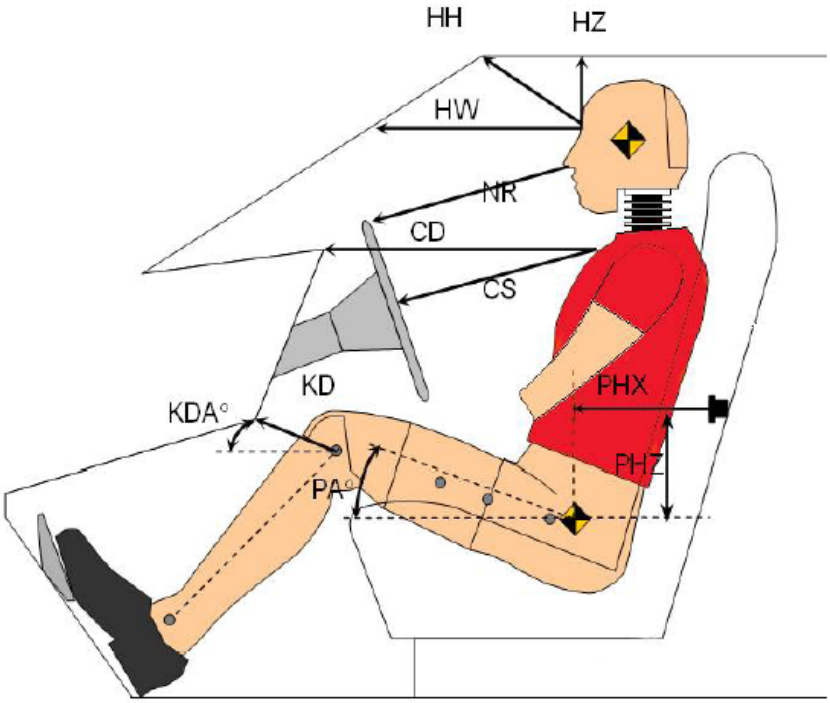
Is the Actual Amount of Solvent Used in the test equal to 93% ± 1% of the Usable Capacity stated in the Form No. 1? ☒ **Yes** ☐ **No**

**DATA SHEET NO. 3**

**DUMMY LONGITUDINAL CLEARANCE DIMENSIONS**

Test Vehicle: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20



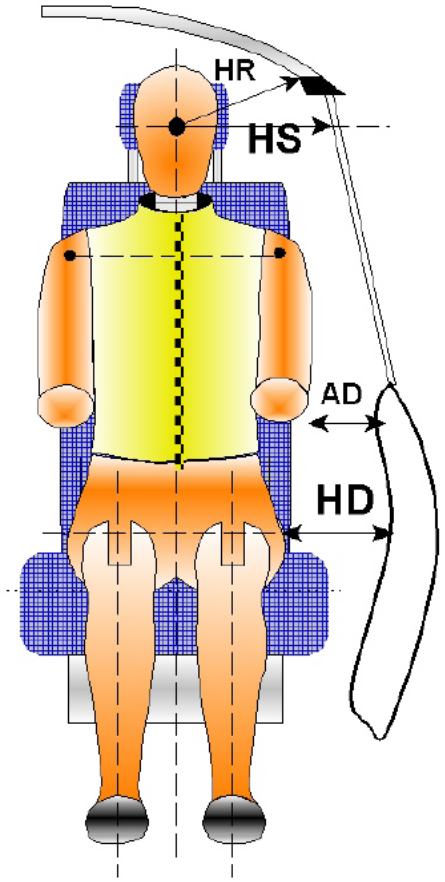

| Driver Code | Description | Driver | |
|---|---|---|---|
| | | Length (mm) | Angle (º) |
| HH | Head to Header | 280 | |
| HW | Head to Windshield | 628 | |
| HZ | Head to Roof | 225 | |
| NR | Nose to Rim | 249 | |
| CD | Chest to Dash | 450 | |
| CS | Chest to Steering Wheel | 186 | |
| KD(L)/KDA(L)° | Left Knee to Dash | 105 | 32.8 |
| KD(R)/KDA(R)° | Right Knee to Dash | 100 | 34.3 |
| PAX° | Pelvic Tilt Angle (x-axis) | | 19.6 |
| PAY° | Pelvic Tilt Angle (y-axis) | | 0.1 |
| PHX | Hip Point to Striker (x-axis) | 350 | |
| PHZ | Hip Point to Striker (z-axis) | 206 | |

**DATA SHEET NO. 4**

**DUMMY LATERAL CLEARANCE DIMENSIONS**

Test Vehicle: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20



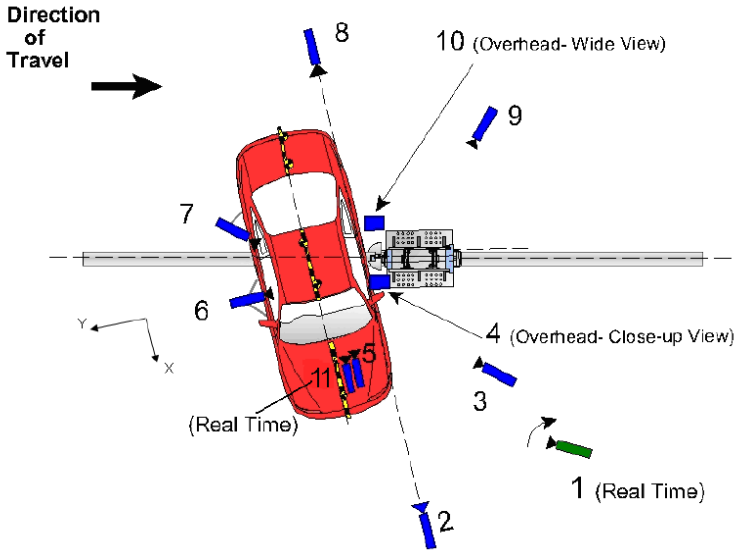

| Code | Measurement Description | Units | Driver |
|---|---|---|---|
| HR | Head to Side Header | mm | 286 |
| HS | Head to Side Window | mm | 405 |
| AD | Arm to Door | mm | 180 |
| HD | Hip Point to Door | mm | 176 |

## DATA SHEET NO. 5

## CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20




Reference from Point of Impact for X and Y; from Ground for Z):
+X = Forward of Vehicle, +Y = Right of Vehicle, +Z = Down

| Camera No. | View | Coordinates (m) | | | Lens (mm) | Film Speed (fps) |
|---|---|---|---|---|---|---|
| | | X* | Y* | Z* | | |
| 1 | Real Time Pan View of Impact | 8.89 | 46.57 | -3.04 | | 30 |
| 2 | Front Ground Level - Impact View | 8.34 | -0.05 | -0.93 | 24 | 1000 |
| 3 | Impact Side 45° - Forward Pole View | 4.10 | -2.15 | -1.15 | 8.5 | 1000 |
| 4 | Overhead Close-Up View of Impact | 0.00 | 0.00 | -5.79 | 12.5 | 1000 |
| 5 | On-Board - Dummy Front View | 0.81 | 0.57 | -1.53 | 8.5 | 1000 |
| 6 | On-Board - Dummy Side View | 0.04 | 1.72 | -1.19 | 8.5 | 1000 |
| 7 | On-Board - Dummy Rear Oblique View | -1.27 | 1.68 | -1.38 | 8.5 | 1000 |
| 8 | Rear Ground Level - Impact View | -6.12 | -6.23 | -0.96 | 24 | 1000 |
| 9 | Impact Side 45° - Rearward Pole View | -8.02 | 0.04 | -1.01 | 35 | 1000 |
| 10 | Overhead Wide View of Impact | -0.06 | 0.22 | -5.79 | 14 | 1000 |
| 11 | Real Time Dummy Front View | 0.77 | 0.59 | -1.52 | | 30 |

*All measurements accurate to ±6 mm

### INSTRUMENTATION

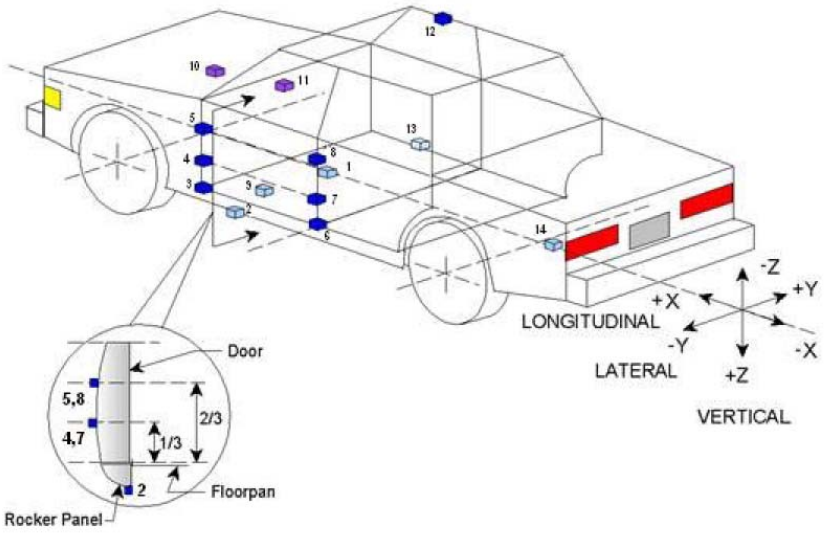
| | |
|---|---|
| Driver Dummy Channels | 19 |
| Vehicle Structure Accelerometers | 18 |
| Pole Load Cells | 8 |
| Total | 45 |

**DATA SHEET NO. 6**

**TEST VEHICLE ACCELEROMETER LOCATIONS**

Test Vehicle: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20




| Loc. No. | Sensor Description | Coordinates (mm) | | |
|---|---|---|---|---|
| | | X | Y | Z |
| 1 | Vehicle CG | 2280 | 0 | -465 |
| 2 | Left Floor Sill | 2930 | -840 | -285 |
| 3 | A-Pillar Sill | 3400 | -900 | -430 |
| 4 | A-Pillar Low | 3430 | -910 | -500 |
| 5 | A-Pillar Mid | 3445 | -920 | -930 |
| 6 | B-Pillar Sill | 2500 | -770 | -525 |
| 7 | B-Pillar Low | 2425 | -780 | -800 |
| 8 | B-Pillar Mid | 2445 | -780 | -1180 |
| 9 | Driver Seat Track | 2730 | -650 | -580 |
| 10 | Engine Top | 4010 | 300 | -530 |
| 11 | Firewall | 3625 | 400 | -920 |
| 12 | Right Roof | 2520 | 580 | -1700 |
| 13 | Right Floor Sill | 2850 | 820 | -490 |
| 14 | Rear Floorpan | 690 | 0 | -750 |

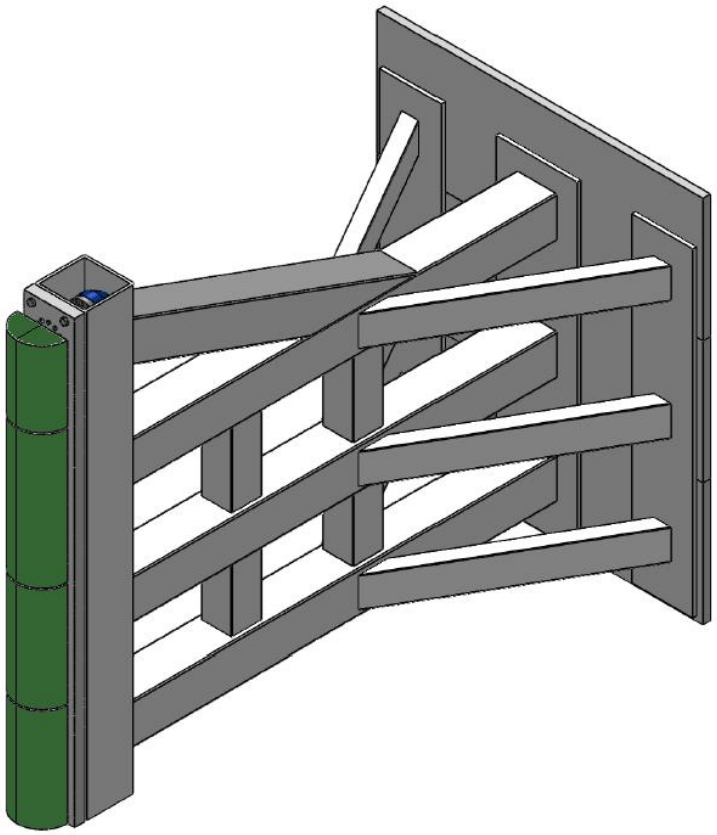
Reference: X – Rear surface of vehicle (+ forward)
Y – Vehicle centerline (+ to right)
Z – Ground plane (+ down)

**DATA SHEET NO. 7**

**RIGID POLE LOAD CELL DATA**

Test Vehicle: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20



| ID | Units | Height From Ground |
|---|---|---|
| 1 | mm | 87 |
| 2 | mm | 468 |
| 3 | mm | 648 |
| 4 | mm | 978 |
| 5 | mm | 1168 |
| 6 | mm | 1651 |
| 7 | mm | 1816 |
| 8 | mm | 2057 |

## DATA SHEET NO. 8

## POST-TEST OBSERVATIONS

Test Vehicle: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20

### TEST DUMMY INFORMATION AND CONTACT POINTS

| Dummy Body Part | Driver SID-IIs Dummy |
|---|---|
| Face | Curtain Airbag |
| Top of Head | Curtain Airbag |
| Left Side of Head | Curtain Airbag |
| Back of Head | Curtain Airbag, Headrest |
| Left Shoulder | Side Airbag |
| Upper Torso | Side Airbag, Seatback |
| Lower Torso | Side Airbag, Seatback |
| Left Hip | Side Airbag, Seat, Door Panel |
| Left Knee | None |

### POST-TEST DOOR PERFORMANCE

| Description | Struck Side | | Non-Struck Side | | Rear Hatch/Other Door |
|---|---|---|---|---|---|
| | 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 |

### POST-TEST SEAT PERFORMANCE

| Description | Struck Side | | Non-Struck Side | |
|---|---|---|---|---|
| | Front | Rear | Front | Rear |
| Seat Movement Along Seat Track | 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 |

## DATA SHEET NO. 8 … (CONTINUED)

## POST-TEST OBSERVATIONS

Test Vehicle: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20

### POST-TEST STRUCTURAL OBSERVATIONS

| Critical Areas of Performance | Observations and Conclusions |
|---|---|
| Pillar Performance | No separation occurred |
| Sill Separation | No separation occurred |
| Windshield Damage | Broken |
| Side Window Damage | Left front window broken |
| Other Notable Effects | None |

### SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

| Restraint Type | Struck Side Driver | | Struck Side Rear Passenger | |
|---|---|---|---|---|
| | Mounted | Deployed | Mounted | Deployed |
| Frontal Airbag | Yes | No | No | |
| Knee Airbag | Yes | No | 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

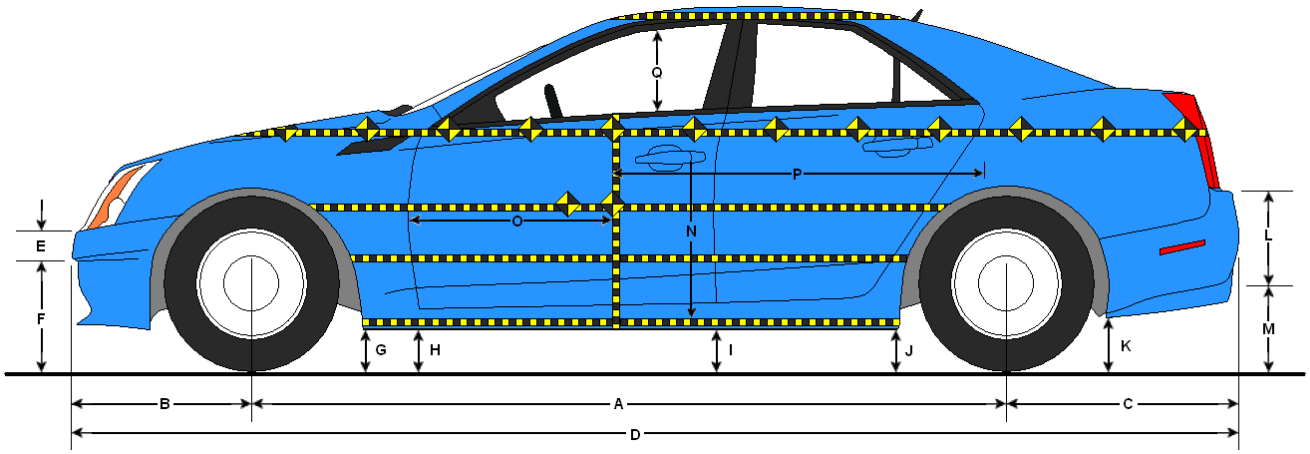
| Measured Parameter | Units | Tolerance | Value |
|---|---|---|---|
| Vertical Impact Reference Line (Aft of Front Axle)(Intended Impact Point) | mm | | 1094 |
| Actual Impact Point (Aft of Front Axle) | mm | | 1101 |
| Horizontal Offset (+ forward / - rearward) | mm | ± 38 of Intended Impact Point | -7 |
| Angle Between Vehicle's Longitudinal Centerline and Line of Forward Motion | ° | 75 ± 3 | 76.3 |
| Trap No. 1 Velocity (Primary) | km/h | 31.4 to 33.0 | 31.70 |
| Trap No. 2 Velocity (Redundant) | km/h | 31.4 to 33.0 | 31.73 |

## DATA SHEET NO. 9

## TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20




**LEFT SIDE VIEW**

All measurements in mm with tolerance of ± 3mm

### VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

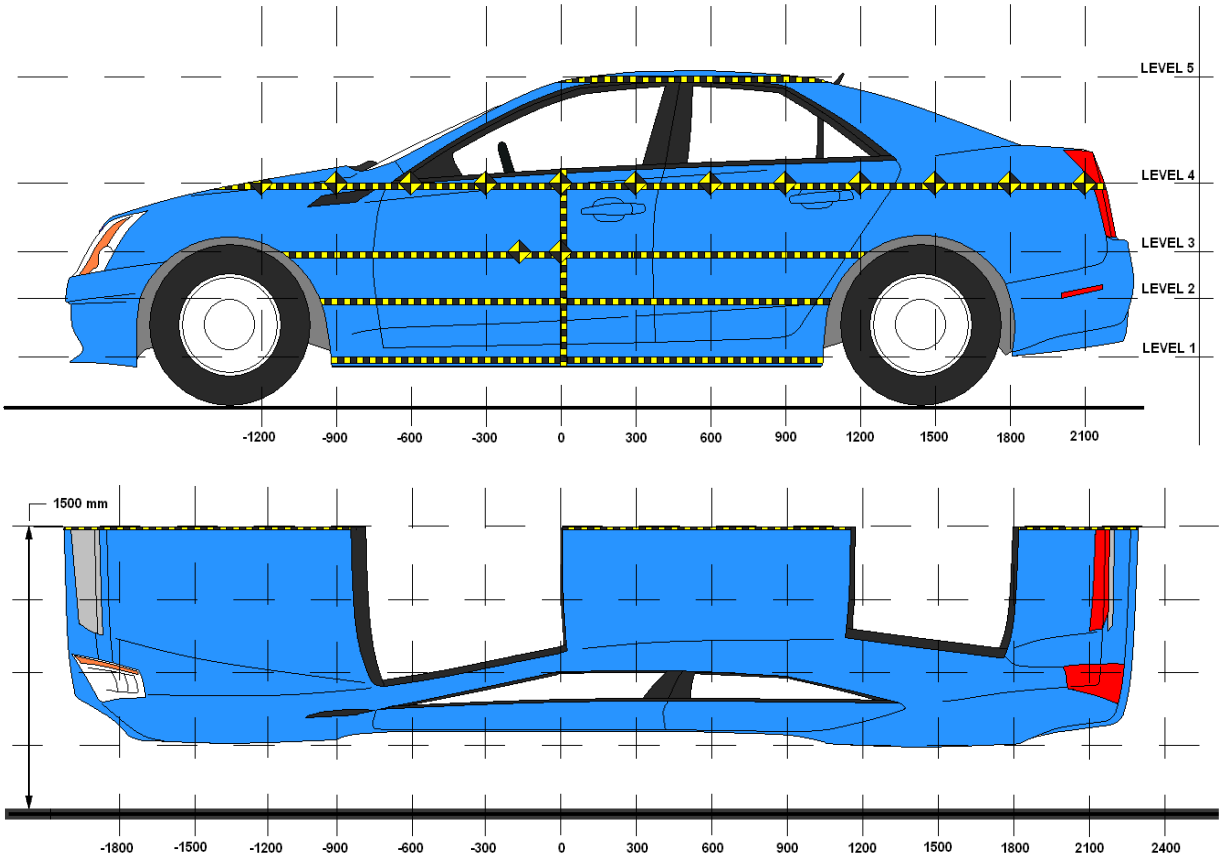
| Code | Description | Pre-Test | Post-Test | Difference |
|---|---|---|---|---|
| A | Wheelbase | 2904 | 2820 | -84 |
| B | Front Axle to FSOV | 944 | 980 | 36 |
| C | Rear Axle to RSOV | 1113 | 1123 | 10 |
| D | Total Length at Centerline | 4958 | 4922 | -36 |
| E | Front Bumper Thickness | 140 | 141 | 1 |
| F | Fromt Bumper Bottom to Ground | 460 | 436 | -24 |
| G | Sill Height at Front Wheel Well | 302 | 248 | -54 |
| H | Sill Height at Front Door Leading Edge | 326 | 277 | -49 |
| I | Sill Height at B-Pillar | 330 | 295 | -35 |
| J1 | Sill Height at Rear Wheel Well | 340 | 336 | -4 |
| J2 | Pinch Weld Height at Rear Wheel Well | 293 | 299 | 6 |
| K | Sill Height Aft of Rear Wheel Well | 407 | 400 | -7 |
| L | Rear Bumper Thickness | 177 | 177 | 0 |
| M | Rear Bumper Bottom to Ground | 573 | 572 | -1 |
| N | Sill Height to Bottom of Front Window Sill | 768 | 754 | -14 |
| O | Front Door Leading Edge to Impact CL | 559 | 478 | -81 |
| P | Rear Door Trailing Edge to Impact CL | 1636 | 1550 | -86 |
| Q | Front Window Opening | 475 | 516 | 41 |
| R | Right Side Length | 3505 | 3521 | 16 |
| S | Left Side Length | 3506 | 3404 | -102 |
| T | Vehicle Width at B-Pillar | 1944 | 1881 | -63 |

## DATA SHEET NO. 10

## TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20




**NOTE:** All measurements in mm with tolerance of ± 3mm

### MAXIMUM EXTERIOR CRUSH MEASUREMENTS

| Level | Description | Height Above Ground (mm) | Maximum Exterior Static Crush | Distance from Impact |
|---|---|---|---|---|
| 1 | Sill Top | 358 | 319 | 0 |
| 2 | Occupant H-Point | 755 | 347 | 0 |
| 3 | Mid-Door | 776 | 349 | 0 |
| 4 | Window Sill | 1061 | 316 | 0 |
| 5 | Window Top | 1688 | 92 | 150 |

**DATA SHEET NO. 10 … (CONTINUED)**

**TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS**

Test Vehicle: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20

**EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL**

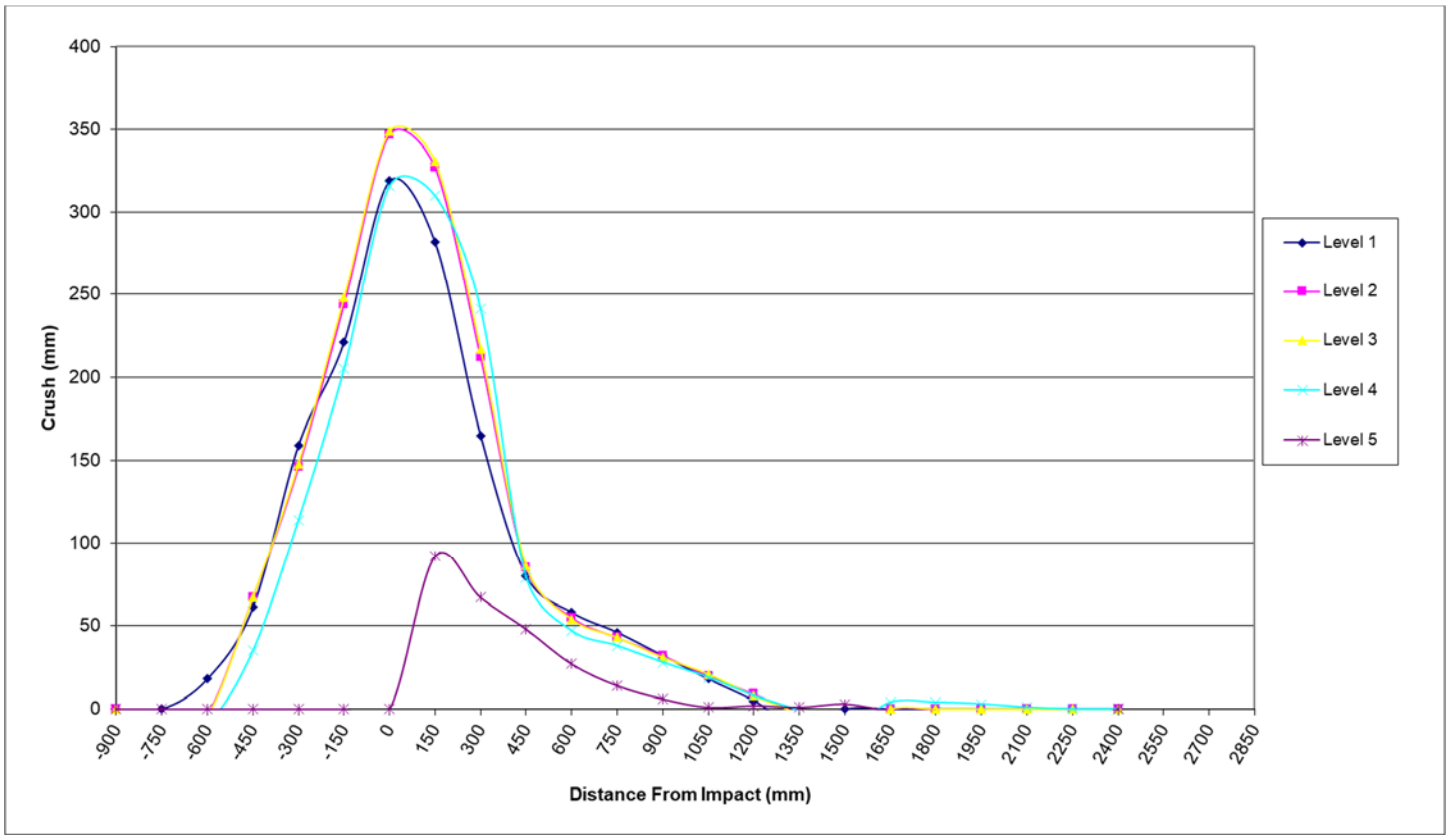
| | Pre-Test (mm) | | | | | Post-Test (mm) | | | | | Difference (mm) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| -900 | | | | 581 | | | | | 543 | | | | | -38 | |
| -750 | | 515 | 517 | 581 | | | 497 | 500 | 557 | | | -18 | -17 | -24 | |
| -600 | 551 | 516 | 517 | 583 | | 569 | 513 | 513 | 573 | | 18 | -3 | -4 | -10 | |
| -450 | 555 | 535 | 536 | 583 | | 616 | 602 | 603 | 618 | | 61 | 67 | 67 | 35 | |
| -300 | 557 | 540 | 538 | 577 | | 716 | 686 | 686 | 691 | | 159 | 146 | 148 | 114 | |
| -150 | 559 | 539 | 537 | 572 | | 780 | 783 | 785 | 777 | | 221 | 244 | 248 | 205 | |
| 0 | 557 | 538 | 536 | 569 | | 876 | 885 | 885 | 885 | | 319 | 347 | 349 | 316 | |
| 150 | 556 | 538 | 536 | 566 | 853 | 838 | 865 | 867 | 876 | 945 | 282 | 327 | 331 | 310 | 92 |
| 300 | 556 | 537 | 535 | 524 | 850 | 721 | 749 | 752 | 765 | 917 | 165 | 212 | 217 | 241 | 67 |
| 450 | 556 | 538 | 535 | 553 | 844 | 636 | 623 | 621 | 632 | 892 | 80 | 85 | 86 | 79 | 48 |
| 600 | 558 | 539 | 537 | 559 | 843 | 616 | 594 | 591 | 606 | 870 | 58 | 55 | 54 | 47 | 27 |
| 750 | 559 | 541 | 539 | 559 | 841 | 605 | 584 | 582 | 597 | 855 | 46 | 43 | 43 | 38 | 14 |
| 900 | 560 | 543 | 542 | 559 | 839 | 592 | 575 | 573 | 587 | 845 | 32 | 32 | 31 | 28 | 6 |
| 1050 | 559 | 544 | 542 | 559 | 839 | 577 | 564 | 563 | 578 | 840 | 18 | 20 | 21 | 19 | 1 |
| 1200 | 556 | 535 | 535 | 558 | 838 | 561 | 544 | 543 | 566 | 840 | 5 | 9 | 8 | 8 | 2 |
| 1350 | 547 | 521 | 521 | 525 | 840 | 536 | 518 | 518 | 524 | 841 | -11 | -3 | -3 | -1 | 1 |
| 1500 | | 516 | 518 | 537 | 842 | | 501 | 502 | 525 | 845 | | -15 | -16 | -12 | 3 |
| 1650 | | | | 549 | 843 | | | | 553 | 842 | | | | 4 | -1 |
| 1800 | | | | 547 | 845 | | | | 551 | 844 | | | | 4 | -1 |
| 1950 | | | | 550 | 850 | | | | 553 | 846 | | | | 3 | -4 |
| 2100 | | | | 557 | 855 | | | | 558 | 850 | | | | 1 | -5 |
| 2250 | | | | 574 | 863 | | | | 574 | 857 | | | | 0 | -6 |
| 2400 | | | | | | | | | | | | | | | |
| 2550 | | | | | | | | | | | | | | | |
| 2700 | | | | | | | | | | | | | | | |
| 2850 | | | | | | | | | | | | | | | |

**DATA SHEET NO. 10 … (CONTINUED)**

**TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS**

Test Vehicle: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20

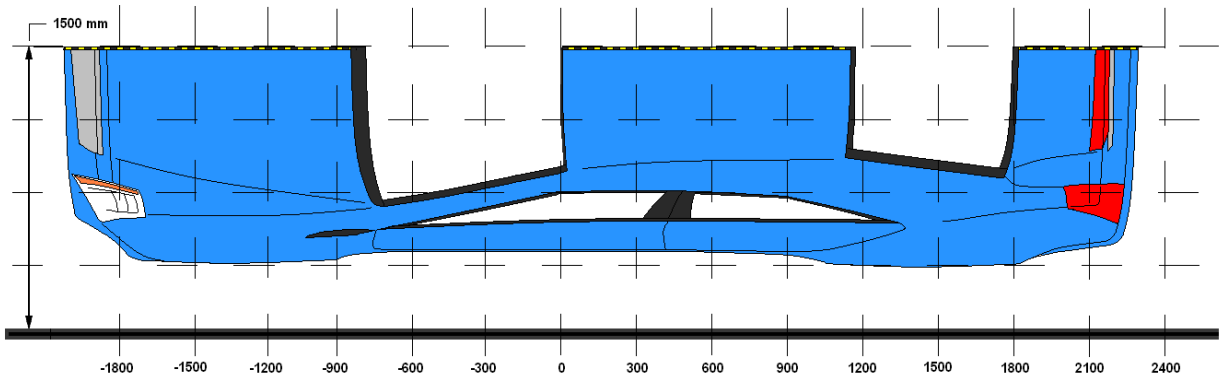


## DATA SHEET NO. 11

## VEHICLE DAMAGE PROFILE DISTANCES

Test Vehicle: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20




| DPD | Distance From Impact Point (mm) | Level | Pre-Test (mm) | Post-Test (mm) | Crush (mm) |
|---|---|---|---|---|---|
| 1 | 2250 | 4 | 574 | 574 | 0 |
| 2 | 1650 | 4 | 549 | 553 | 4 |
| 3 | 1050 | 3 | 542 | 563 | 21 |
| 4 | 300 | 4 | 524 | 765 | 241 |
| 5 | -300 | 1 | 557 | 716 | 159 |
| 6 | -900 | 4 | 581 | 543 | -38 |

## DATA SHEET NO. 12

## FMVSS NO. 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20

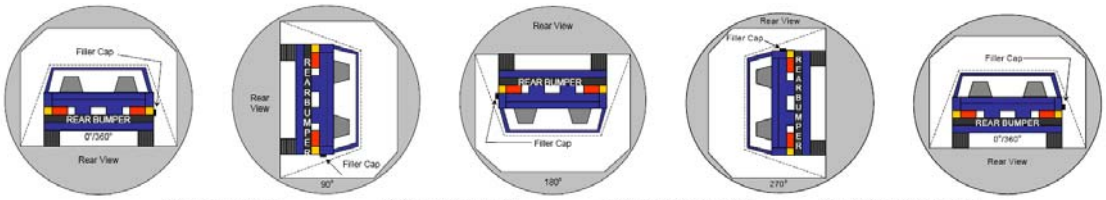
Temperature at Time of Impact: 26.1° C Test Time: 4:42 PM

A. From impact until vehicle motion ceases: 0 oz.
(Maximum allowable = 1 oz.)

B. For the 5 minute period after motion ceases: 0 oz.
(Maximum allowable = 5 oz.)

C. For the following 25 minutes: 0 oz.
(Maximum allowable = 1 oz./minute)

D. Spillage Details: There was no Stoddard solvent spillage.




### SOLVENT COLLECTION TIME TABLE IN SECONDS

| Test Phase | Rotation Time | Hold Time | Total Time |
|---|---|---|---|
| 0° To 90° | 81 | 300 | 381 |
| 90° To 180° | 79 | 300 | 379 |
| 180° To 270° | 82 | 300 | 382 |
| 270° To 360° | 78 | 300 | 378 |

### FMVSS 301 SPILLAGE TABLE

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

### SOLVENT SPILLAGE LOCATION TABLE

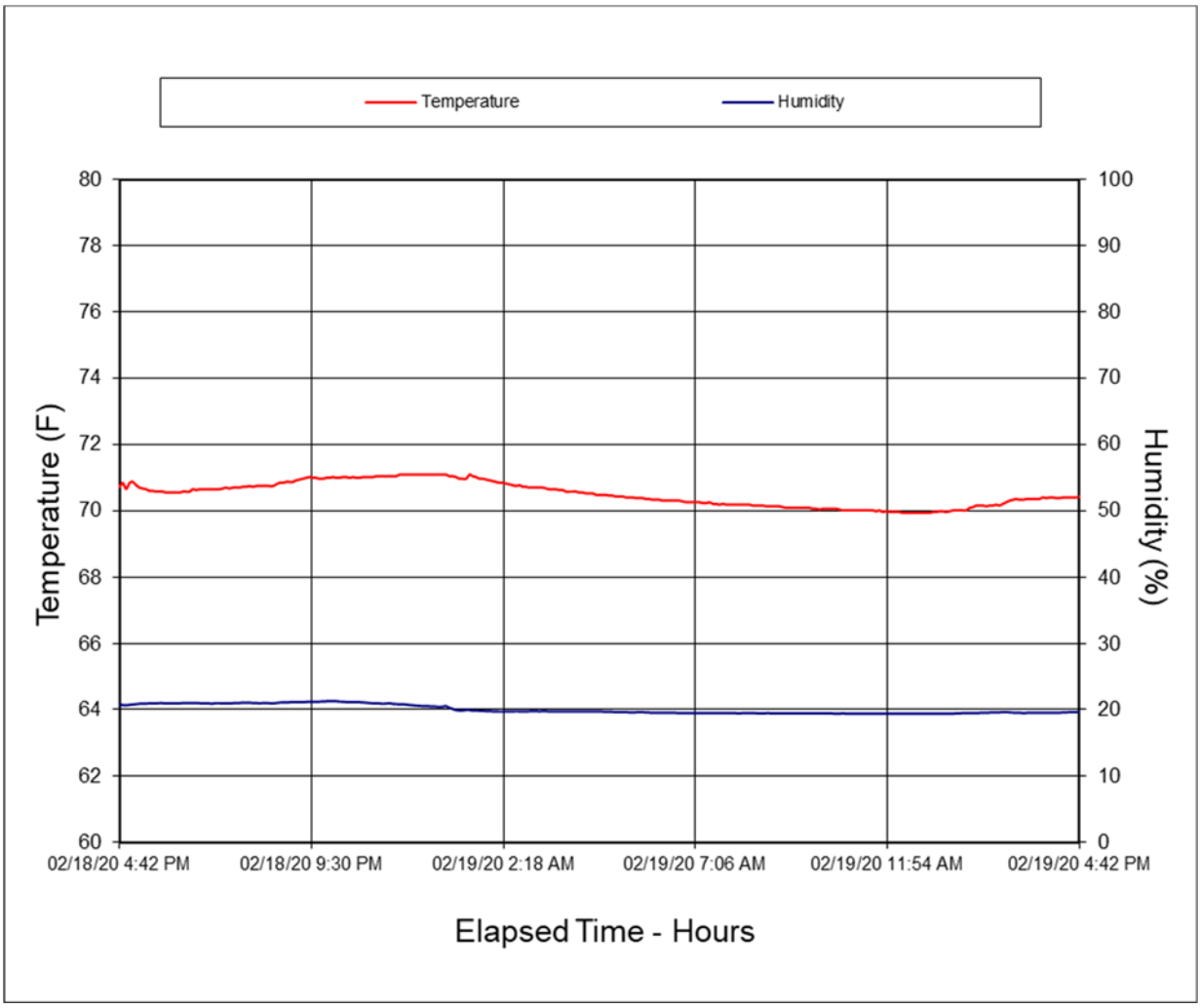
| Test Phase | Spillage Location |
|---|---|
| 0° To 90° | No Spillage Occurred |
| 90° To 180° | No Spillage Occurred |
| 180° To 270° | No Spillage Occurred |
| 270° To 360° | No Spillage Occurred |

**DATA SHEET NO. 13**

**DUMMY/VEHICLE TEMPERATURE AND HUMIDITY STABILIZATION**

Test Vehicle: 2020 Hyundai Palisade 5-Door MPV NHTSA No. M20204204

Test Program: NCAP Side Pole Impact Test Test Date: 02/19/20



# APPENDIX A
# PHOTOGRAPHS

## TABLE OF PHOTOGRAPHS

## TABLE OF PHOTOGRAPHS … (CONTINUED)

## TABLE OF PHOTOGRAPHS … (CONTINUED)

FIGURE 1. As-Delivered Right Front ¾ View of Test Vehicle


FIGURE 2. As-Delivered Left Rear ¾ 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 ¾ View of Test Vehicle


FIGURE 6. Post-Test Left Front ¾ 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 ¾ View of Test Vehicle


FIGURE 10. Post-Test Left Rear ¾ 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

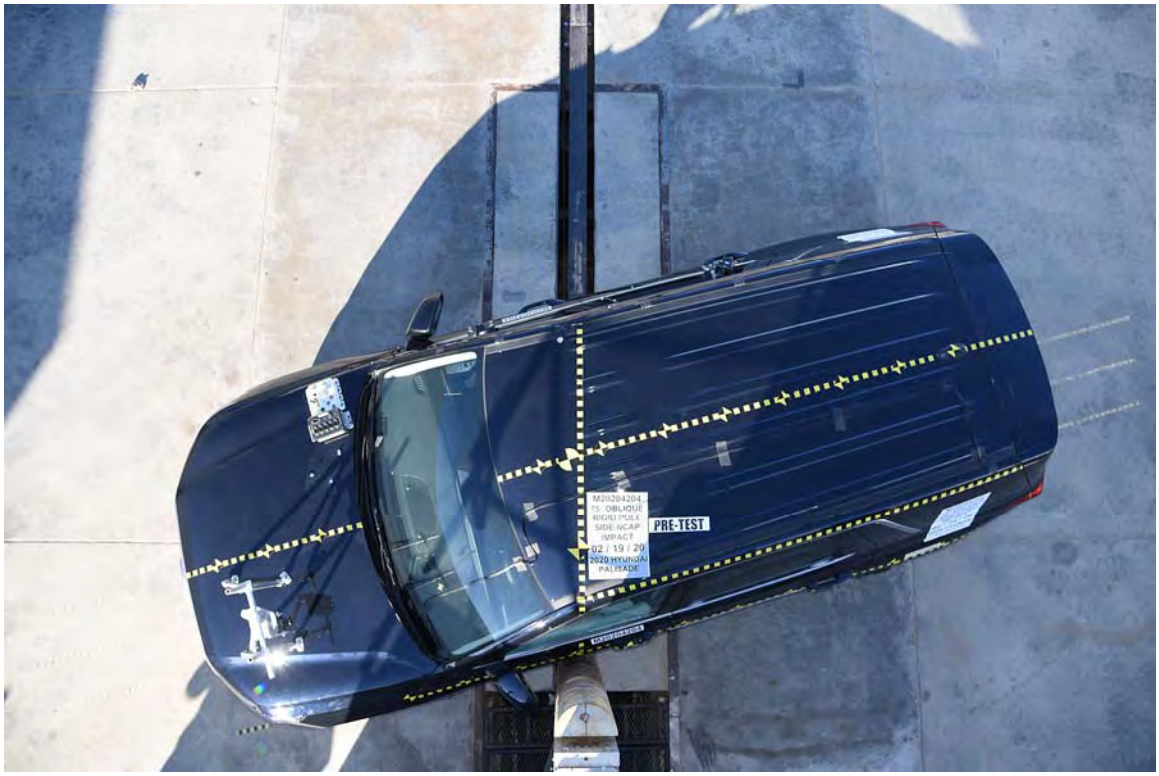



FIGURE 15. Pre-Test Overhead View of Test Area


FIGURE 16. Post-Test Overhead View of Test Area


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


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


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


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


FIGURE 21. Pre-Test Front Close-Up View of Dummy Head and Chest


FIGURE 22. Post-Test Front Close-Up View of Dummy


FIGURE 23. Pre-Test Left Side View of Dummy Showing Belt and Chalking

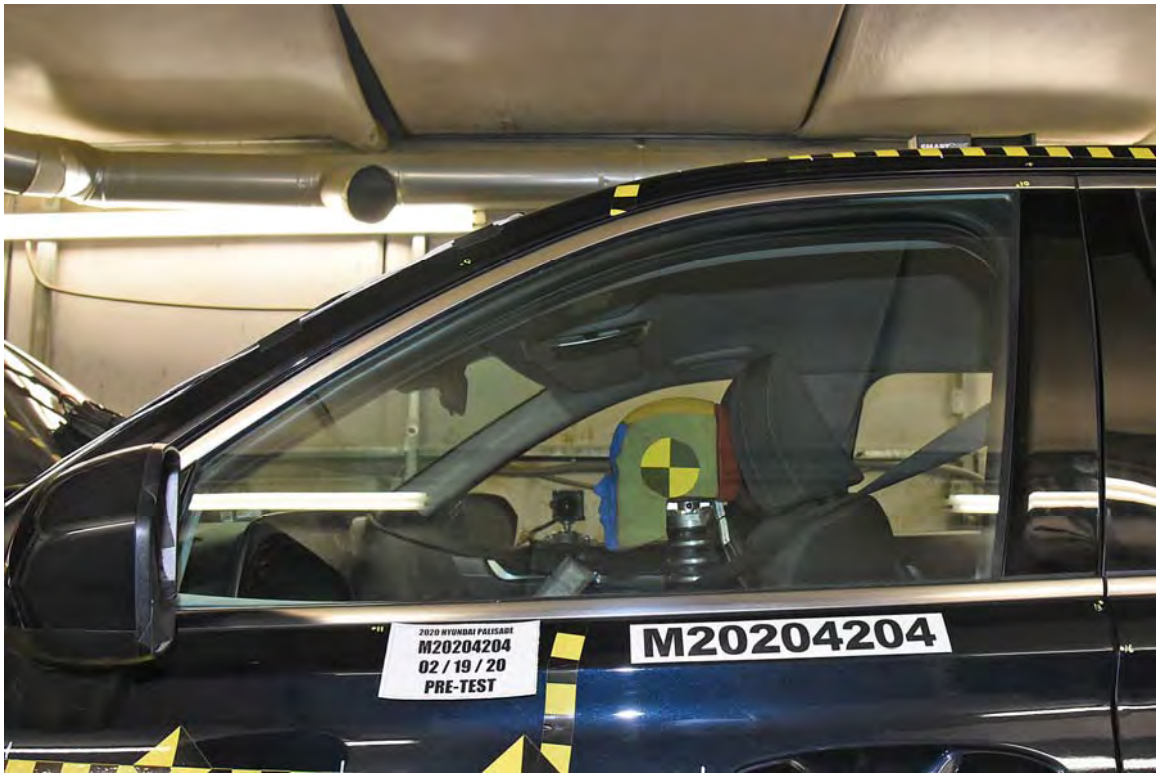



FIGURE 24. Pre-Test Left Side View of Dummy Shoulder and Door Top View


FIGURE 25. Post-Test Left Side View of Dummy Shoulder and Door Top View


FIGURE 26. Pre-Test Frontal View of Seat Back Prior to Dummy Positioning


FIGURE 27. Pre-Test Frontal Close-Up View of
Dummy Head and Shoulders in Relation to Head Restraint


FIGURE 28. Pre-Test Overhead View of Seat Pan Prior to Dummy Positioning


FIGURE 29. Pre-Test Overhead View of Dummy Thighs on Seat Pan


FIGURE 30. Pre-Test Left Side View of Dummy's Neck
Showing Position of Adjustable Neck Bracket


FIGURE 31. Pre-Test Left Side View of Dummy's Head

Showing Dummy’s Head is Level


FIGURE 32. Pre-Test Placement of Dummy's Feet


FIGURE 33. Pre-Test View of Belt Anchorage for Dummy


FIGURE 34. Pre-Test Left Side View of Steering Wheel


FIGURE 35. View of Disengaged Parking Brake


FIGURE 36. Pre-Test View of Parking Brake

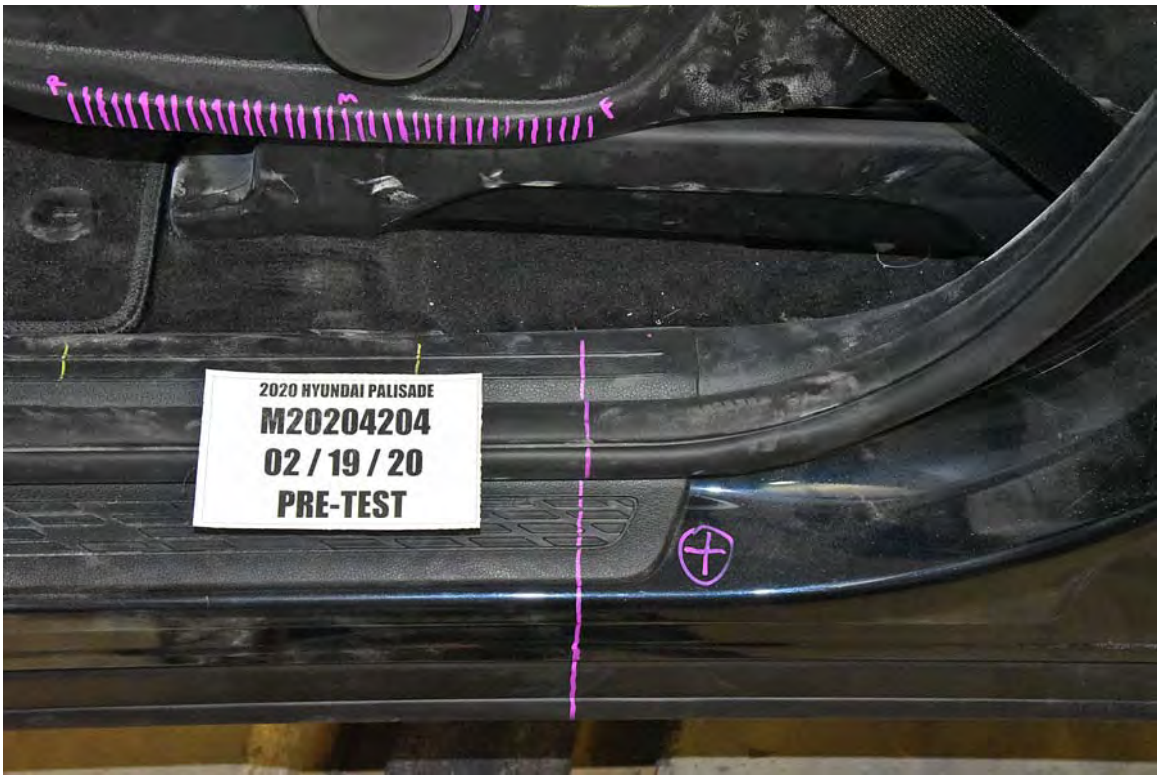



FIGURE 37. Pre-Test Close-Up Left Side View of Driver Seat Track


FIGURE 38. Pre-Test Close-Up Left Side View of Driver Seat Back


FIGURE 39. Pre-Test Close-Up View of Driver Seat Back or Head Restraint

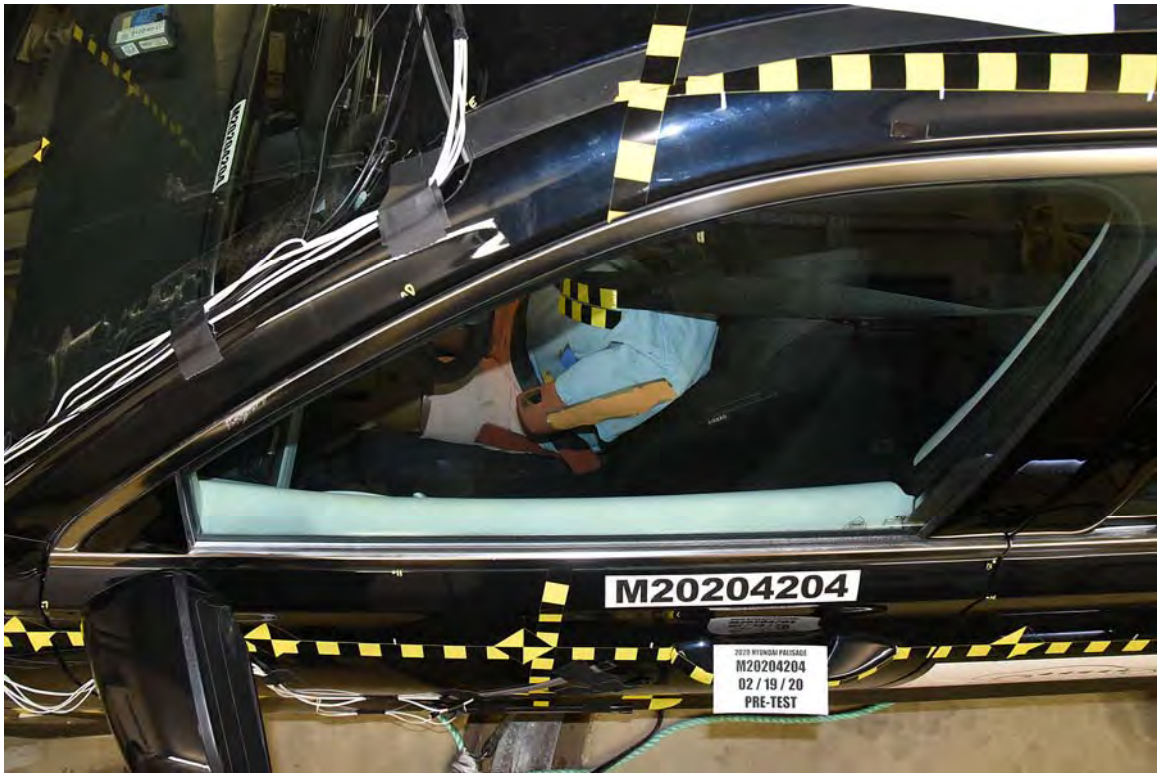



FIGURE 40. Pre-Test Dummy and Door Clearance View


FIGURE 41. Post-Test Dummy and Door Clearance View


FIGURE 42. Pre-Test Right Side View of Dummy and
Front Seat of Occupant Compartment


FIGURE 43. Post-Test Right Side View of Dummy and
Front Seat of Occupant Compartment


FIGURE 44. Pre-Test Inner Door Panel View


FIGURE 45. Post-Test Inner Door Panel View Showing Dummy Contact Locations


FIGURE 46. Post-Test Dummy Close-Up Head Contact with Vehicle Interior View


FIGURE 47. Post-Test Dummy Close-Up Head Contact With Side Airbag View

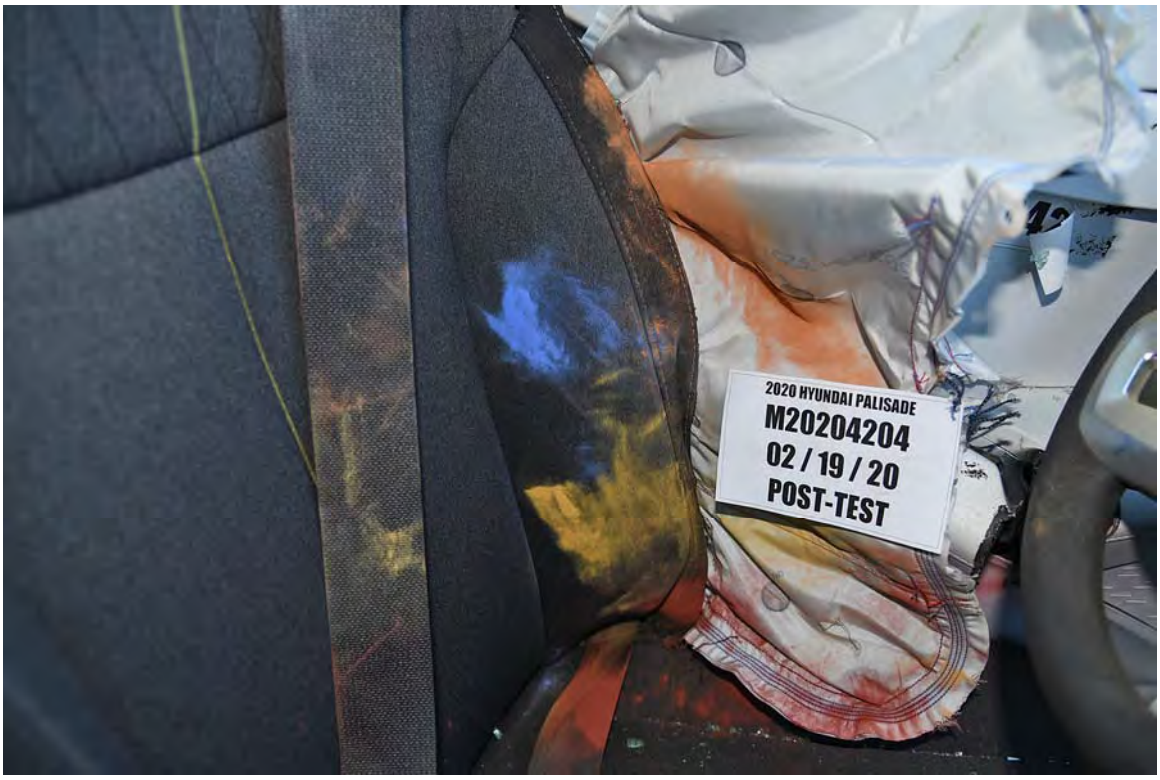



FIGURE 48. Post-Test Dummy Close-Up Torso Contact With Vehicle Interior View


FIGURE 49. Post-Test Dummy Close-Up Torso Contact With Side Airbag View


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


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

Photograph Not Applicable

No Driver Knee Contact with Vehicle Interior

FIGURE 52. Post-Test Dummy Close-Up Knee Contact with Vehicle Interior View


FIGURE 53. Pre-Test View of Fuel Filler Cap or Fuel Filler Neck


FIGURE 54. Post-Test View of Fuel Filler Cap or Fuel Filler Neck


FIGURE 55. Close-Up View of Vehicle's Certification Label


FIGURE 56. Close-Up View of Vehicle's Tire Information Placard or Label


FIGURE 57. Pre-Test Pole Barrier Front View


FIGURE 58. Post-Test Pole Barrier Front View


FIGURE 59. Pre-Test Pole Barrier Side View


FIGURE 60. Post-Test Pole Barrier Side View


FIGURE 61. Pre-Test Ballast View

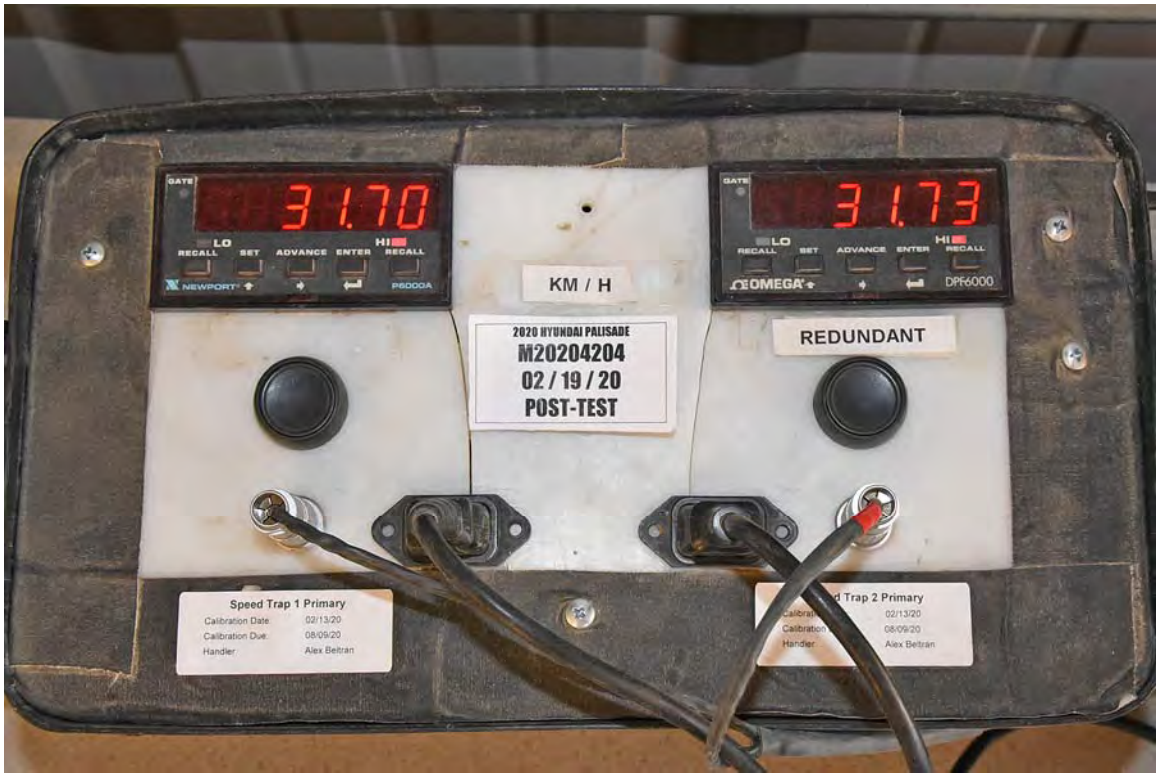



FIGURE 62. Post-Test Primary and Redundant Speed Trap Read-Out

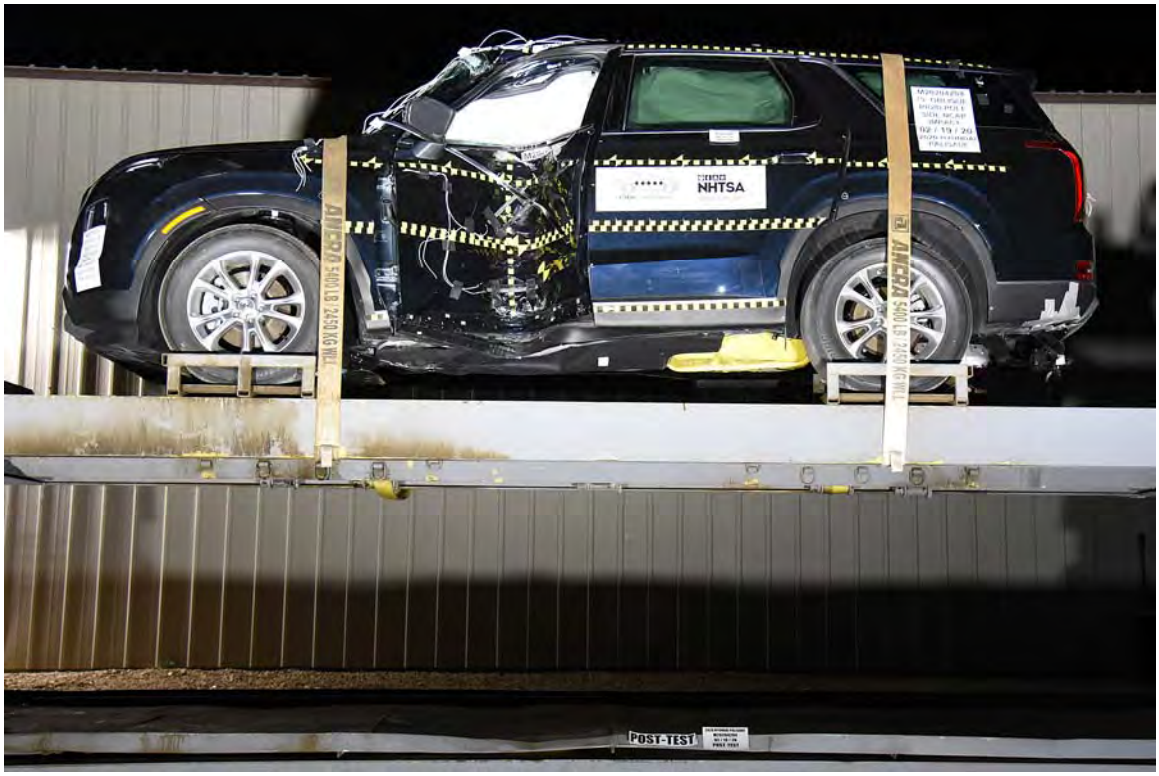



FIGURE 63. FMVSS No. 301 Static Rollover 0 Degrees


FIGURE 64. FMVSS No. 301 Static Rollover 90 Degrees


FIGURE 65. FMVSS No. 301 Static Rollover 180 Degrees

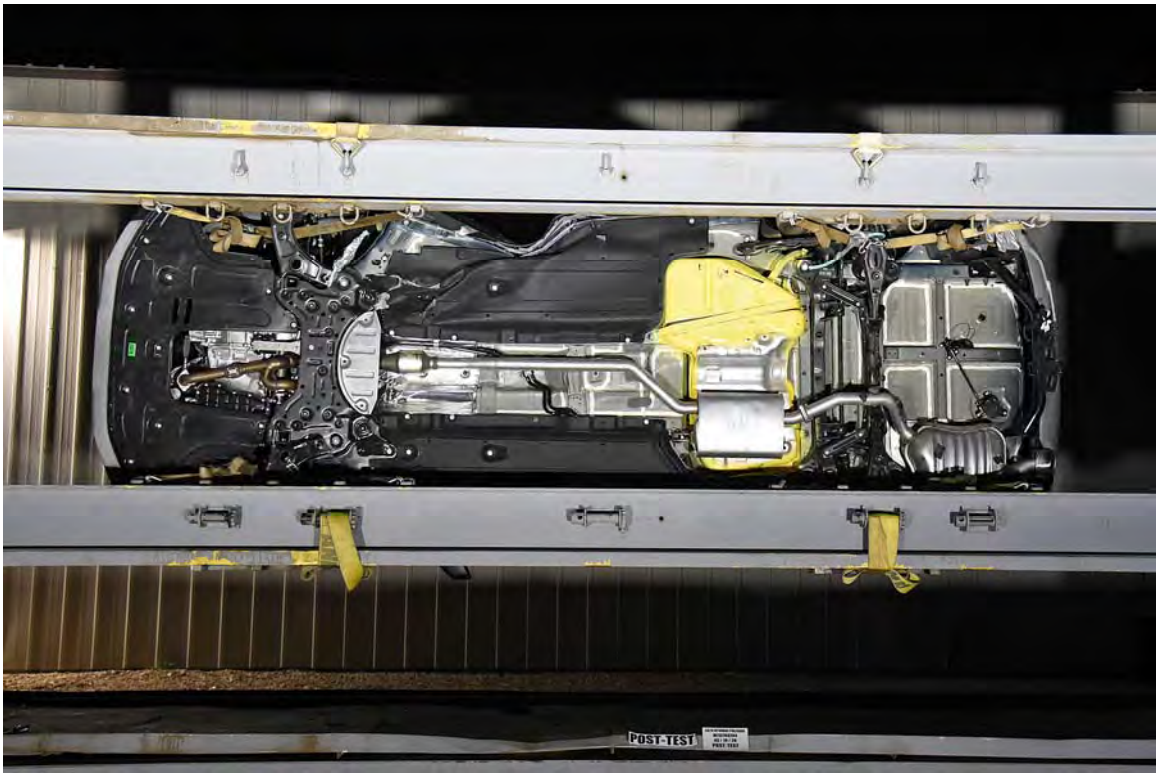



FIGURE 66. FMVSS No. 301 Static Rollover 270 Degrees

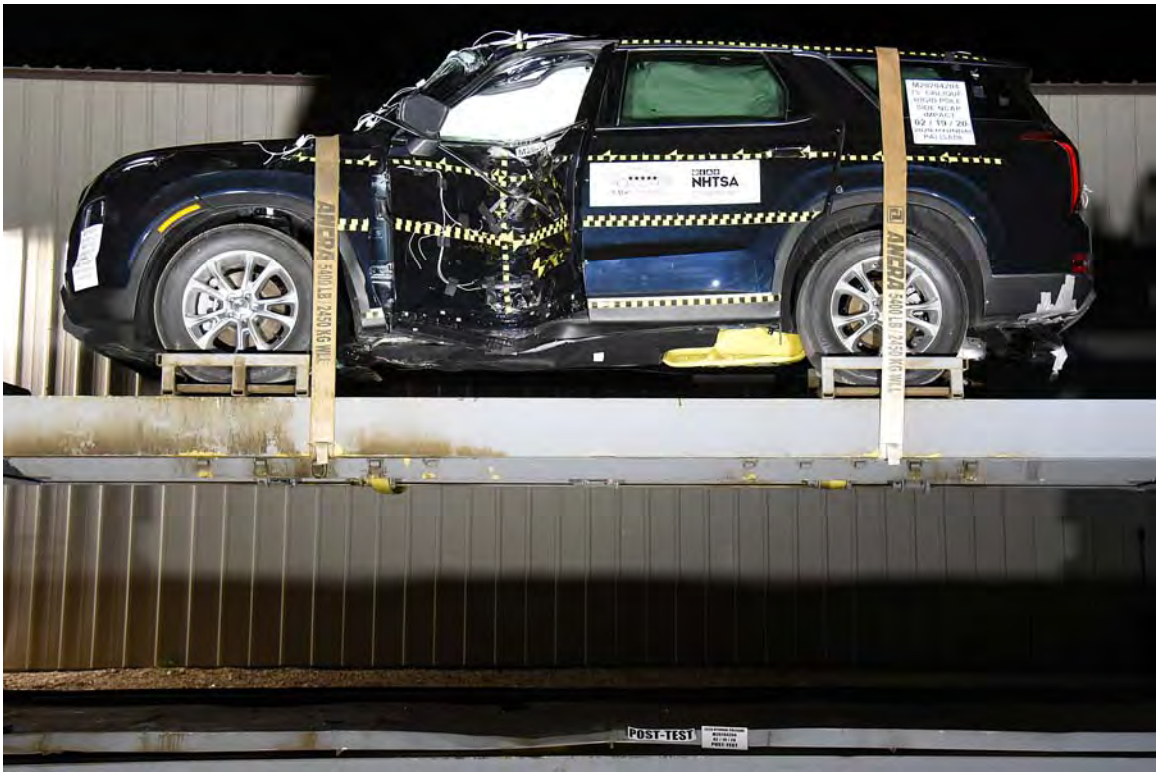



FIGURE 67. FMVSS No. 301 Static Rollover 360 Degrees


FIGURE 68. Impact Event


FIGURE 69. Monroney Label

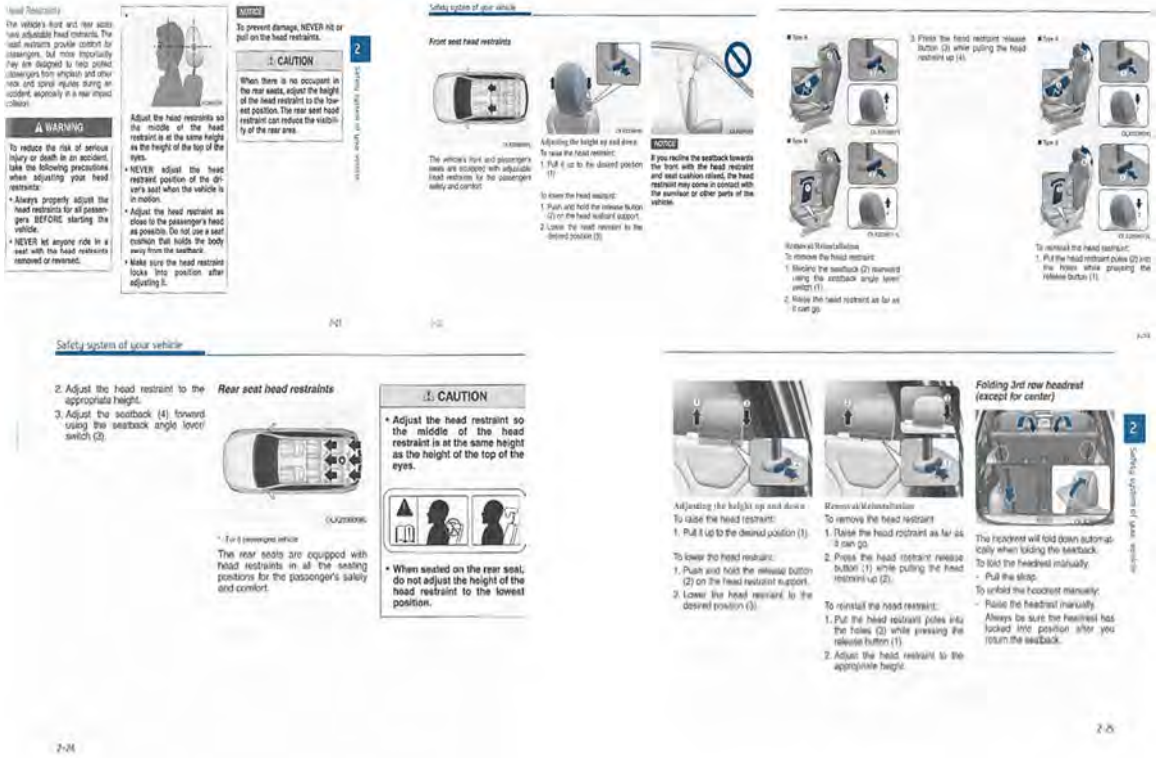



FIGURE 70. Head Restraint Use and Adjustment Information from Vehicle Owner's Manual

FIGURE 71. Post-Test View of Shattered Vehicle Inner Door Panel

# APPENDIX B
# DUMMY RESPONSE DATA

## TABLE OF DATA PLOTS



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

**Additional Driver Dummy Instrumentation Data**

Driver Head Acceleration Redundant (X)

Driver Head Acceleration Redundant (Y)

Driver 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)

Left Floor Sill Acceleration (Y)

Left A-Pillar Sill Acceleration (Y)

Left Lower A-Pillar Acceleration (Y)

Left Mid A-Pillar Acceleration (Y)

Left B-Pillar Sill Acceleration

Left Lower B-Pillar Acceleration (Y)

Left Mid B-Pillar Acceleration (Y)

Driver Seat Track at Dummy Hip Point Acceleration (Y)

Engine Top Acceleration (X)

Engine Top Acceleration (Y)

Firewall Center Acceleration (Y)

Right Roof at Vertical Impact Reference Line Acceleration (Y)

Right Sill at Vertical Impact Reference Line Acceleration (Y)

Rear Floorpan Behind Rear Axle at Centerline Acceleration (X)

Rear Floorpan Behind Rear Axle at Centerline Acceleration (Y)

**Pole Instrumentation Data**

Load Cell Pole Barrier #1 Force (Y)

Load Cell Pole Barrier #2 Force (Y)

Load Cell Pole Barrier #3 Force (Y)

Load Cell Pole Barrier #4 Force (Y)

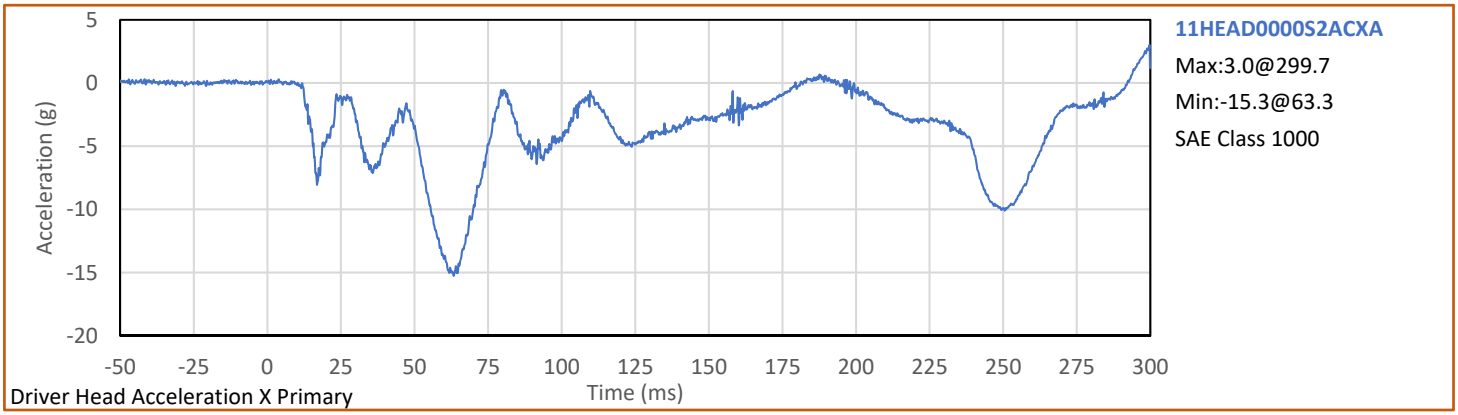
Load Cell Pole Barrier #5 Force (Y)

Load Cell Pole Barrier #6 Force (Y)

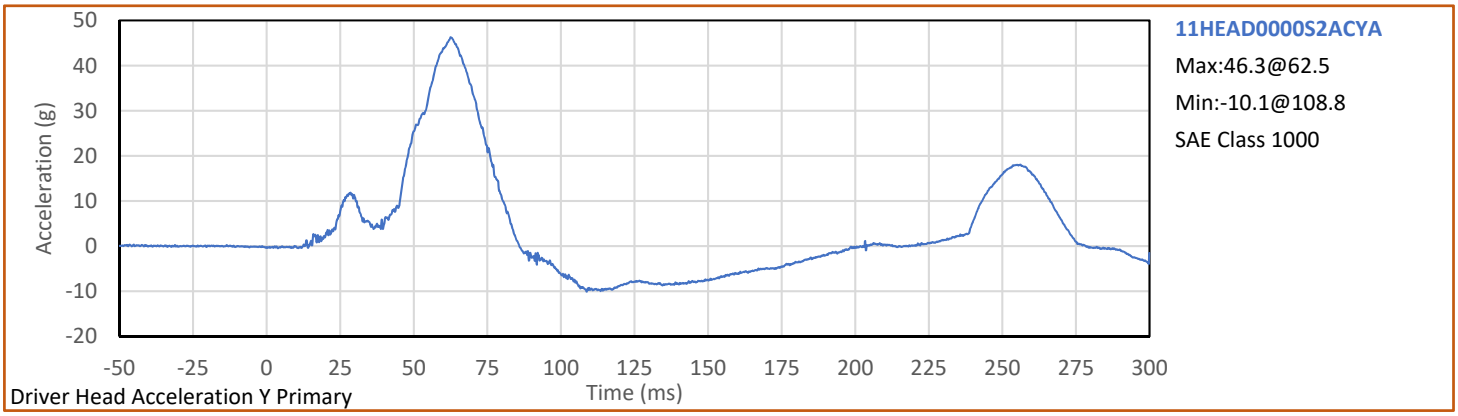
Load Cell Pole Barrier #7 Force (Y)

Load Cell Pole Barrier #8 Force (Y)

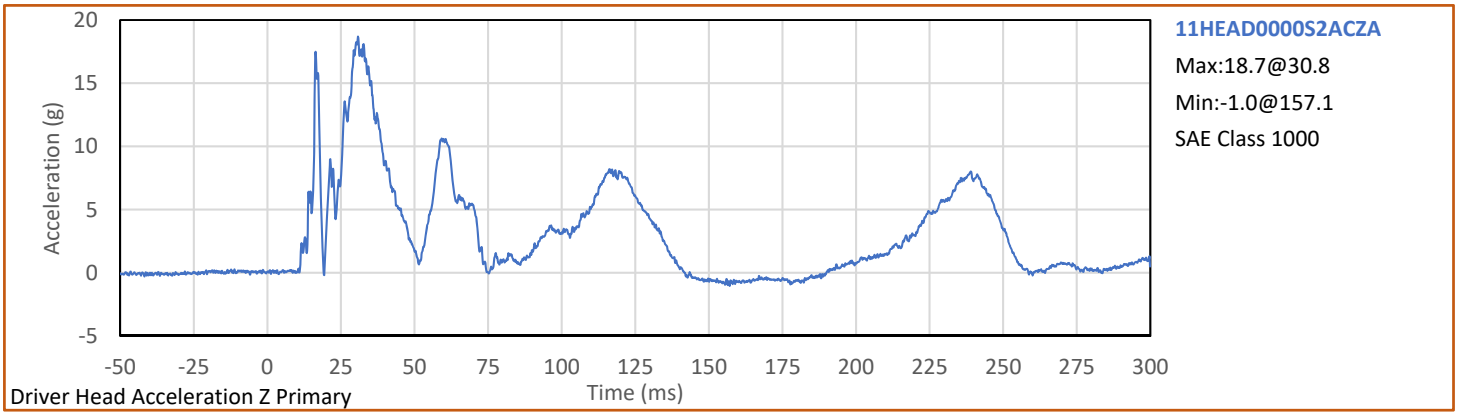
| | | | |
|---|---|---|---|
| Test Vehicle: | 2020 Hyundai Palisade 5-Door MPV | NHTSA No.: | M20204204 |
| Test Program: | NCAP Side Pole Impact Test | Test Date: | 2/19/2020 |



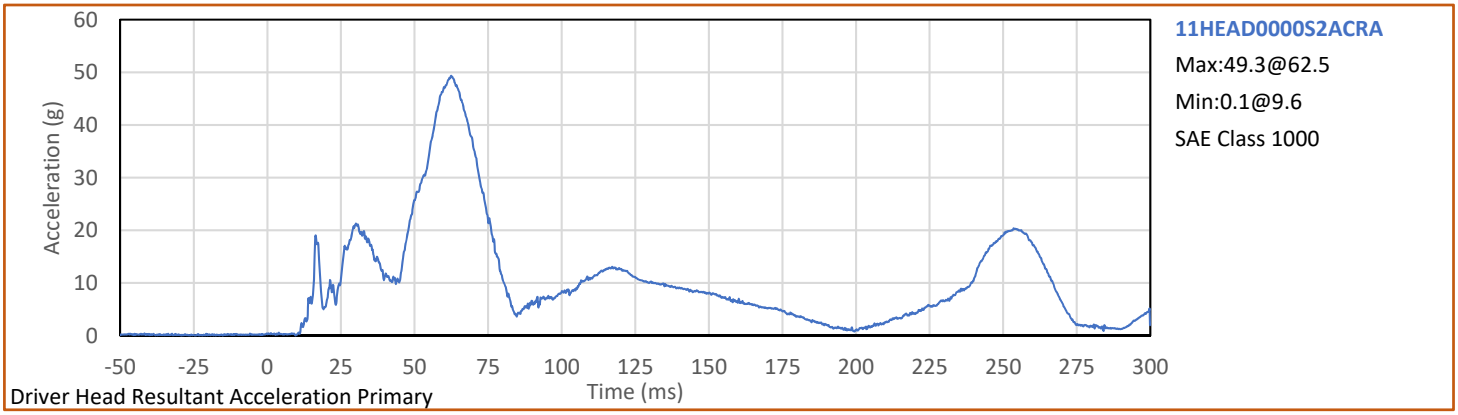
Driver Head Acceleration X Primary



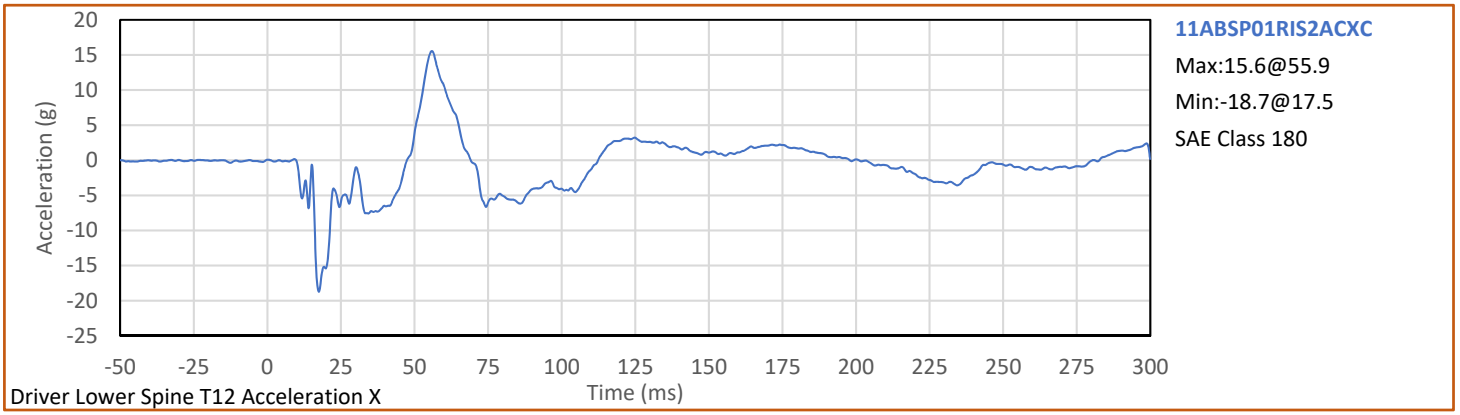
Driver Head Acceleration Y Primary



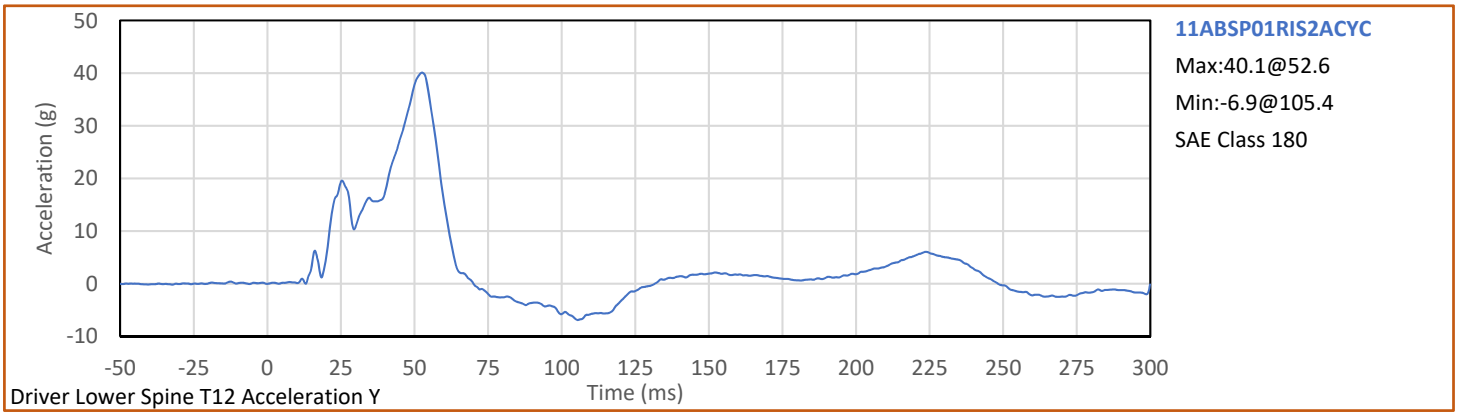
Driver Head Acceleration Z Primary



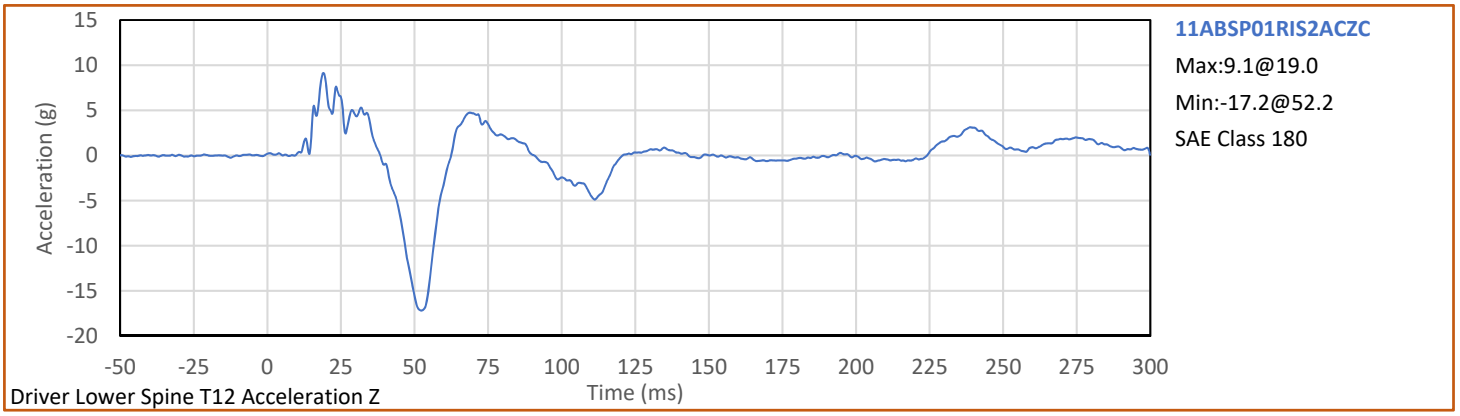
Driver Head Resultant Acceleration Primary



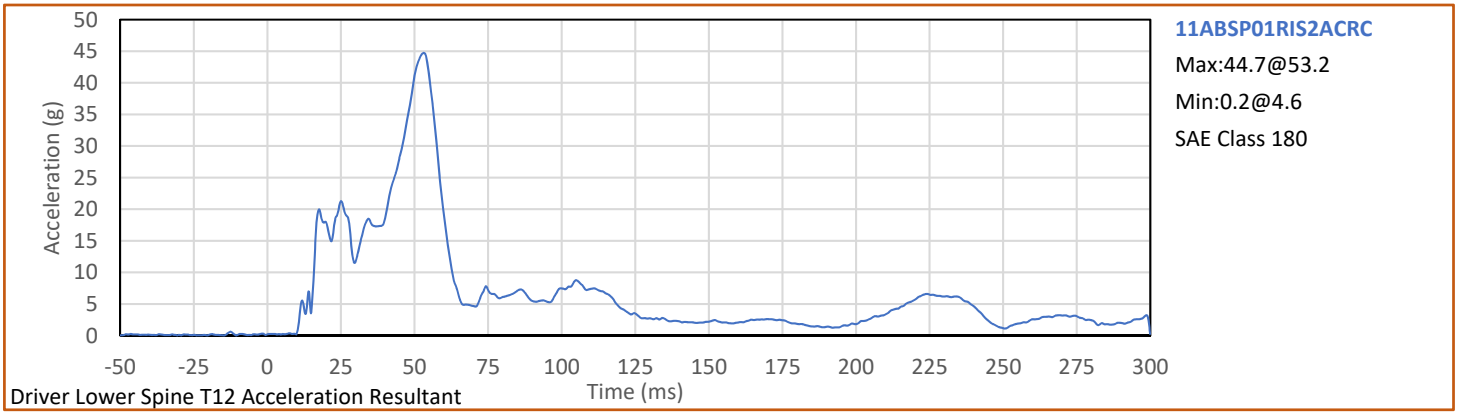
Driver Lower Spine T12 Acceleration X



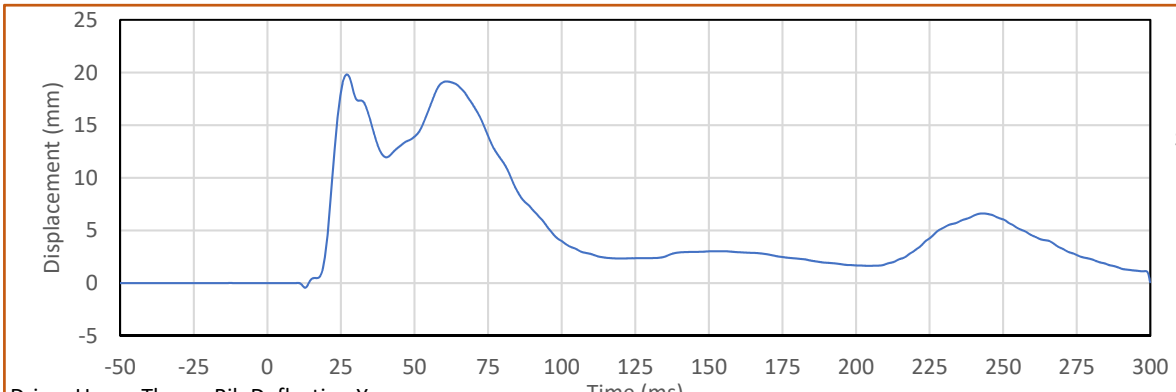
Driver Lower Spine T12 Acceleration Y



Driver Lower Spine T12 Acceleration Z

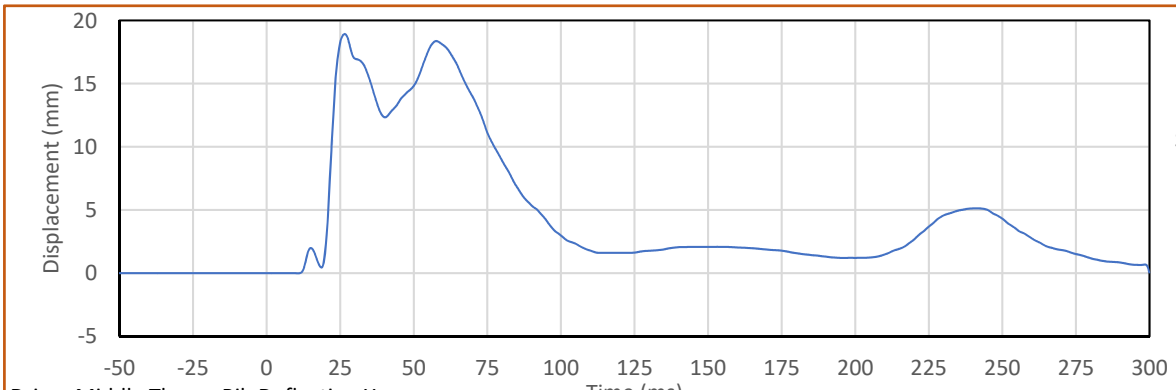


Driver Lower Spine T12 Acceleration Resultant



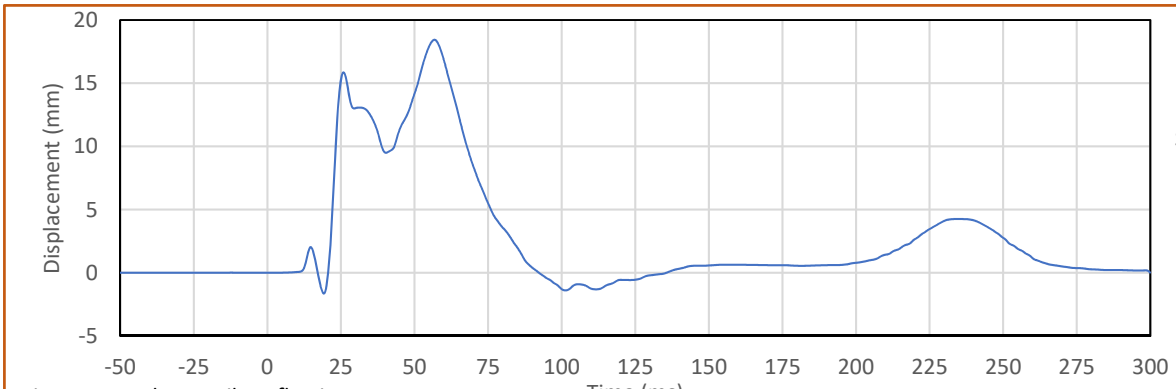

Driver Upper Thorax Rib Deflection Y

**11TRRI01LES2DSYC**
Max:19.8@27.0
Min:-0.4@12.8
SAE Class 180



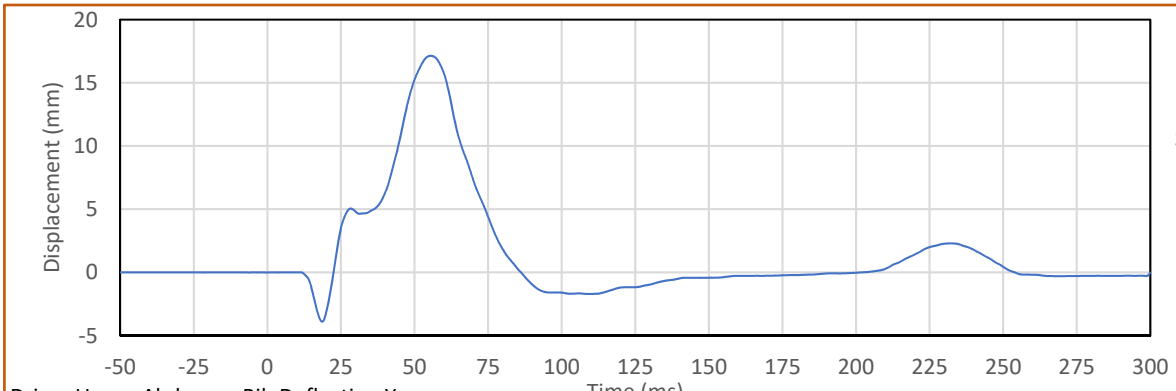

Driver Middle Thorax Rib Deflection Y

**11TRRI02LES2DSYC**
Max:18.9@26.5
Min:0.0@10.7
SAE Class 180



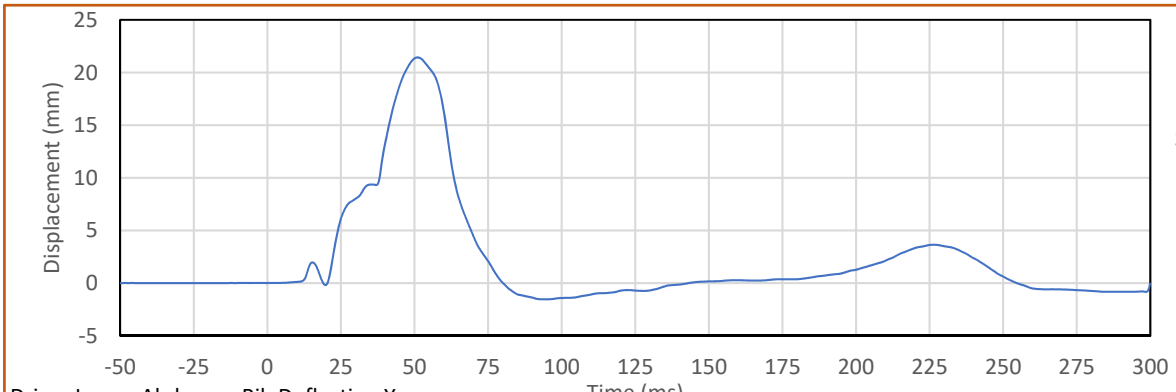

Driver Lower Thorax Rib Deflection Y

**11TRRI03LES2DSYC**
Max:18.4@56.8
Min:-1.6@19.2
SAE Class 180




Driver Upper Abdomen Rib Deflection Y

**11ABRI01LES2DSYC**
Max:17.1@55.5
Min:-3.9@18.6
SAE Class 180




Driver Lower Abdomen Rib Deflection Y

**11ABRI02LES2DSYC**
Max:21.4@51.0
Min:-1.5@95.0
SAE Class 180


Driver Acetabulum Impact Side Force Y

**11ACTBLE00S2FOYB**
Max:2299.9@48.6
Min:-136.1@72.0
SAE Class 600


Driver Iliac Wing Impact Side Force Y

**11ILACLE00S2FOYB**
Max:962.6@50.2
Min:-29.3@257.8
SAE Class 600


Driver Combined Pelvic Force

**11PELVLE00S2FOYB**
Max:3221.1@48.5
Min:-86.2@102.1
SAE Class 600

# APPENDIX C
# ATD CONFIGURATION AND PERFORMANCE VERIFICATION DATA

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

Applus IDIADA
KARCO

## SID-IIs Small Side Impact ATD
## External Measurements

ATD Serial No.: 308 Test Date: 2020-01-28

| 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 | 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 | 83 | Pass |
| D - H Point From Seatback | mm | 141 | 151 | 145 | Pass |
| E - Shoulder Pivot From Backline | mm | 97 | 107 | 104 | Pass |
| F - Thigh Clearance | mm | 119 | 135 | 123 | Pass |
| G - Head Breadth | mm | 140 | 148 | 146 | Pass |
| H - Head Back From Backline | mm | 40 | 46 | 44 | Pass |
| I - Head Depth | mm | 178 | 188 | 187 | Pass |
| J - Head Circumference | mm | 541 | 551 | 545 | Pass |
| K - Buttock To Knee Length | mm | 514 | 540 | 530 | Pass |
| L - Popliteal Height | mm | 343 | 369 | 351 | Pass |
| K - Knee Pivot To Floor Height | mm | 392 | 409 | 403 | Pass |
| N - Buttock Popliteal Length | mm | 416 | 442 | 438 | Pass |
| O - Chest Depth W/O Jacket | mm | 195 | 211 | 209 | Pass |
| P - Foot Length | mm | 216 | 232 | 220 | Pass |
| Q - Hip Breadth (W/Pelvic Plugs) | mm | 313 | 323 | 319 | Pass |
| R - Arm Length | mm | 249 | 259 | 258 | Pass |
| S - Knee Joint To Seatback | mm | 477 | 493 | 489 | Pass |
| V - Shoulder Width | mm | 341 | 357 | 343 | Pass |
| W - Foot Width | mm | 78 | 94 | 83 | Pass |
| Y - Chest Circumference W/Jacket | mm | 851 | 881 | 863 | Pass |
| Z - Waist Circumference | mm | 761 | 791 | 770 | Pass |
| | | | Overall Test Results | | Pass |

Technician: J. Hernandez

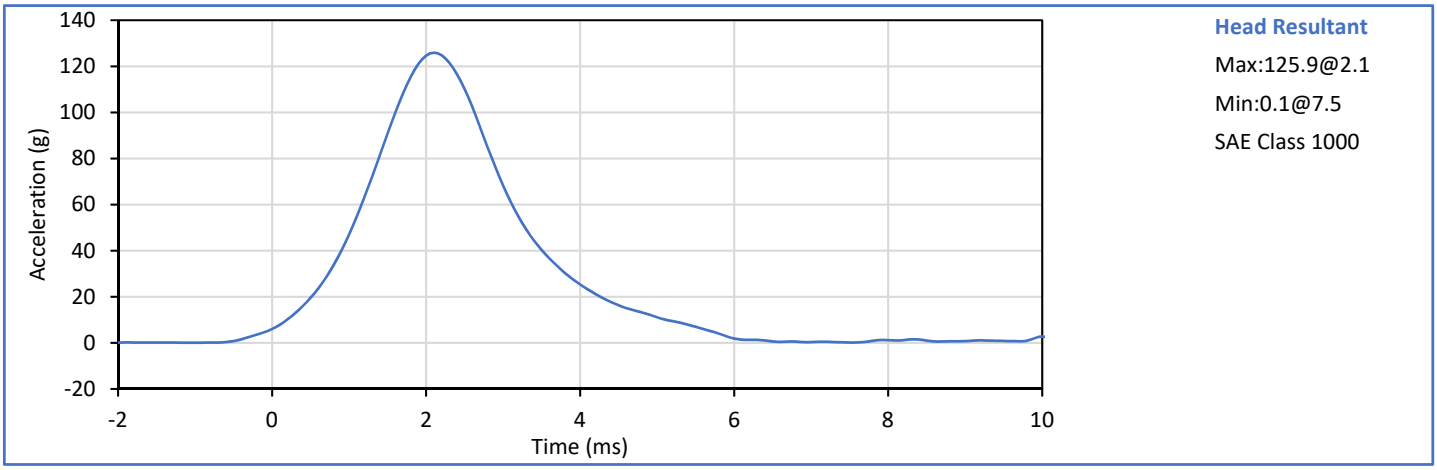
Approved By: P. Puzzuto

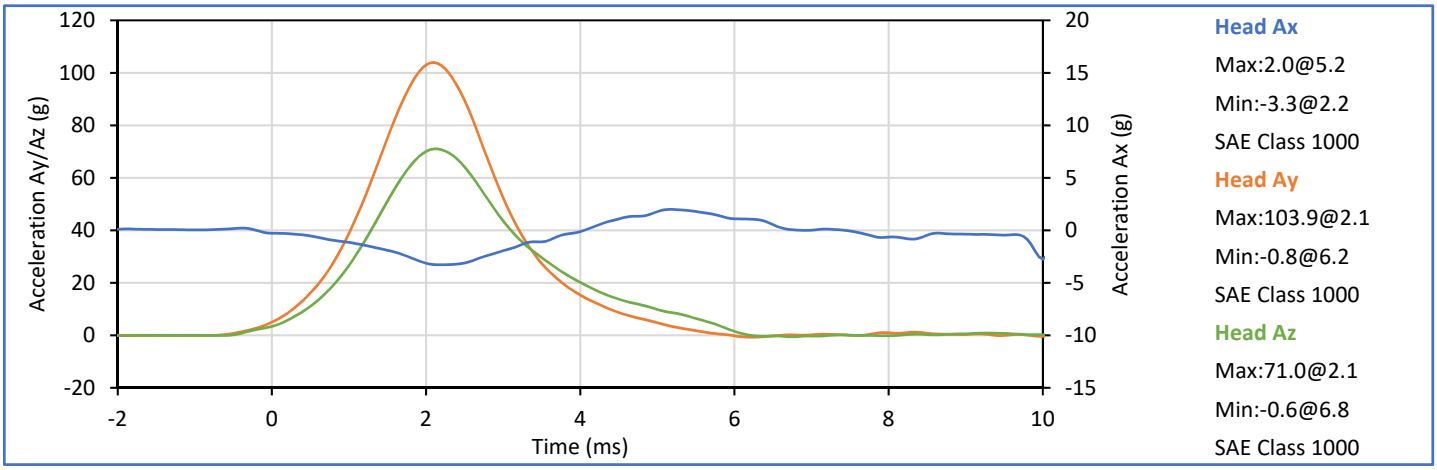
Applus IDIADA KARCO

## SID-IIs Small Side Impact ATD
## Head Drop

ATD Serial No.: 308 Test Date: 2020-01-29

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | °C | 18.9 | 25.6 | 21.1 | Pass |
| Laboratory Humidity | % | 10 | 70 | 27 | Pass |
| Peak Resultant Acceleration | g | 115.0 | 137.0 | 125.9 | Pass |
| Peak Head Ax | g | -15.0 | 15.0 | -3.3 | Pass |
| Oscillations After Main Pulse | % | 0.0 | 15.0 | 2.2 | Pass |
| Is Acceleration Unimodal? | Yes/No | Yes | | Yes | Pass |
| | | | Overall Test Results | | Pass |



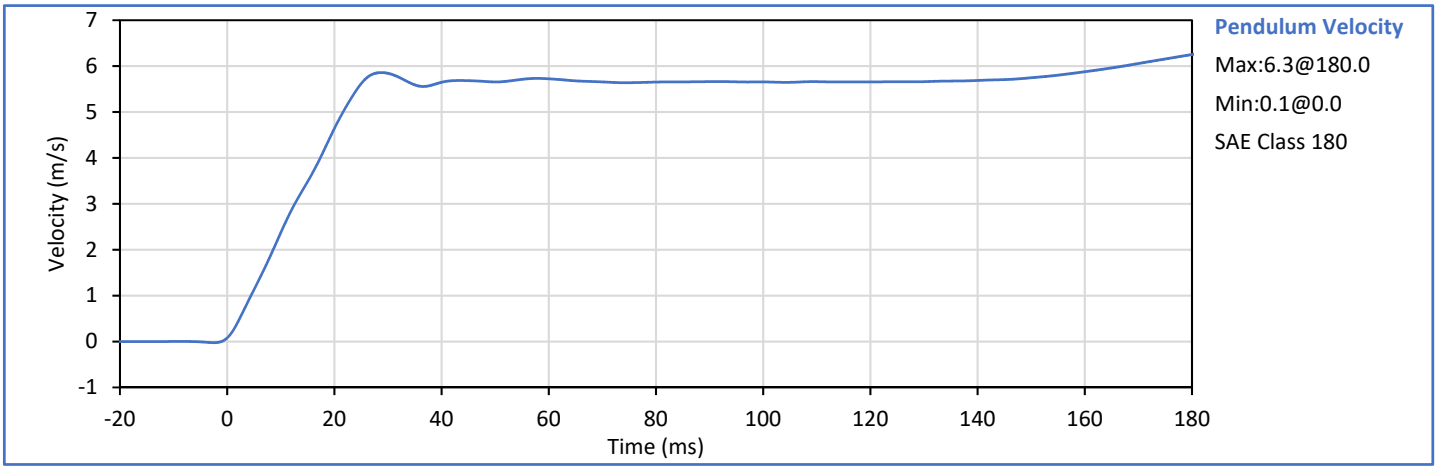

Technician: J. Hernandez Approved By: P. Puzzuto

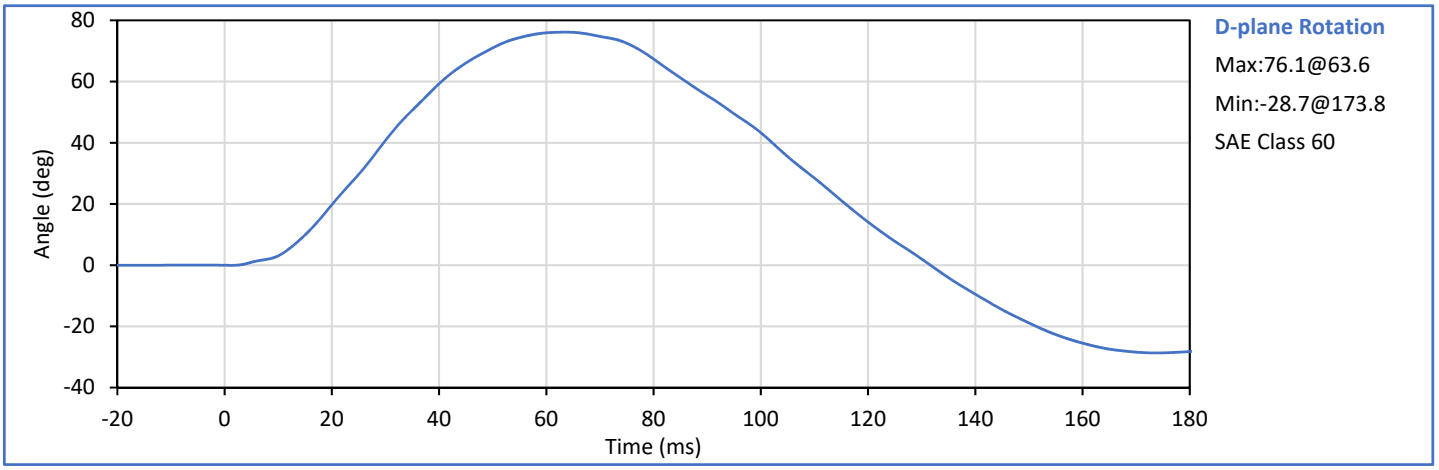
Applus IDIADA KARCO

# SID-IIs Small Side Impact ATD
## Neck Flexion

ATD Serial No.: 308 Test Date: 2020-01-28

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.1 | Pass |
| Laboratory Humidity | % | 10 | 70 | 30 | Pass |
| Pendulum Velocity | m/s | 5.51 | 5.63 | 5.62 | Pass |
| Pendulum Decel at 10 ms | m/s | 2.20 | 2.80 | 2.37 | Pass |
| Pendulum Decel at 15 ms | m/s | 3.30 | 4.10 | 3.48 | Pass |
| Pendulum Decel at 20 ms | m/s | 4.40 | 5.40 | 4.64 | Pass |
| Pendulum Decel at 25 ms | m/s | 5.40 | 6.10 | 5.62 | Pass |
| Pendulum Decel from 25-100 ms | m/s | 5.50 | 6.20 | 5.86 | Pass |
| Peak "D" Plane Rotation | deg | 71.0 | 81.0 | 76.1 | Pass |
| Time of Peak "D" Plane Rotation | ms | 50.0 | 70.0 | 63.6 | Pass |
| Peak Occ. Condyle Moment | Nm | -44.0 | -36.0 | -37.7 | Pass |
| Time of Moment Decay to 0 Nm | ms | 102.0 | 126.0 | 125.1 | Pass |
| | | | Overall Test Results | | Pass |



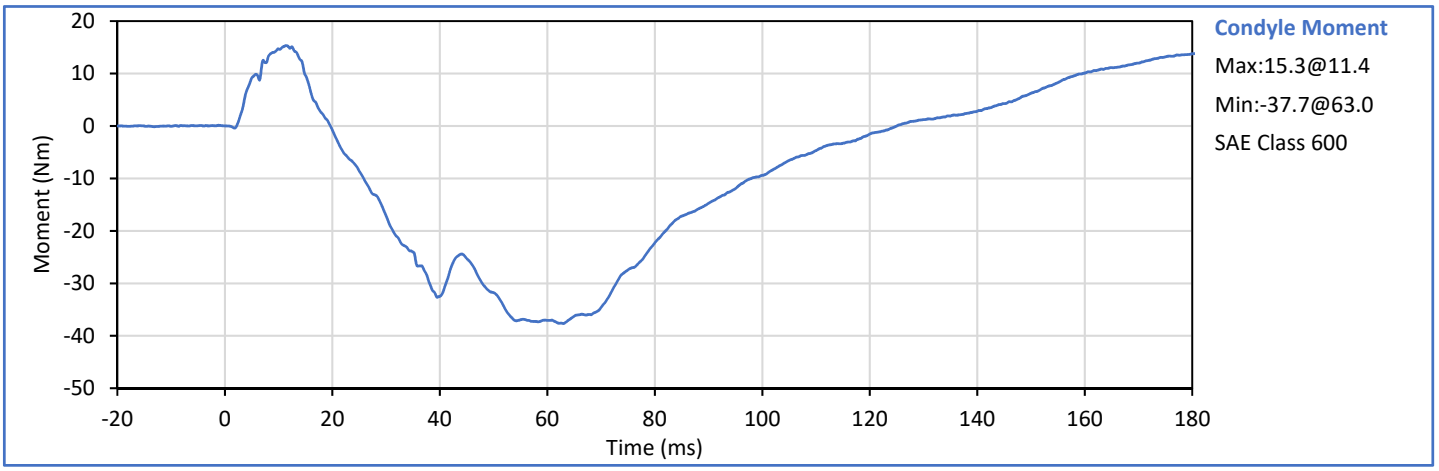

Technician: J. Hernandez

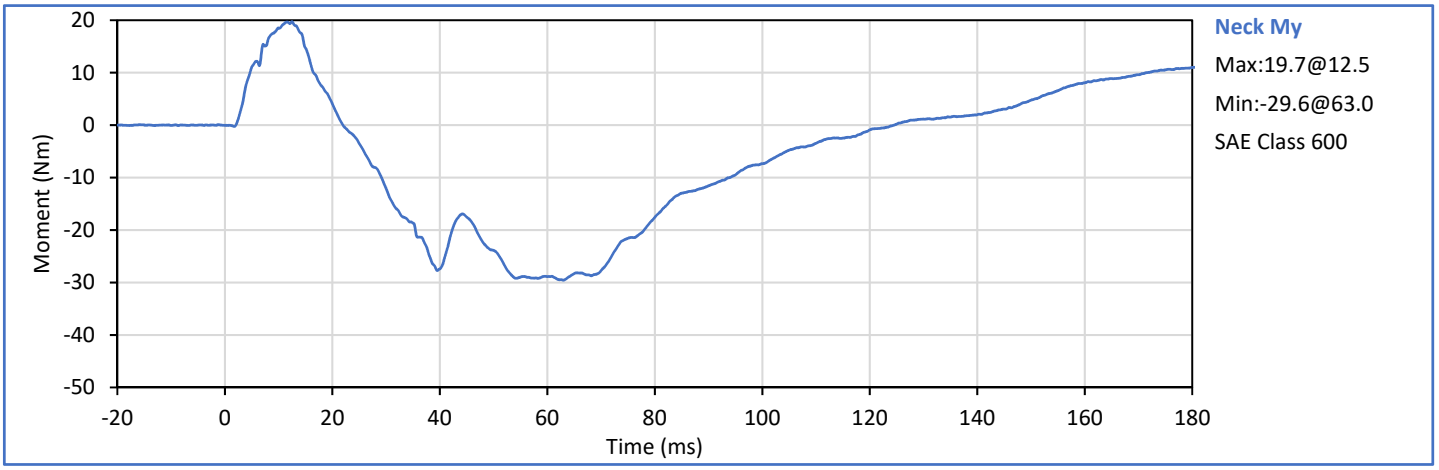
Approved By: P. Puzzuto

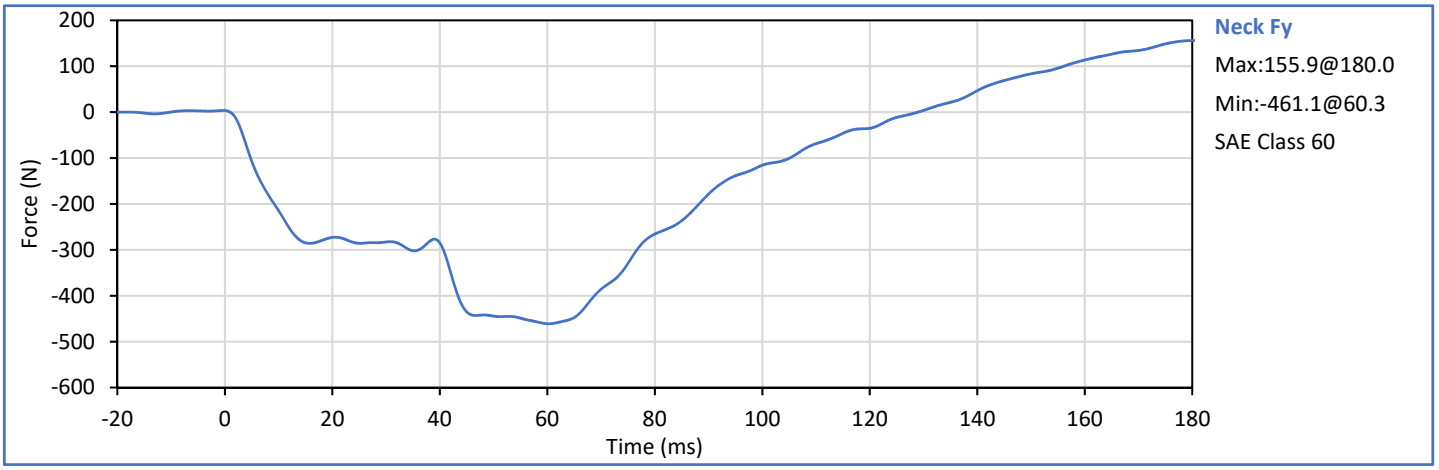
Applus IDIADA KARCO

**SID-IIs Small Side Impact ATD**
**Neck Flexion**

ATD Serial No.: 308 Test Date: 2020-01-28



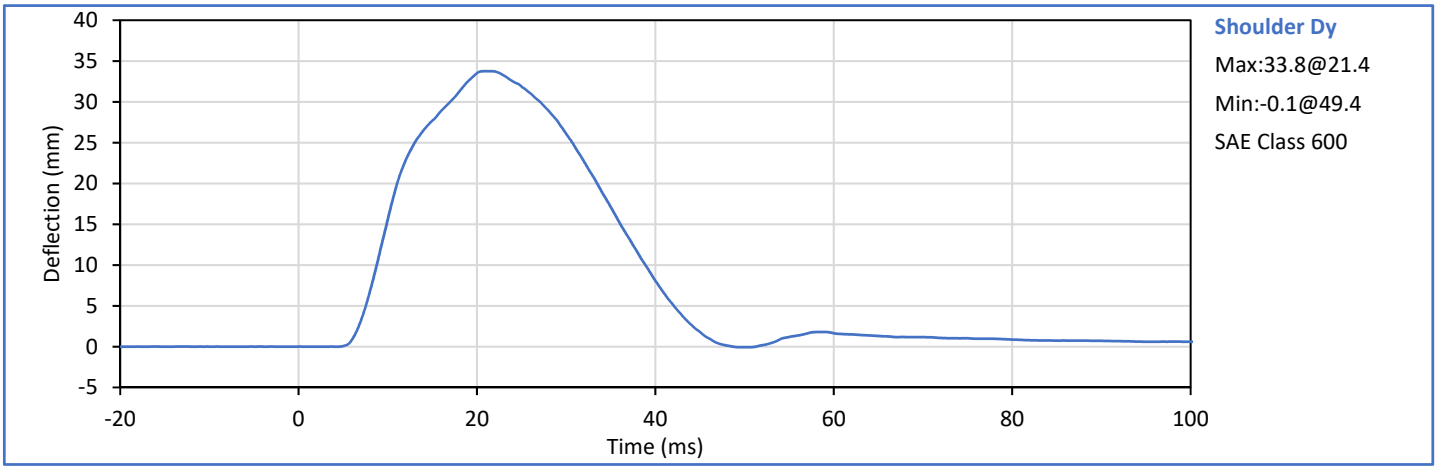



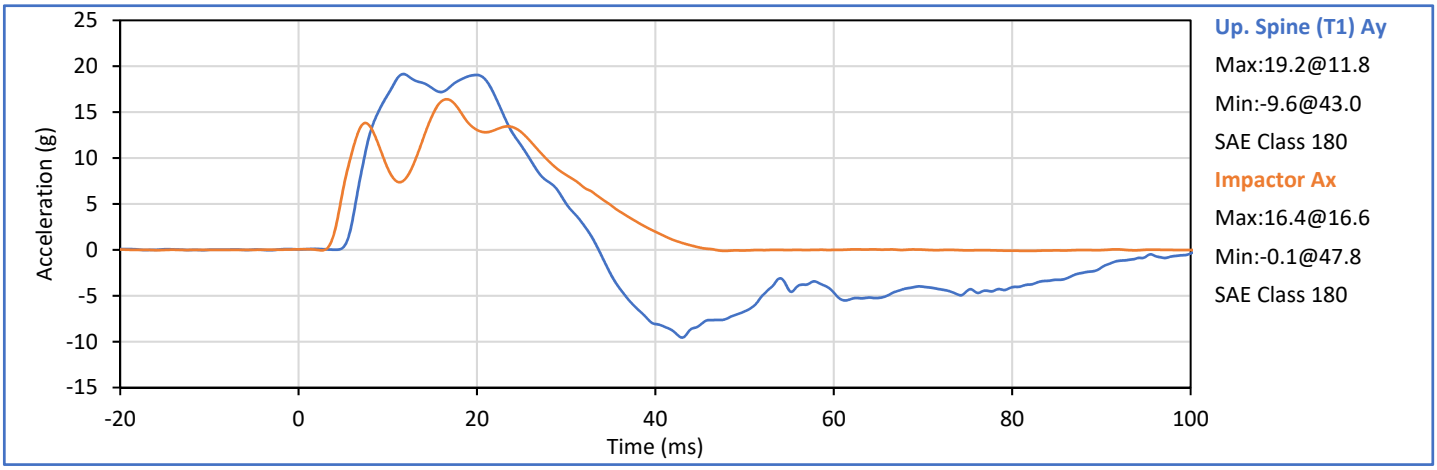
Applus IDIADA
KARCO

**SID-IIs Small Side Impact ATD**
**Shoulder Impact Test**

ATD Serial No.: 308 Test Date: 2020-01-30

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.7 | Pass |
| Laboratory Humidity | % | 10 | 70 | 21 | Pass |
| Impactor Velocity | m/s | 4.20 | 4.40 | 4.28 | Pass |
| Peak Shoulder Dy | mm | 28.0 | 37.0 | 33.8 | Pass |
| Peak Upper Spine (T1) Ay | g | 17.0 | 22.0 | 19.2 | Pass |
| Peak Impactor Ax | g | 13.0 | 18.0 | 16.4 | Pass |
| | | | Overall Test Results | | Pass |




Technician: J. Hernandez

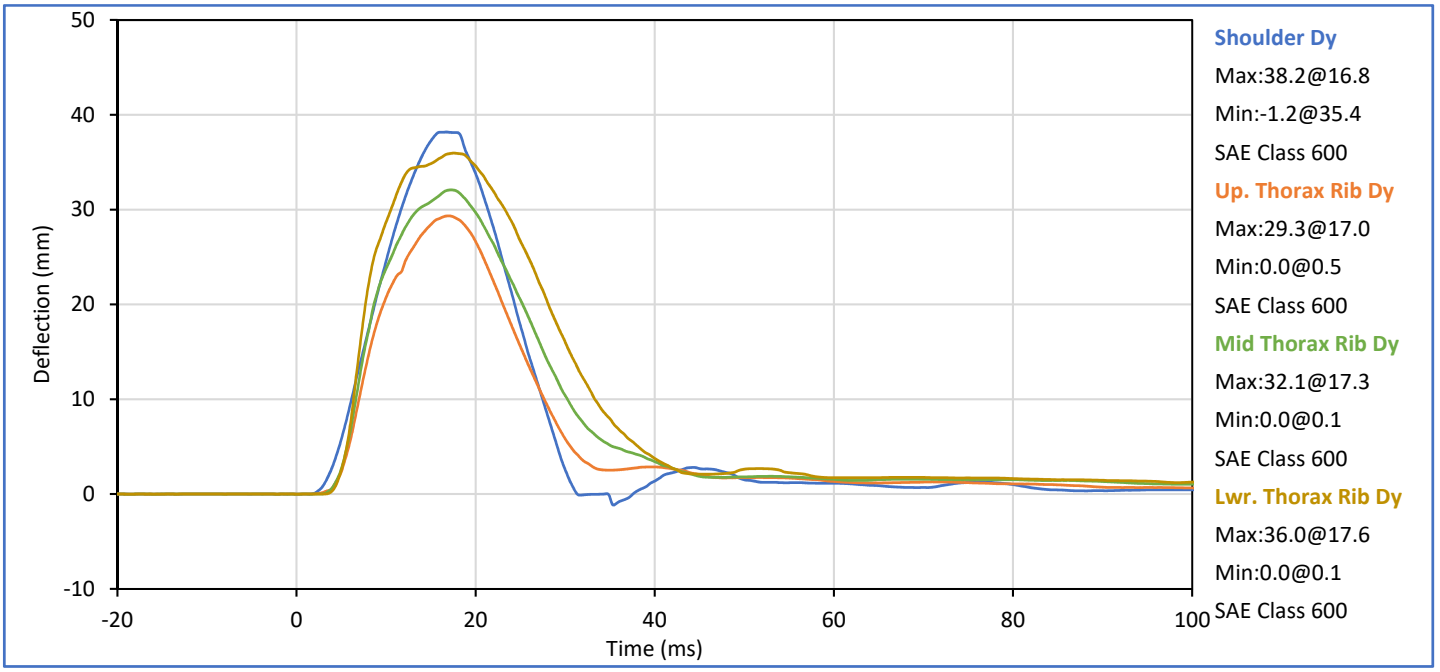
Approved By: P. Puzzuto

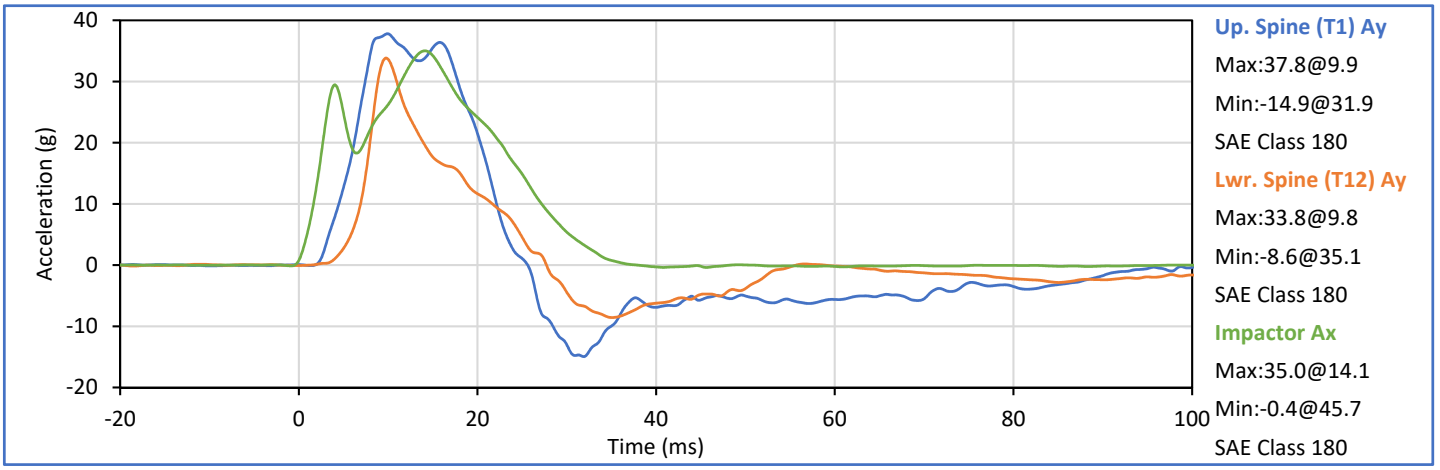
Applus IDIADA
KARCO

# SID-IIs Small Side Impact ATD
## Thorax (With Arm)

ATD Serial No.: 308 Test Date: 2020-01-30

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.7 | Pass |
| Laboratory Humidity | % | 10 | 70 | 21 | Pass |
| Impactor Velocity | m/s | 6.60 | 6.80 | 6.65 | Pass |
| Peak Shoulder Dy | mm | 31.0 | 40.0 | 38.2 | Pass |
| Peak Upper Rib Dy | mm | 25.0 | 32.0 | 29.3 | Pass |
| Peak Middle Rib Dy | mm | 30.0 | 36.0 | 32.1 | Pass |
| Peak Lower Rib Dy | mm | 32.0 | 38.0 | 36.0 | Pass |
| Peak Upper Spine (T1) Ay | g | 34.0 | 43.0 | 37.8 | Pass |
| Peak Lower Spine (T12) Ay | g | 29.0 | 37.0 | 33.8 | Pass |
| Peak Impactor Ax | g | 30.0 | 36.0 | 35.0 | Pass |
| | | | Overall Test Results | | Pass |




Technician: J. Hernandez

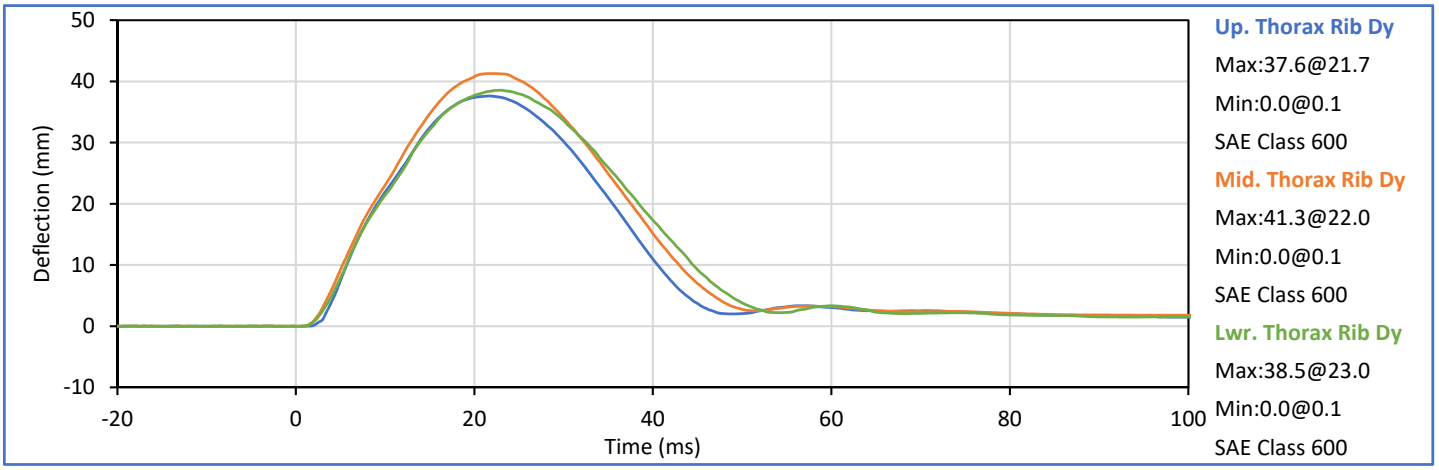
Approved By: P. Puzzuto

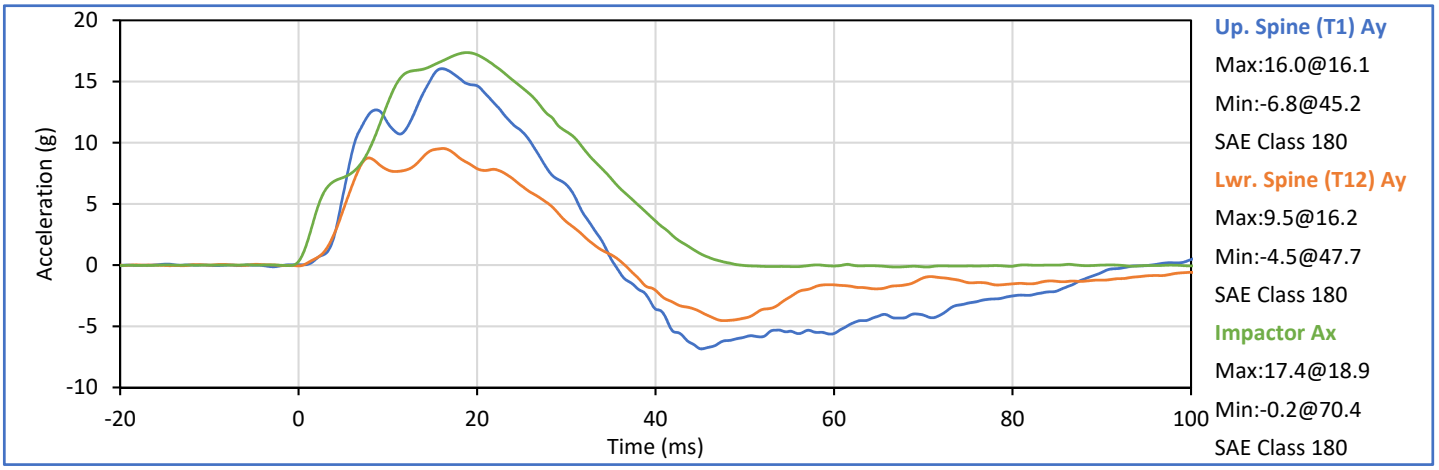
Applus IDIADA KARCO

## SID-IIs Small Side Impact ATD
## Thorax (No Arm)

ATD Serial No.: 308 Test Date: 2020-01-30

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.7 | Pass |
| Laboratory Humidity | % | 10 | 70 | 21 | Pass |
| Impactor Velocity | m/s | 4.20 | 4.40 | 4.31 | Pass |
| Peak Upper Rib Dy | mm | 32.0 | 40.0 | 37.6 | Pass |
| Peak Middle Rib Dy | mm | 39.0 | 45.0 | 41.3 | Pass |
| Peak Lower Rib Dy | mm | 35.0 | 43.0 | 38.5 | Pass |
| Peak Upper Spine (T1) Ay | g | 13.0 | 17.0 | 16.0 | Pass |
| Peak Lower Spine (T12) Ay | g | 7.0 | 11.0 | 9.5 | Pass |
| Peak Impactor Ax | g | 14.0 | 18.0 | 17.4 | Pass |
| | | | Overall Test Results | | Pass |




Technician: J. Hernandez

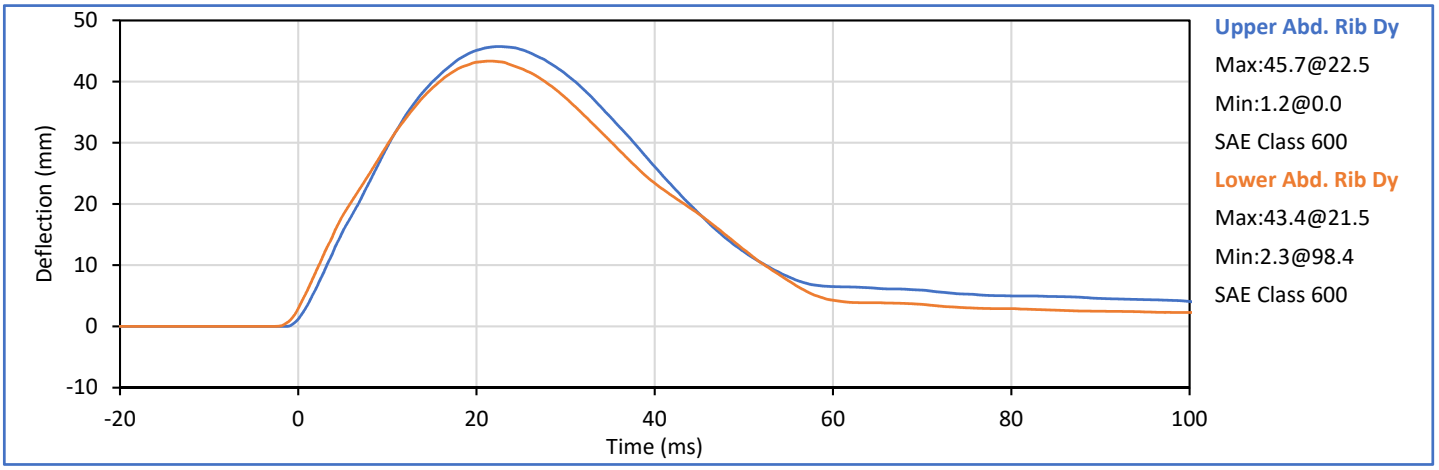
Approved By: P. Puzzuto

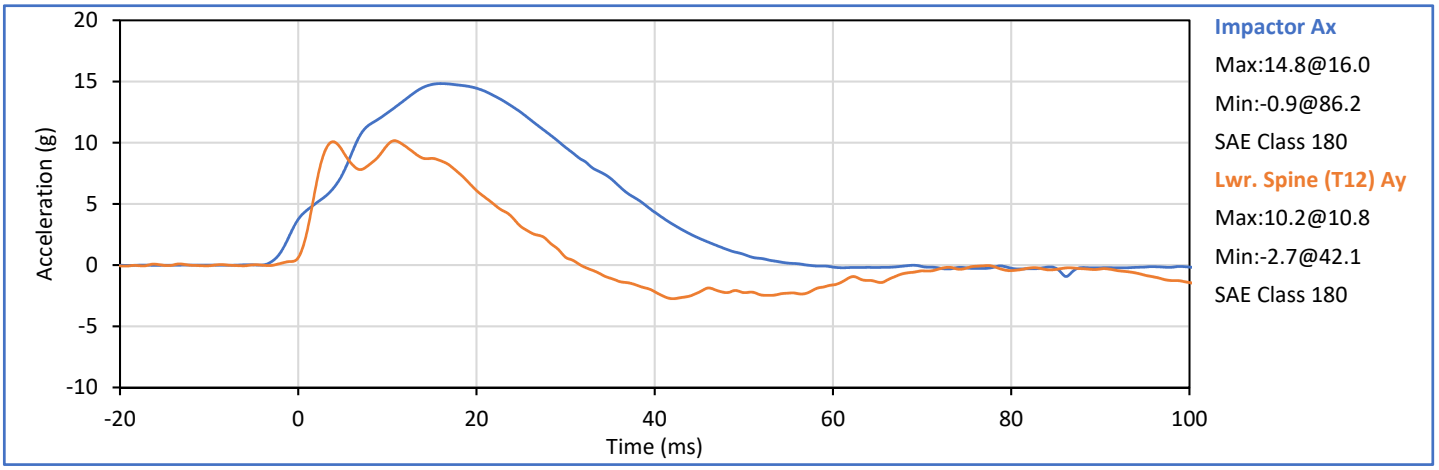
Applus IDIADA KARCO

## SID-IIs Small Side Impact ATD
## Abdomen Impact

ATD Serial No.: 308 Test Date: 2020-01-30

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.7 | Pass |
| Laboratory Humidity | % | 10 | 70 | 20 | Pass |
| Impactor Velocity | m/s | 4.20 | 4.40 | 4.33 | Pass |
| Peak Upper Abdomen Rib Dy | mm | 36.0 | 47.0 | 45.7 | Pass |
| Peak Lower Abdomen Rib Dy | mm | 33.0 | 44.0 | 43.4 | Pass |
| Peak Lower Spine T12 Ay | mm | 9.0 | 14.0 | 10.2 | Pass |
| Peak Impactor Ax | g | 12.0 | 16.0 | 14.8 | Pass |
| | | | Overall Test Results | | Pass |




Technician: J. Hernandez

Approved By: P. Puzzuto

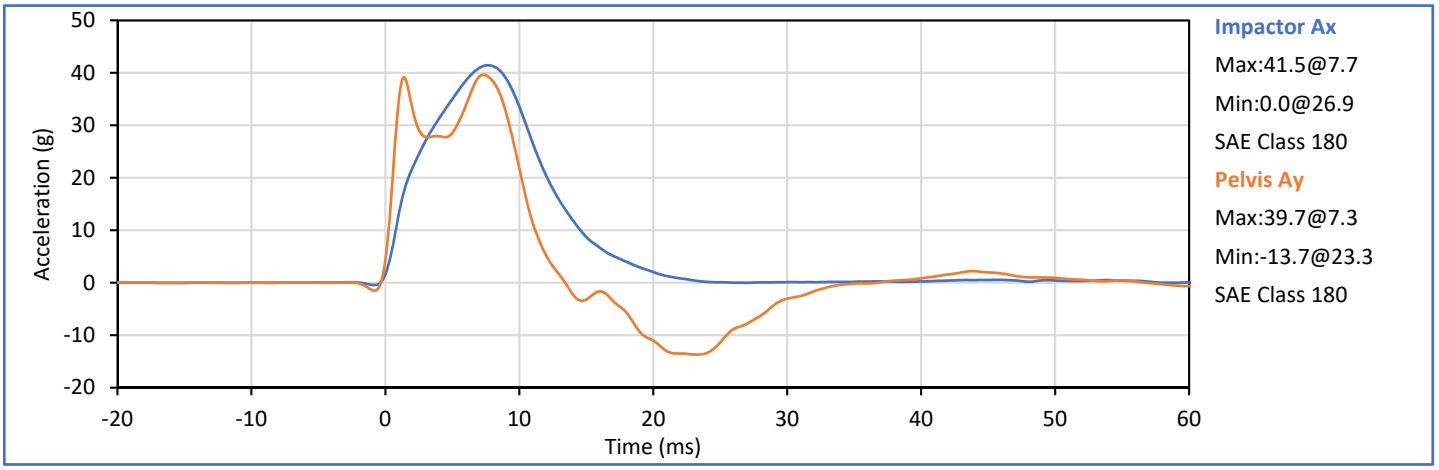
Applus IDIADA KARCO

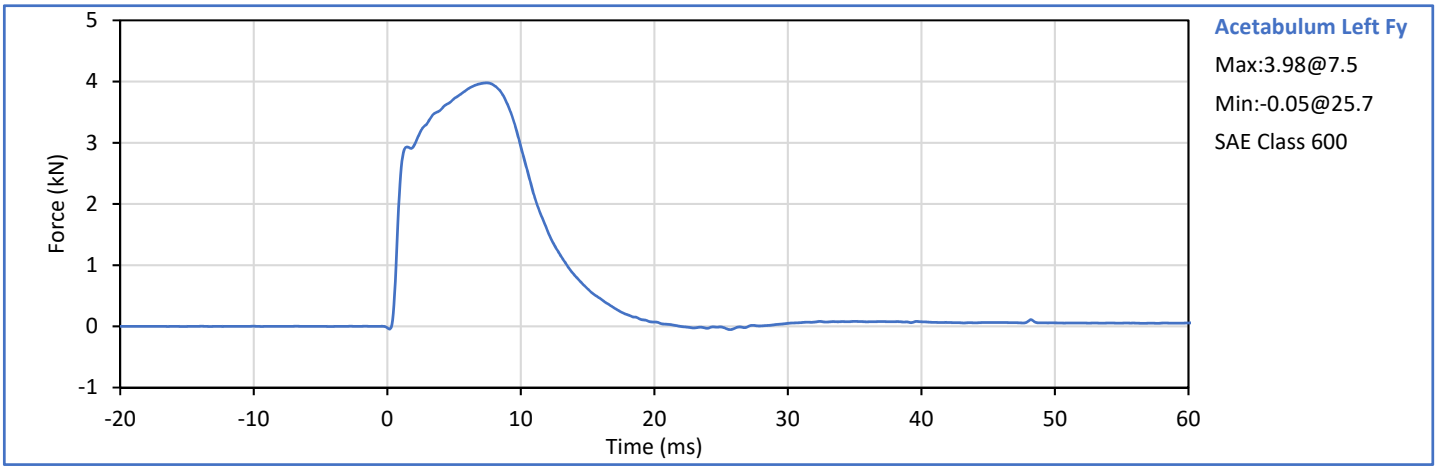
**SID-IIs Small Side Impact ATD**
**Pelvis Acetabulum Impact**

ATD Serial No.: 308 Test Date: 2020-01-30

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.7 | Pass |
| Laboratory Humidity | % | 10 | 70 | 21 | Pass |
| Impactor Velocity | m/s | 6.60 | 6.80 | 6.73 | Pass |
| Peak Acetabulum Fy | kN | 3.60 | 4.30 | 3.98 | Pass |
| Pelvis Ay after 6ms | g | 34.0 | 42.0 | 39.7 | Pass |
| Peak Impactor Ax | g | 38.0 | 47.0 | 41.5 | Pass |
| | | | Overall Test Results | | Pass |

Pelvis Plug S/N: 11358 (SACO)




Technician: J. Hernandez

Approved By: P. Puzzuto

**SID-IIs Small Side Impact ATD**
**Pelvis Acetabulum Impact**

ATD Serial No.: 308 Test Date: 2020-01-30

Pelvis Plug S/N: 11358 (SACO)

SACO RESEARCH

**SID-IIs Pelvis Plug Certification Test**

Plug S/N 11358
Test Number 2750
Report Number 2747
Test Date 5/3/2016 8:06:45 AM

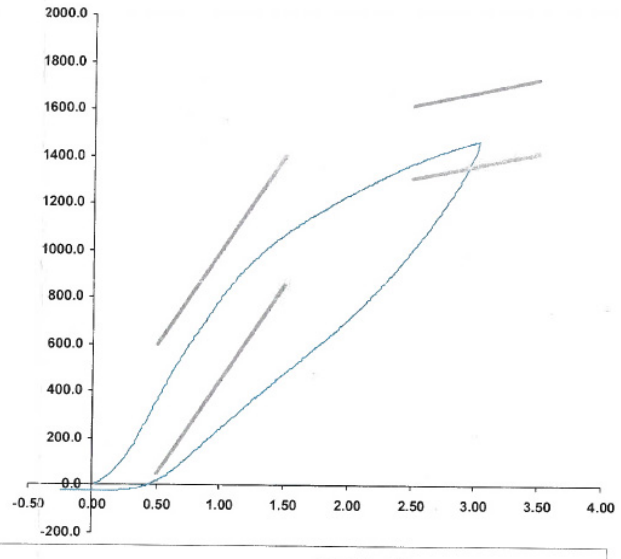
| | Test Results | Spec Min | Spec Max |
|---|---|---|---|
| Force @ 0.5 mm (N) | 359.78 | 50.00 | 600.00 |
| Force @ 1.5 mm (N) | 1,065.20 | 850.00 | 1,400.00 |
| Force @ 2.5 mm (N) | 1,368.92 | 1,306.00 | 1,618.00 |
| Force @ 3.0 mm (N) | 1,462.53 | 1,361.00 | 1,673.00 |

Testing Machine STM-20 5965542
Load Cell S/N (TI240813), Units (LBS) 1000

Crosshead Speed ( mm / min ) or Rate 12.7
Extension or Position Measured by XHD_100 ( XHD100 )

Notes:

Force (-N) vs Extension (-mm)




Operator DC

Part Number 180-4450

Template No 107 03-May-16
SACO Research

By : DC Date : 5/3/16

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

Applus IDIADA
KARCO

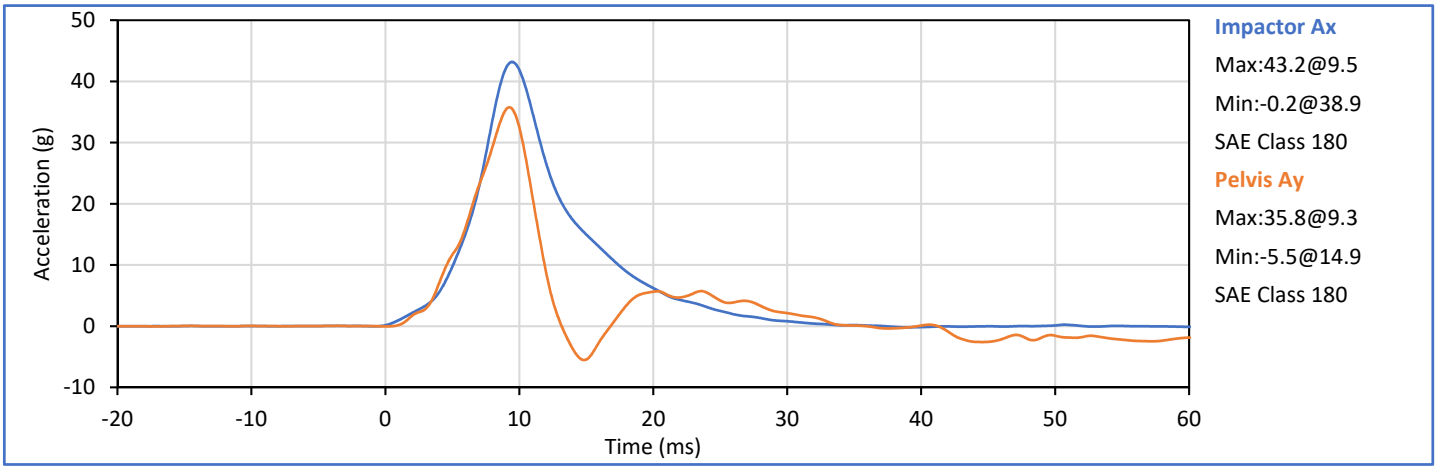
**SID-IIs Small Side Impact ATD**
**Pelvis Iliac Impact**

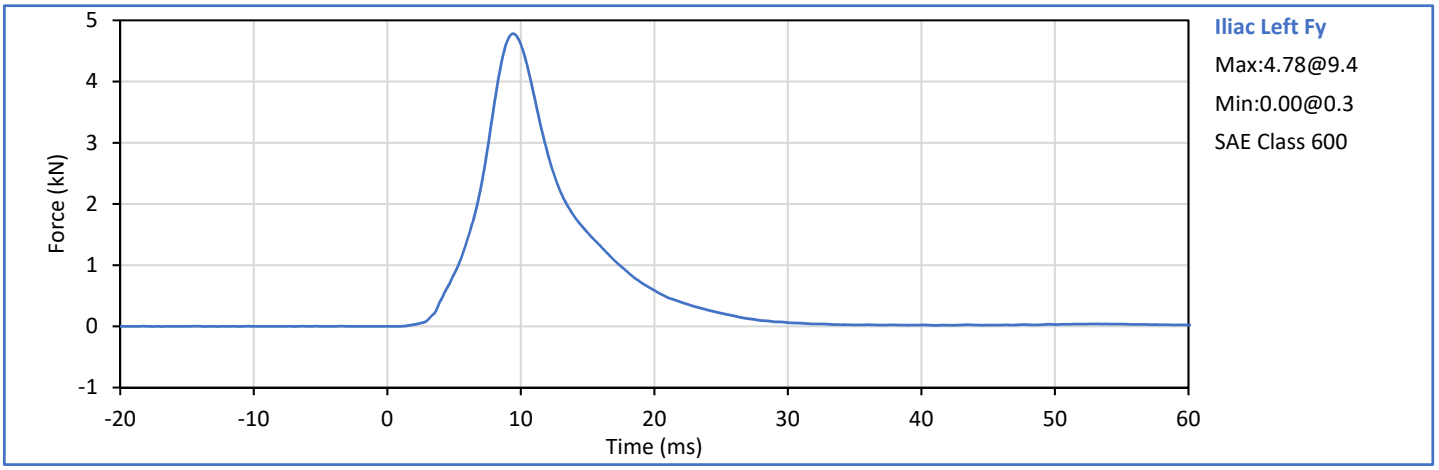
ATD Serial No.: 308 Test Date: 2020-01-29

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.1 | Pass |
| Laboratory Humidity | % | 10 | 70 | 27 | Pass |
| Impactor Velocity | m/s | 4.20 | 4.40 | 4.36 | Pass |
| Peak Iliac Fy | kN | 4.10 | 5.10 | 4.78 | Pass |
| Pelvis Ay after 6ms | g | 28.0 | 39.0 | 35.8 | Pass |
| Peak Impactor Ax | g | 36.0 | 45.0 | 43.2 | Pass |
| | | | Overall Test Results | | Pass |

Pelvis Plug S/N: 12228 (SACO) *

* Plug is not impacted and remains certified




Technician: J. Hernandez

Approved By: P. Puzzuto

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

Applus IDIADA
KARCO

**SID-IIs Small Side Impact ATD**
**External Measurements**

ATD Serial No.: 308 Test Date: 2020-02-24

| 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 | 44 | Pass |
| A - Sitting Height | mm | 772 | 788 | 779 | Pass |
| B - Shoulder Pivot Height | mm | 437 | 453 | 450 | Pass |
| C - Hpoint Height | mm | 79 | 89 | 86 | Pass |
| D - H Point From Seatback | mm | 141 | 151 | 150 | Pass |
| E - Shoulder Pivot From Backline | mm | 97 | 107 | 105 | Pass |
| F - Thigh Clearance | mm | 119 | 135 | 130 | Pass |
| G - Head Breadth | mm | 140 | 148 | 142 | Pass |
| H - Head Back From Backline | mm | 40 | 46 | 42 | Pass |
| I - Head Depth | mm | 178 | 188 | 186 | 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 | 355 | Pass |
| K - Knee Pivot To Floor Height | mm | 392 | 409 | 400 | Pass |
| N - Buttock Popliteal Length | mm | 416 | 442 | 433 | Pass |
| O - Chest Depth W/O Jacket | mm | 195 | 211 | 204 | Pass |
| P - Foot Length | mm | 216 | 232 | 222 | Pass |
| Q - Hip Breadth (W/Pelvic Plugs) | mm | 313 | 323 | 320 | Pass |
| R - Arm Length | mm | 249 | 259 | 254 | Pass |
| S - Knee Joint To Seatback | mm | 477 | 493 | 486 | Pass |
| V - Shoulder Width | mm | 341 | 357 | 347 | Pass |
| W - Foot Width | mm | 78 | 94 | 85 | Pass |
| Y - Chest Circumference W/Jacket | mm | 851 | 881 | 871 | Pass |
| Z - Waist Circumference | mm | 761 | 791 | 777 | Pass |
| | | | Overall Test Results | | Pass |

Technician: J. Hernandez

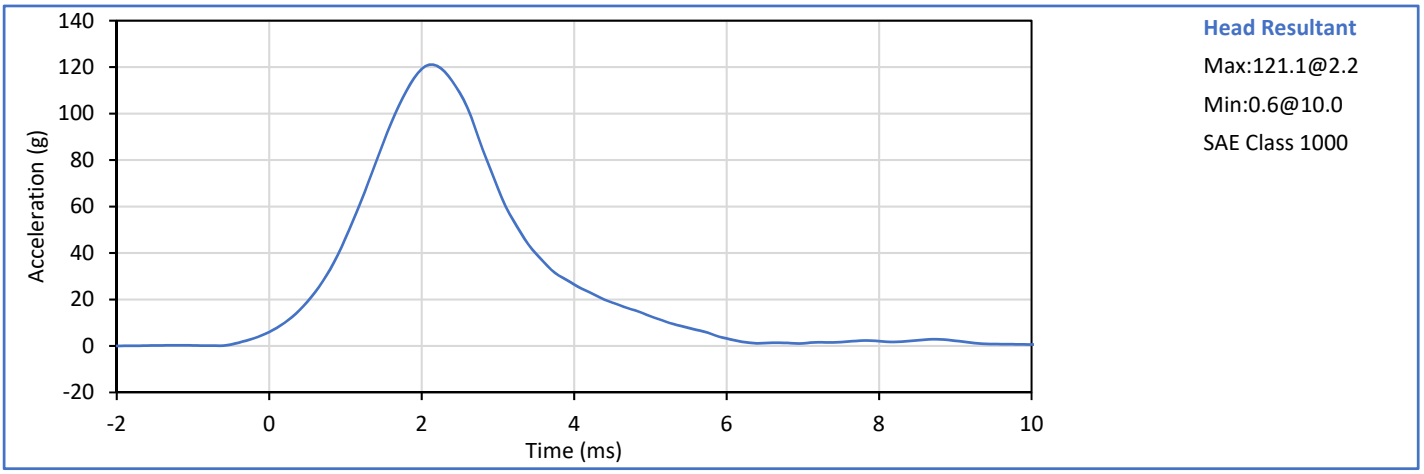
Approved By: P. Puzzuto

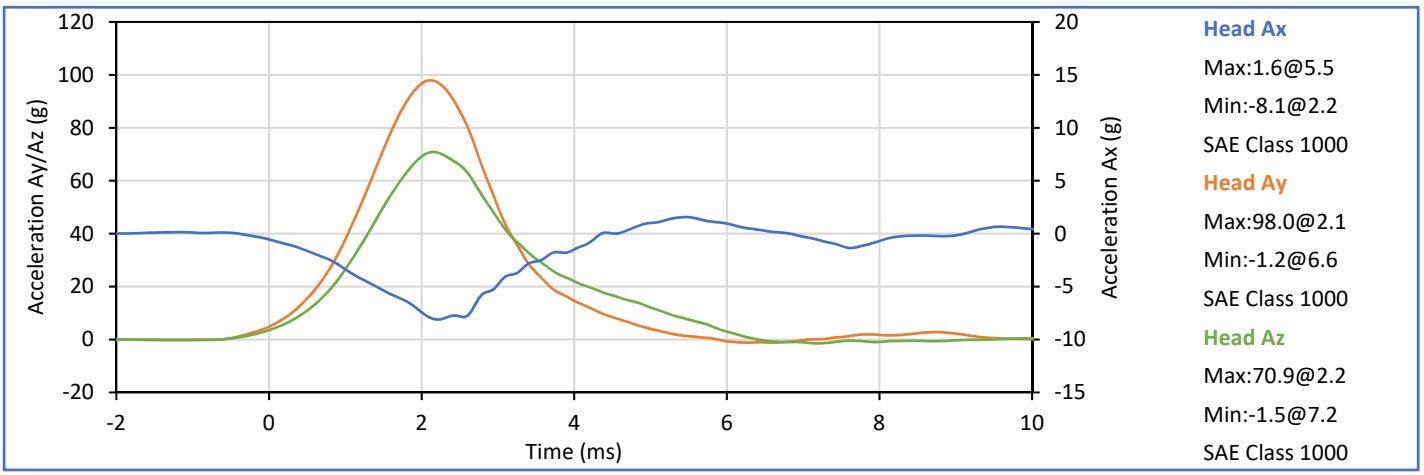
Applus IDIADA
KARCO

# SID-IIs Small Side Impact ATD
## Head Drop

ATD Serial No.: 308 Test Date: 2020-02-25

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | °C | 18.9 | 25.6 | 20.6 | Pass |
| Laboratory Humidity | % | 10 | 70 | 28 | Pass |
| Peak Resultant Acceleration | g | 115.0 | 137.0 | 121.1 | Pass |
| Peak Head Ax | g | -15.0 | 15.0 | -8.1 | Pass |
| Oscillations After Main Pulse | % | 0.0 | 15.0 | 2.4 | Pass |
| Is Acceleration Unimodal? | Yes/No | Yes | | Yes | Pass |
| | | | Overall Test Results | | Pass |




Technician: J. Hernandez

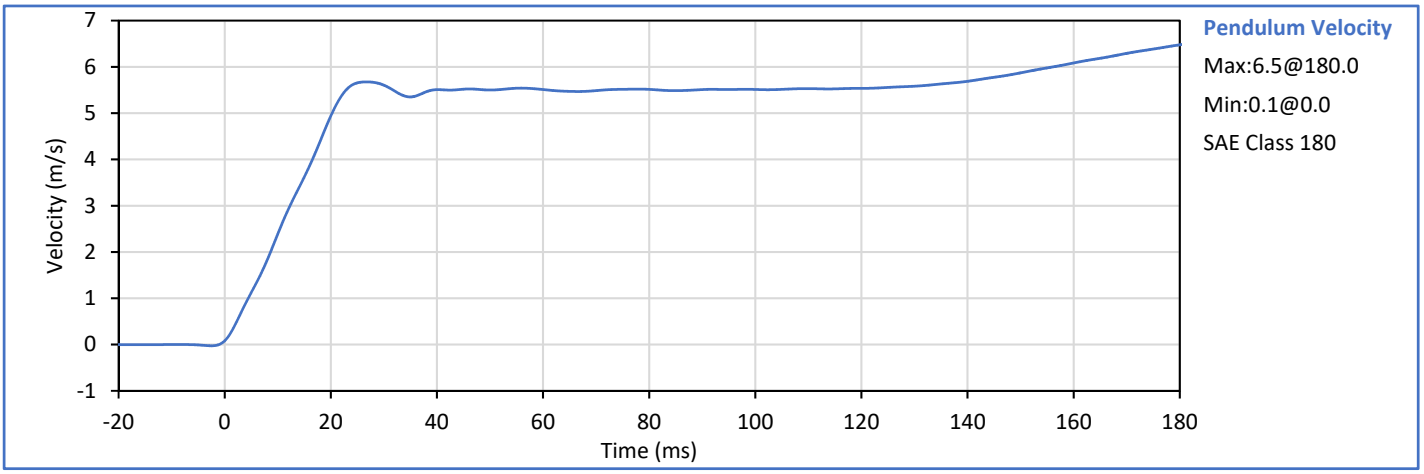
Approved By: P. Puzzuto

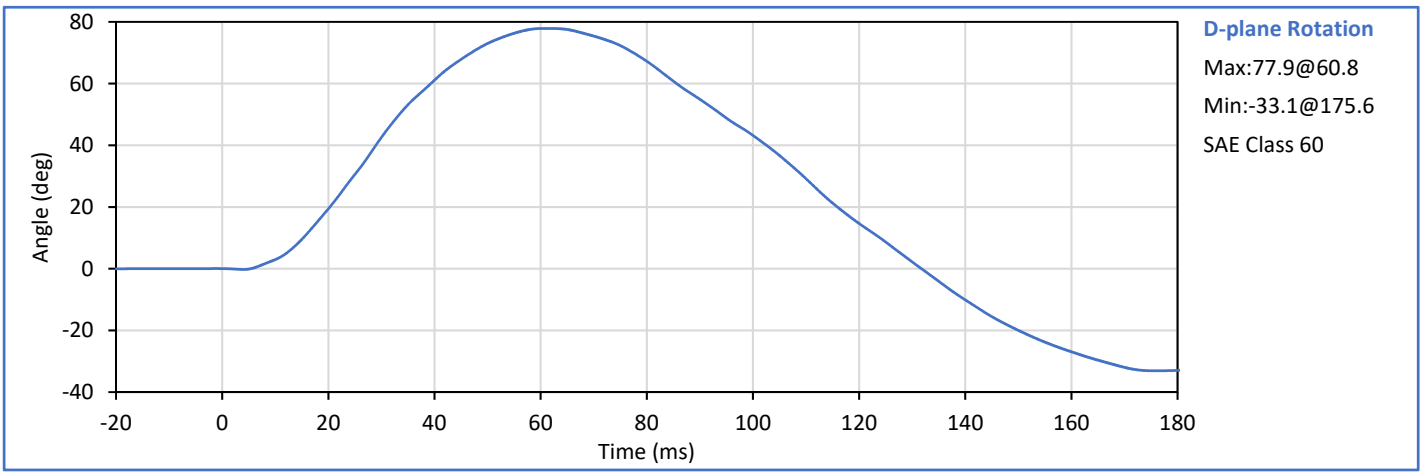
Applus IDIADA
KARCO

# SID-IIs Small Side Impact ATD
## Neck Flexion

ATD Serial No.: 308 Test Date: 2020-02-24

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.1 | Pass |
| Laboratory Humidity | % | 10 | 70 | 34 | Pass |
| Pendulum Velocity | m/s | 5.51 | 5.63 | 5.61 | Pass |
| Pendulum Decel at 10 ms | m/s | 2.20 | 2.80 | 2.39 | Pass |
| Pendulum Decel at 15 ms | m/s | 3.30 | 4.10 | 3.62 | Pass |
| Pendulum Decel at 20 ms | m/s | 4.40 | 5.40 | 4.94 | Pass |
| Pendulum Decel at 25 ms | m/s | 5.40 | 6.10 | 5.65 | Pass |
| Pendulum Decel from 25-100 ms | m/s | 5.50 | 6.20 | 5.68 | Pass |
| Peak "D" Plane Rotation | deg | 71.0 | 81.0 | 77.9 | Pass |
| Time of Peak "D" Plane Rotation | ms | 50.0 | 70.0 | 60.8 | Pass |
| Peak Occ. Condyle Moment | Nm | -44.0 | -36.0 | -43.4 | Pass |
| Time of Moment Decay to 0 Nm | ms | 102.0 | 126.0 | 114.4 | Pass |
| | | | Overall Test Results | | Pass |



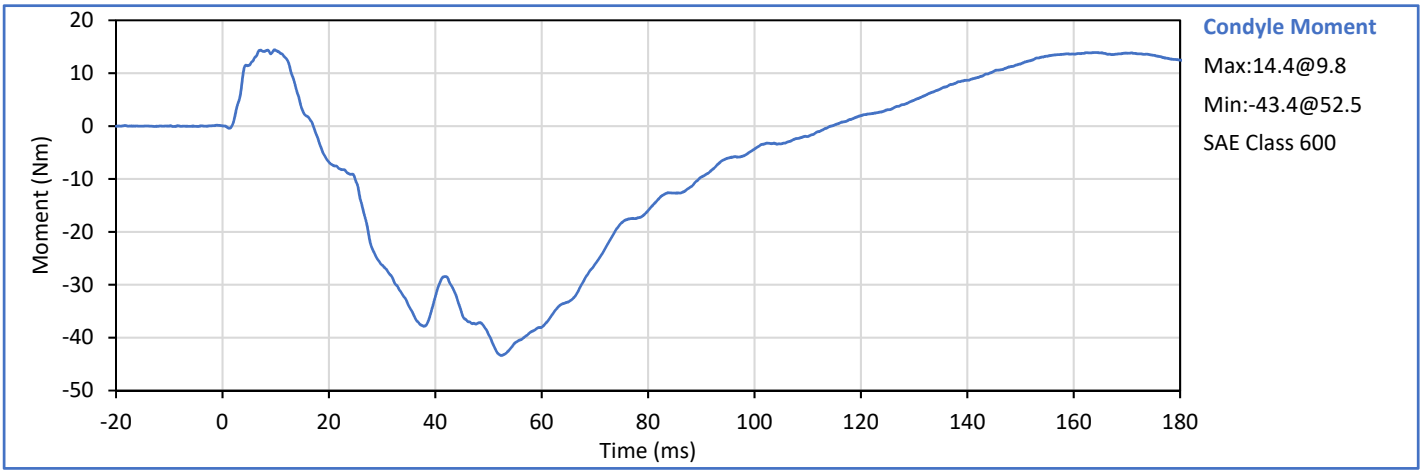

Technician: J. Hernandez

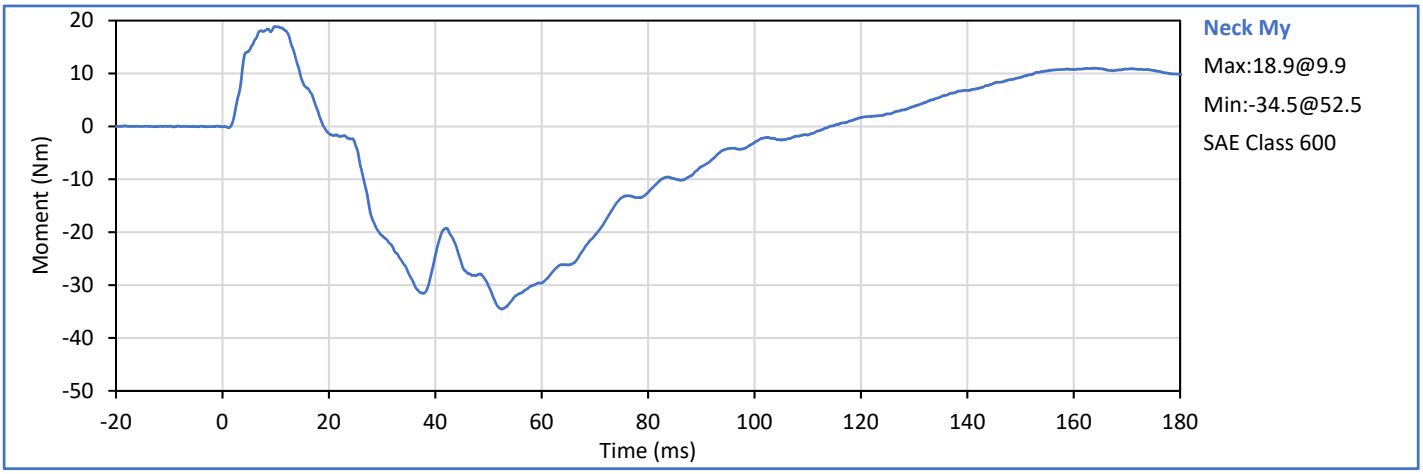
Approved By: P. Puzzuto

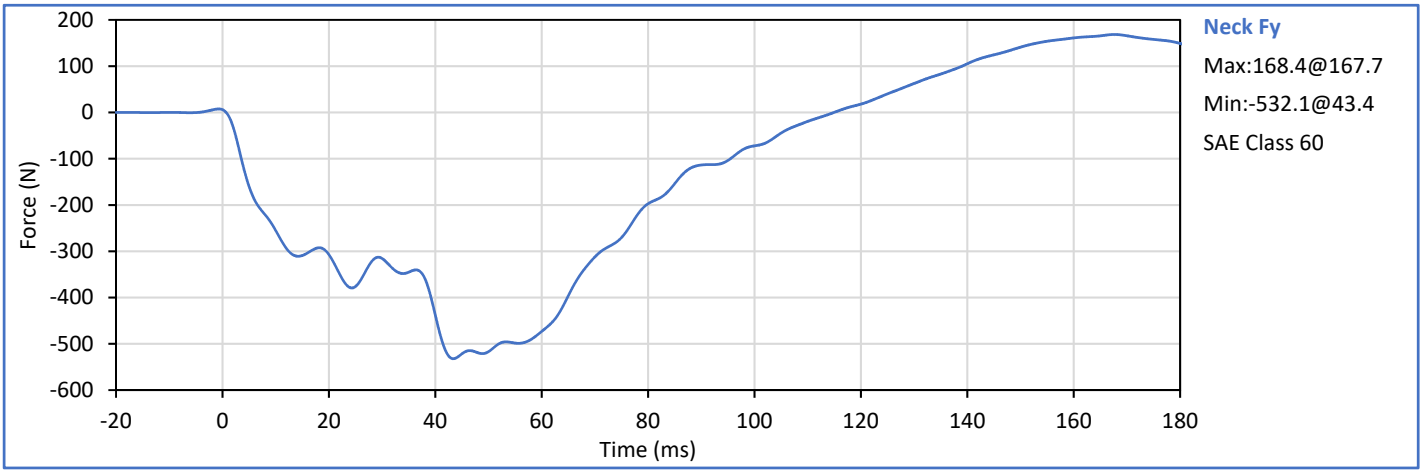
Applus IDIADA KARCO

**SID-IIs Small Side Impact ATD**
**Neck Flexion**

ATD Serial No.: 308 Test Date: 2020-02-24



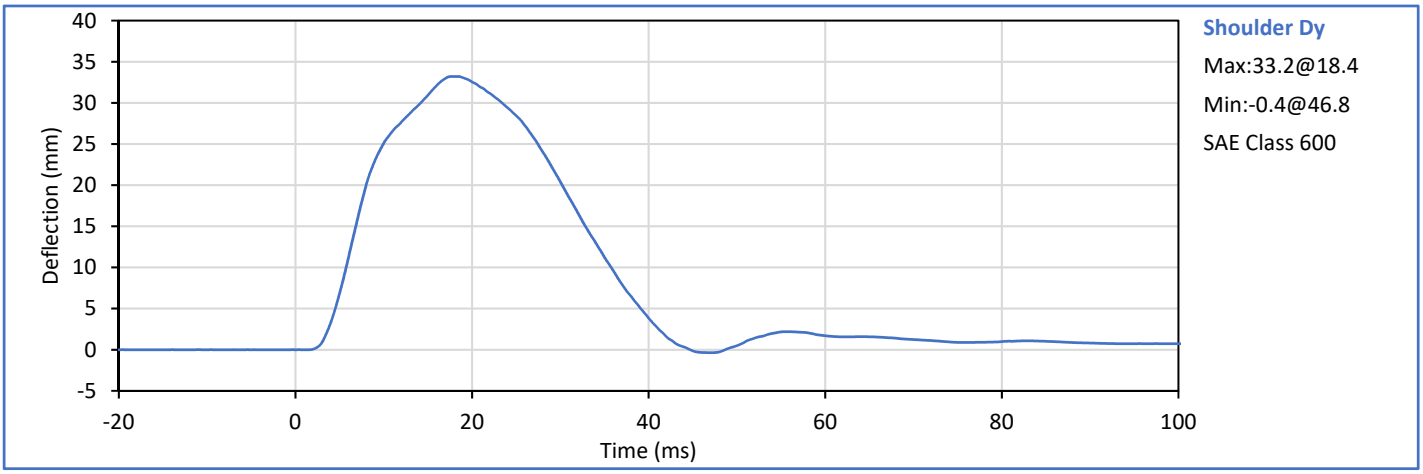



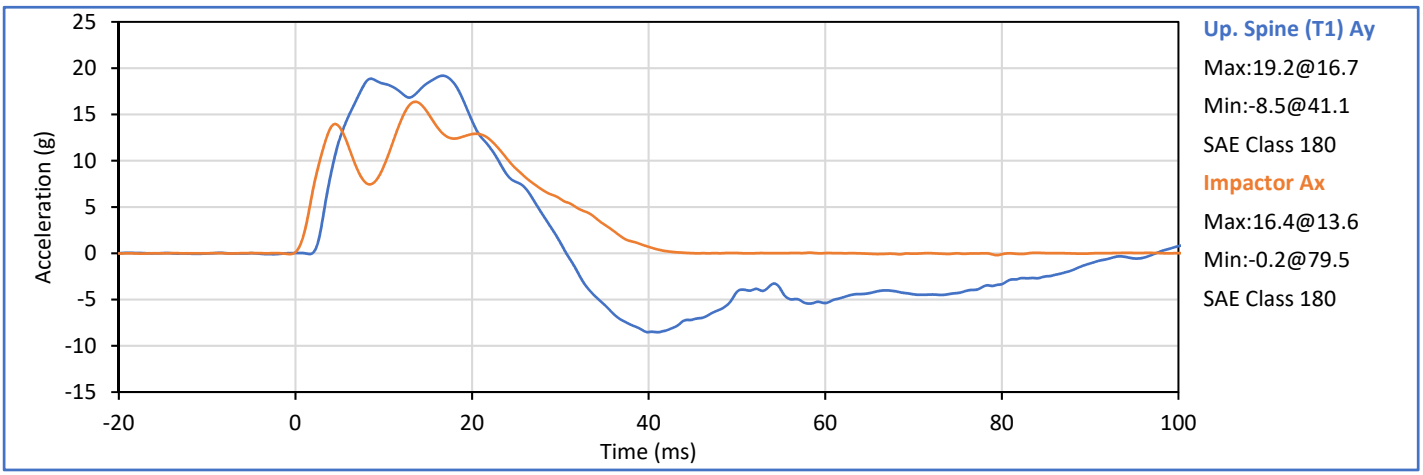
Applus IDIADA
KARCO

# SID-IIs Small Side Impact ATD
## Shoulder Impact Test

ATD Serial No.: 308 Test Date: 2020-02-24

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.1 | Pass |
| Laboratory Humidity | % | 10 | 70 | 32 | Pass |
| Impactor Velocity | m/s | 4.20 | 4.40 | 4.28 | Pass |
| Peak Shoulder Dy | mm | 28.0 | 37.0 | 33.2 | Pass |
| Peak Upper Spine (T1) Ay | g | 17.0 | 22.0 | 19.2 | Pass |
| Peak Impactor Ax | g | 13.0 | 18.0 | 16.4 | Pass |
| | | | Overall Test Results | | Pass |




Technician: J. Hernandez

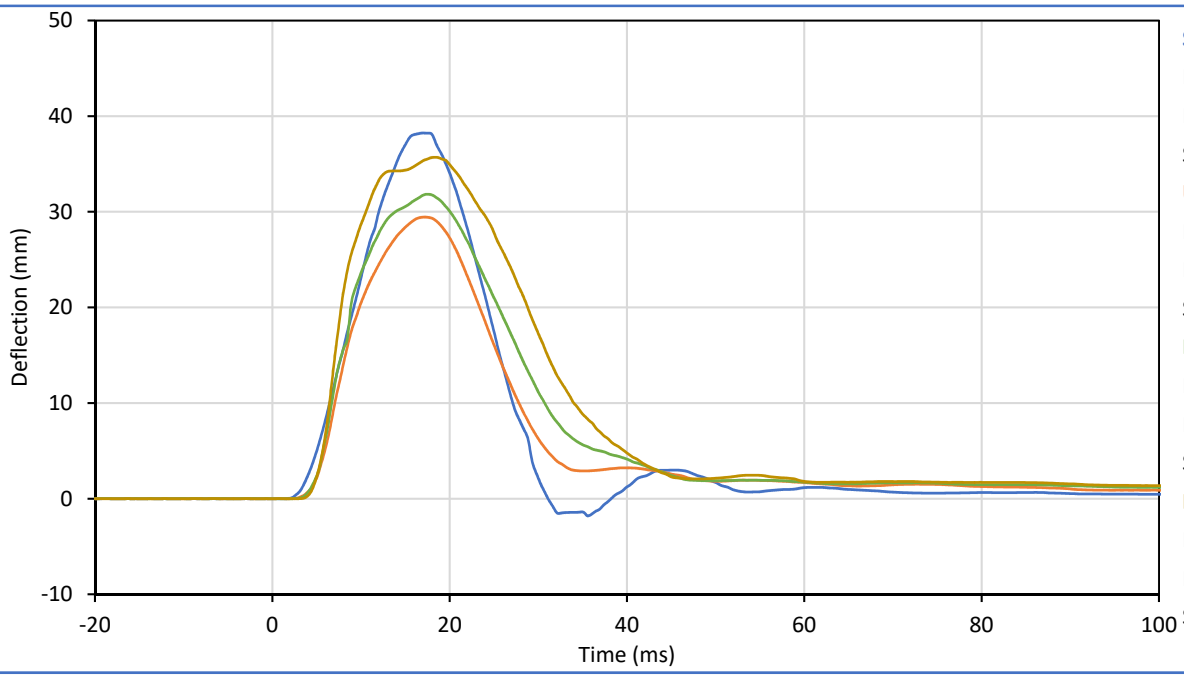
Approved By: P. Puzzuto

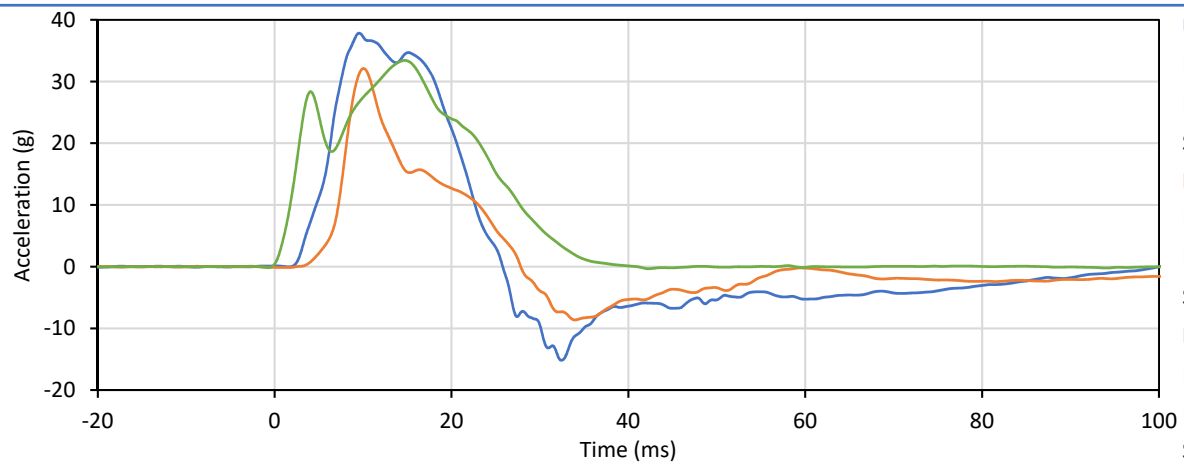
Applus IDIADA
KARCO

# SID-IIs Small Side Impact ATD
## Thorax (With Arm)

ATD Serial No.: 308 Test Date: 2020-02-24

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.1 | Pass |
| Laboratory Humidity | % | 10 | 70 | 31 | Pass |
| Impactor Velocity | m/s | 6.60 | 6.80 | 6.70 | Pass |
| Peak Shoulder Dy | mm | 31.0 | 40.0 | 38.2 | Pass |
| Peak Upper Rib Dy | mm | 25.0 | 32.0 | 29.4 | Pass |
| Peak Middle Rib Dy | mm | 30.0 | 36.0 | 31.8 | Pass |
| Peak Lower Rib Dy | mm | 32.0 | 38.0 | 35.7 | Pass |
| Peak Upper Spine (T1) Ay | g | 34.0 | 43.0 | 37.8 | Pass |
| Peak Lower Spine (T12) Ay | g | 29.0 | 37.0 | 32.1 | Pass |
| Peak Impactor Ax | g | 30.0 | 36.0 | 33.4 | Pass |
| | | | Overall Test Results | | Pass |




Technician: J. Hernandez

Approved By: P. Puzzuto

C-17

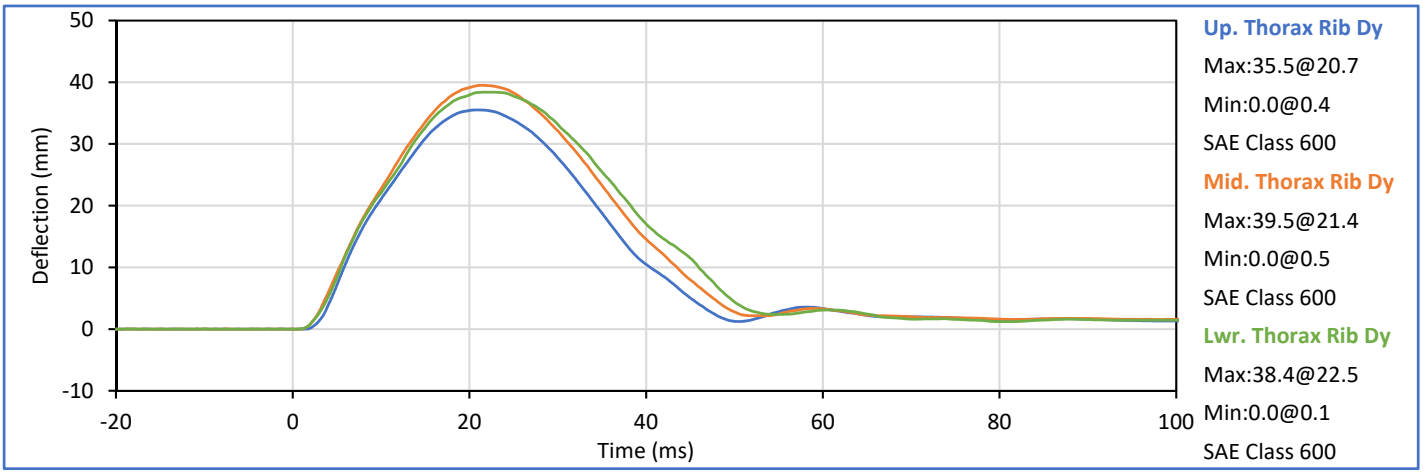
TR-P40047-01-NC

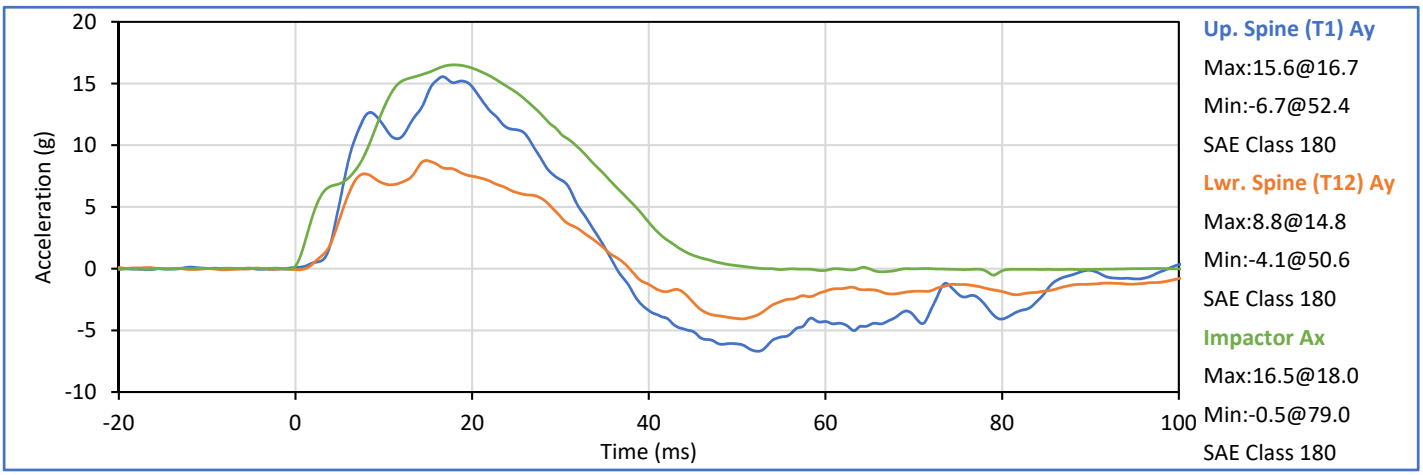
Applus IDIADA
KARCO

# SID-IIs Small Side Impact ATD
## Thorax (No Arm)

ATD Serial No.: 308 Test Date: 2020-02-24

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.1 | Pass |
| Laboratory Humidity | % | 10 | 70 | 31 | Pass |
| Impactor Velocity | m/s | 4.20 | 4.40 | 4.31 | Pass |
| Peak Upper Rib Dy | mm | 32.0 | 40.0 | 35.5 | Pass |
| Peak Middle Rib Dy | mm | 39.0 | 45.0 | 39.5 | Pass |
| Peak Lower Rib Dy | mm | 35.0 | 43.0 | 38.4 | Pass |
| Peak Upper Spine (T1) Ay | g | 13.0 | 17.0 | 15.6 | Pass |
| Peak Lower Spine (T12) Ay | g | 7.0 | 11.0 | 8.8 | Pass |
| Peak Impactor Ax | g | 14.0 | 18.0 | 16.5 | Pass |
| | | | Overall Test Results | | Pass |




Technician: J. Hernandez

Approved By: P. Puzzuto

C-18

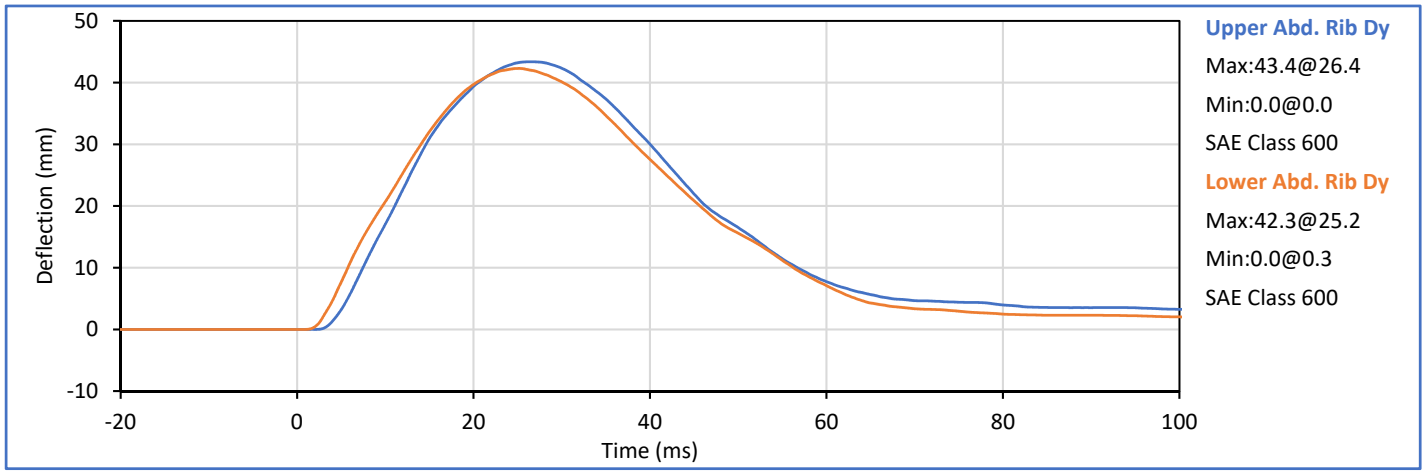
TR-P40047-01-NC

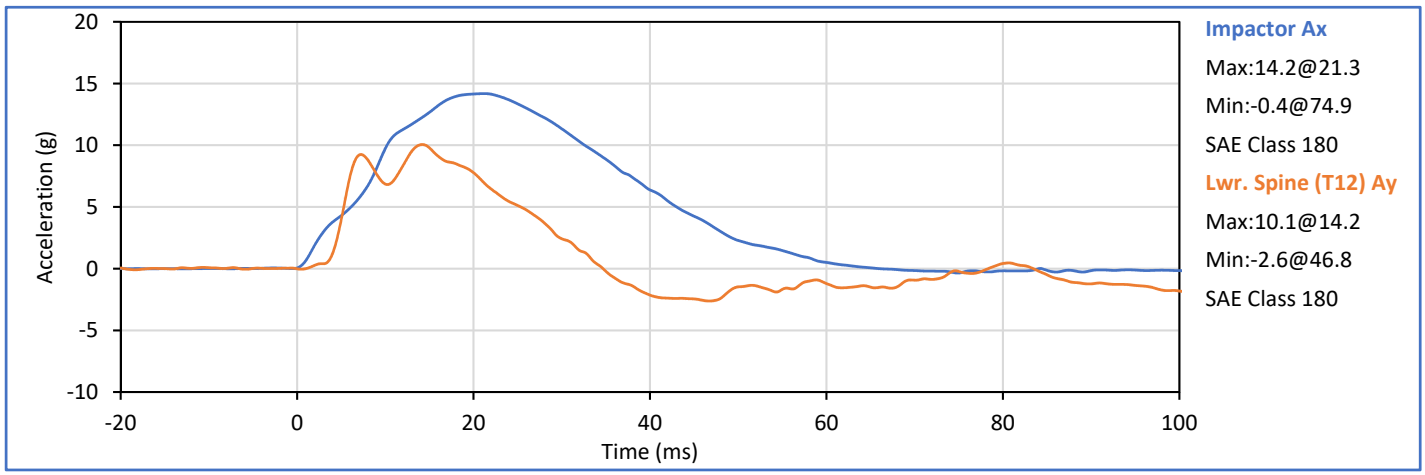
Applus IDIADA
KARCO

# SID-IIs Small Side Impact ATD
## Abdomen Impact

ATD Serial No.: 308 Test Date: 2020-02-24

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.1 | Pass |
| Laboratory Humidity | % | 10 | 70 | 32 | Pass |
| Impactor Velocity | m/s | 4.20 | 4.40 | 4.33 | Pass |
| Peak Upper Abdomen Rib Dy | mm | 36.0 | 47.0 | 43.4 | Pass |
| Peak Lower Abdomen Rib Dy | mm | 33.0 | 44.0 | 42.3 | Pass |
| Peak Lower Spine T12 Ay | mm | 9.0 | 14.0 | 10.1 | Pass |
| Peak Impactor Ax | g | 12.0 | 16.0 | 14.2 | Pass |
| | | | Overall Test Results | | Pass |




Technician: J. Hernandez

Approved By: P. Puzzuto

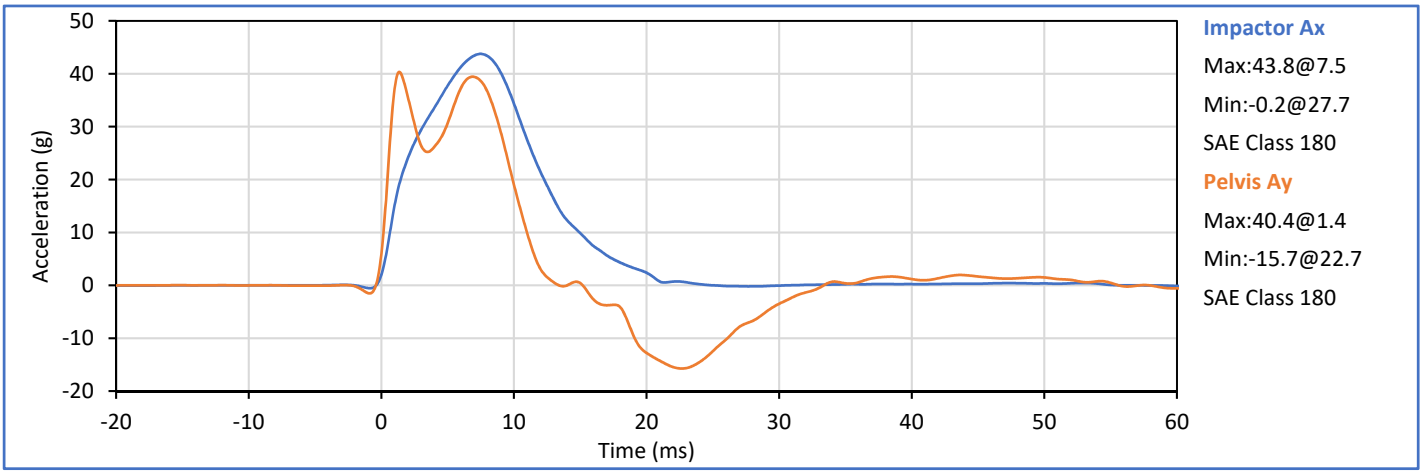
Applus IDIADA
KARCO

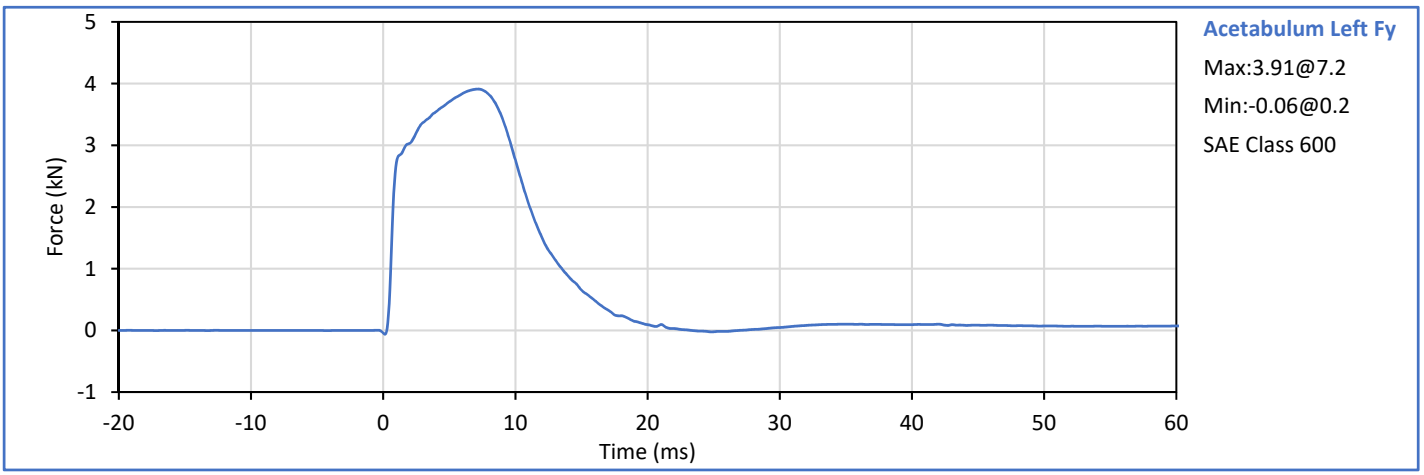
# SID-IIs Small Side Impact ATD
## Pelvis Acetabulum Impact

ATD Serial No.: 308 Test Date: 2020-02-24

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.1 | Pass |
| Laboratory Humidity | % | 10 | 70 | 31 | Pass |
| Impactor Velocity | m/s | 6.60 | 6.80 | 6.71 | Pass |
| Peak Acetabulum Fy | kN | 3.60 | 4.30 | 3.91 | Pass |
| Pelvis Ay after 6ms | g | 34.0 | 42.0 | 39.5 | Pass |
| Peak Impactor Ax | g | 38.0 | 47.0 | 43.8 | Pass |
| | | | Overall Test Results | | Pass |

Pelvis Plug S/N: 11381




Technician: J. Hernandez

Approved By: P. Puzzuto

C-20

TR-P40047-01-NC

**SID-IIs Small Side Impact ATD**
**Pelvis Acetabulum Impact**

ATD Serial No.: 308 Test Date: 2020-02-24

Pelvis Plug S/N: 11381

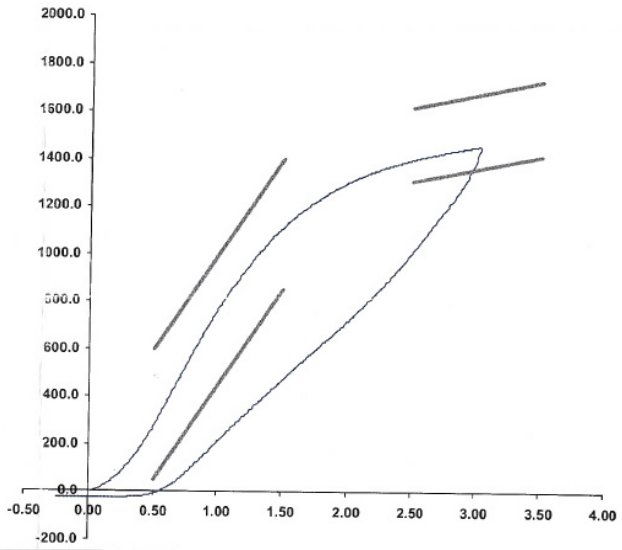
SACO RESEARCH

**SID-IIs Pelvis Plug Certification Test**

Plug S/N 11381
Test Number 2850
Report Number 2847
Test Date 8/29/2016 9:06:54 AM

| | Test Results | Spec Min | Spec Max |
|---|---|---|---|
| Force @ 0.5 mm (N) | 281.94 | 50.00 | 600.00 |
| Force @ 1.5 mm (N) | 1,111.77 | 850.00 | 1,400.00 |
| Force @ 2.5 mm (N) | 1,398.09 | 1,306.00 | 1,618.00 |
| Force @ 3.0 mm (N) | 1,454.04 | 1,361.00 | 1,673.00 |

Force (-N) vs Extension (-mm)




Testing Machine STM-20 5965542
Load Cell S/N (TI240813), Units (LBS ) 1000

Crosshead Speed ( mm / min ) or Rate 12.7
Extension or Position Measured by XHD_100 ( XHD100 )

Notes:

Operator DC

Part Number 180-4450

Template No 107 29-Aug-16
SACO Research

By : DC Date : 8/29/16

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

Applus IDIADA
KARCO

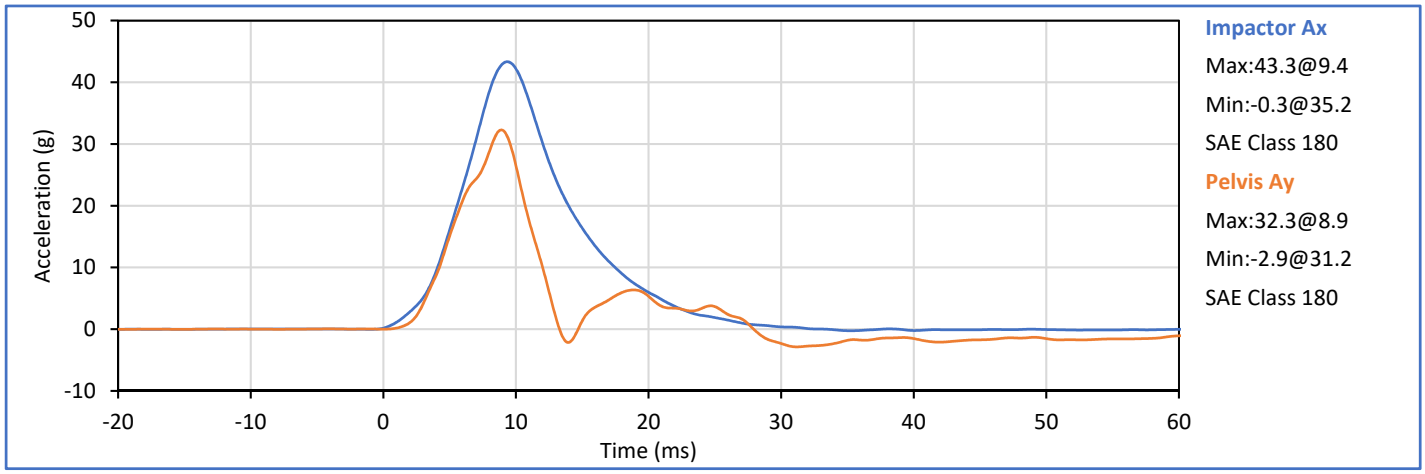
# SID-IIs Small Side Impact ATD
## Pelvis Iliac Impact

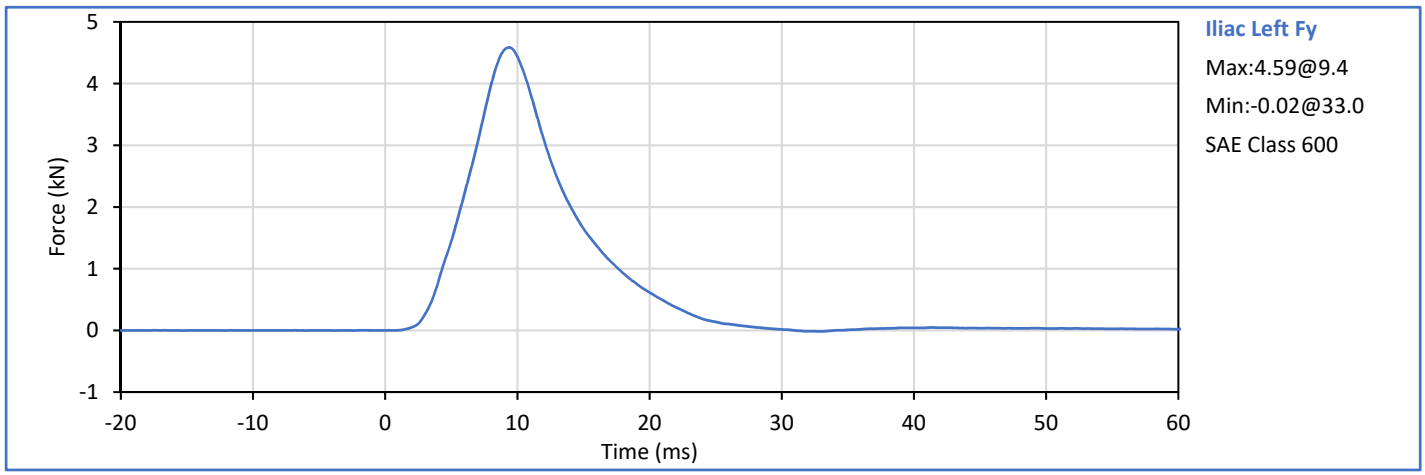
ATD Serial No.: 308 Test Date: 2020-02-24

| Tested Parameter | Units | Spec. Low | Spec. High | Result | Pass/Fail |
|---|---|---|---|---|---|
| Laboratory Temperature | °C | 20.6 | 22.2 | 21.1 | Pass |
| Laboratory Humidity | % | 10 | 70 | 31 | Pass |
| Impactor Velocity | m/s | 4.20 | 4.40 | 4.31 | Pass |
| Peak Iliac Fy | kN | 4.10 | 5.10 | 4.59 | Pass |
| Pelvis Ay after 6ms | g | 28.0 | 39.0 | 32.3 | Pass |
| Peak Impactor Ax | g | 36.0 | 45.0 | 43.3 | Pass |
| | | | Overall Test Results | | Pass |

Pelvis Plug S/N: 12228 (SACO) *

* Plug is not impacted and remains certified




Technician: J. Hernandez

Approved By: P. Puzzuto

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TR-P40047-01-NC

# APPENDIX D
# TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

SID-IIs ATD S/N: 308

**Table 1 - Driver ATD Instrumentation**

| Sensor Location | Sensor S\N | Mfr | Model | Cal Date |
|---|---|---|---|---|
| Head Acceleration X Primary | P63980 | Endevco | 7264C-2k | 2020-01-02 |
| Head Acceleration Y Primary | P58861 | Endevco | 7264C-2k | 2020-01-02 |
| Head Acceleration Z Primary | P51261 | Endevco | 7264C-2k | 2020-01-02 |
| Head Acceleration X Redundant | P58808 | Endevco | 7264C-2k | 2020-01-02 |
| Head Acceleration Y Redundant | P63310 | Endevco | 7264C-2k | 2020-01-02 |
| Head Acceleration Z Redundant | P49189 | Endevco | 7264C-2k | 2020-01-02 |
| Head Rotation Rate X | ARS7498 | DTS | ARS PRO-8k (2000Hz) | 2019-07-08 |
| Head Rotation Rate Y | ARS7367 | DTS | ARS PRO-8k (2000Hz) | 2019-07-08 |
| Head Rotation Rate Z | ARS7377 | DTS | ARS PRO-8k (2000Hz) | 2019-07-08 |
| Upper Thorax Rib Deflection Y | 1249 | Servo | 08TCI-3725 | 2020-01-02 |
| Middle Thorax Rib Deflection Y | 1219 | Servo | 08TCI-3725 | 2020-01-02 |
| Lower Thorax Rib Deflection Y | 1221 | Servo | 08TCI-3725 | 2020-01-02 |
| Upper Abdomen Rib Deflection Y | 1252 | Servo | 08TCI-3725 | 2020-01-02 |
| Lower Abdomen Rib Deflection Y | 1283 | Servo | 08TCI-3725 | 2020-01-02 |
| Lower Spine T12 Acceleration X | P52108 | Endevco | 7264C-2k | 2020-01-02 |
| Lower Spine T12 Acceleration Y | P63970 | Endevco | 7264C-2k | 2020-01-02 |
| Lower Spine T12 Acceleration Z | P51712 | Endevco | 7264C-2k | 2020-01-02 |
| Iliac Wing Impact Side Force Y | 289 Fy (Iliac) | R.A. Denton | 3228J | 2019-10-17 |
| Acetabulum Impact Side Force Y | 277 Fy (Acetabulum) | R.A. Denton | 3249J | 2019-10-07 |

**Table 2 - Vehicle Instrumentation**

| Sensor Location | Sensor S\N | Mfr | Model | Cal Date |
|---|---|---|---|---|
| Vehicle CG Ax | Accels\10247 | Endevco | 757F-2k | 2019-12-16 |
| Vehicle CG Ay | Accels\A273389 | MSI | 52F-2000 | 2019-12-11 |
| Vehicle CG Az | Accels\A227260 | MSI | 52F-2000 | 2019-11-27 |
| Left Floor Sill Ay | Accels\10432 | Endevco | 757F-2k | 2019-12-16 |
| A-Pillar Sill Ay | Accels\10438 | Endevco | 757F-2k | 2019-11-25 |
| A-Pillar Low Ay | Accels\A254843 | MSI | 52F-2000 | 2019-12-13 |
| A-Pillar Mid Ay | Accels\A264816 | MSI | 52F-2000 | 2019-12-02 |
| B-Pillar Sill Ay | Accels\10117 | Endevco | 757F-2k | 2019-12-09 |
| B-Pillar Low Ay | Accels\A273418 | MSI | 52F-2000 | 2019-11-27 |
| B-Pillar Mid Ay | Accels\A254842 | MSI | 52F-2000 | 2019-12-13 |
| Driver Seat Track at H-Point Ay | Accels\10858 | Endevco | 757F-2k | 2019-12-17 |
| Engine Top Ax | Accels\10377 | Endevco | 757F-2k | 2019-12-09 |
| Engine Top Ay | Accels\A254850 | MSI | 52F-2000 | 2019-12-13 |
| Firewall Ay | Accels\A208767 | MSI | 52F-2000 | 2019-12-18 |
| Right Roof Ay | Accels\A265891 | MSI | 52F-2000 | 2019-12-02 |
| Right Floor Sill Ay | Accels\10870 | Endevco | 757F-2k | 2019-12-18 |
| Rear Floorpan Ax | Accels\A185575 | MSI | 52F-2000 | 2019-12-02 |
| Rear Floorpan Ay | Accels\A224532 | MSI | 52F-2000 | 2019-12-18 |

**Table 3 - Barrier Pole Instrumentation**

| Sensor Location | Sensor S\N | Mfr | Model | Cal Date |
|---|---|---|---|---|
| Barrier Pole 01 Fx | 19461A | Interface | 1220FS-50k | 2019-03-20 |
| Barrier Pole 02 Fx | 131822A | Interface | 1220-FS | 2019-05-07 |
| Barrier Pole 03 Fx | 131816A | Interface | 1220AF-50k | 2019-03-20 |
| Barrier Pole 04 Fx | 19325 | Interface | 1220-FS | 2019-05-07 |
| Barrier Pole 05 Fx | 131827A | Interface | 1220-FS | 2019-05-07 |
| Barrier Pole 06 Fx | 19340 | Interface | 1220FS-50k | 2019-03-20 |
| Barrier Pole 07 Fx | 19267 | Interface | 1220-FS | 2019-05-07 |
| Barrier Pole 08 Fx | 19466A | Interface | 1220FS-50k | 2019-03-20 |