**REPORT NUMBER: SINCAP-CAL-16-006**

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

**Toyota Motor Manufacturing, Kentucky, Inc**
**2016 Toyota Avalon**
**Four Door Sedan**

**NHTSA No: M20165107**

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

**May 6, 2016**

**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**

This final test report was prepared for the U.S. Department of Transportation, National Highway Traffic Administration, in response to Contract Number DTNH22-14-D-00352.

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Prepared by: Vanessa Hansen Date: May 6, 2016
Vanessa Hansen, Project Engineer

Approved by: Edward Dutton Date: May 6, 2016
Edward Dutton, Test Engineer
Transportation Test Operations

**FINAL REPORT ACCEPTANCE BY OCWS:**

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

Date: _____

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

Date: _____

# TECHNICAL REPORT DOCUMENTATION PAGE

| | |
|---|---|
| ***1. Report No.***<br>SINCAP-CAL-16-006 | ***2. Government Accession No.*** |
| ***3. Recipient's Catalog No.*** | |
| ***4. Title and Subtitle***<br>Final Report of New Car Assessment Program<br>Side Impact MDB Testing of a<br>2016 Toyota Avalon four door sedan<br>NHTSA No.: M20165107 | ***5. Report Date***<br>May 6, 2016 |
| | ***6. Performing Organization Code***<br>CAL |
| Vanessa Hansen, Test Engineer<br>Edward Dutton , Senior Test Engineer | ***8. Performing Organization Report No.***<br>CAL-DOT-2016-006 |
| ***9. Performing Organization Name and Address***<br>Calspan Corporation<br>Transportation Test Operations<br>P.O. Box 400<br>Buffalo, New York 14225 | ***10. Work Unit No.*** |
| | ***11. Contract or Grant No.***<br>DTNH22-14-D-00352 |
| ***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<br>March 16, 2016 - May 6, 2016 |
| | ***14. Sponsoring Agency Code***<br>NRM-110 |
| **15. *Supplementary Notes*** | |

***16. Abstract***

A 55/28, (61.90 kph / 38.5 mph), $90^0$ Moving Deformable Barrier NCAP Side Impact Test was conducted on the subject 2016 Toyota Avalon four door sedan in accordance with the specifications of the Office of Crashworthiness Standards Test Procedure for the generation of consumer information on vehicle side crash protection. This test was conducted at Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on March 16, 2016.

The impact velocity of the Moving Deformable Barrier (MDB) was 61.67 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle at the time of impact was 21°C. The target vehicle's maximum post-test static crush was 240mm located at level 3. The test vehicle's occupant performance data is as follows:

| Measurement Description | Driver ATD (ES-2re) | | |
|---|---|---|---|
| | Units | IARV | Result |
| Head Injury Criteria ($HIC_{36}$) | N/A | 1000 | 178.382 |
| Maximum Thoracic Rib Deflection | mm | 44 | 15.512 |
| Total Abdominal Force | N | 2500 | 1009.616 |
| Pubic Symphysis Force | N | 6000 | 1322.509 |

| Measurement Description | Passenger ATD (SID-IIs) | | |
|---|---|---|---|
| | Units | IARV | Result |
| Head Injury Criteria ($HIC_{36}$) | N/A | 1000 | 176.187 |
| Lower Spine Resultant Acceleration | G | 82 | 44.624 |
| Total Pelvic Force (sum of acetabular and iliac forces) | N | 5525 | 1937.668 |
| Maximum Thoracic Rib Deflection | mm | 38* | 24.946 |
| Maximum Abdominal Rib Deflection | mm | 45* | 29.895 |

* *Proposed IARV*

The two doors on the struck side of the vehicle did not separate from the body at the hinges or latches and the opposite doors did not open during the side impact event.

| | |
|---|---|
| ***17. Key Words***<br>New Car Assessment Program (NCAP)<br>Side Impact<br>MDB<br>ES-2re<br>SID-IIs | ***18. Distribution Statement***<br>Copies of this report are available from:<br>National Highway Traffic Safety Administration<br>Technical Information Services Division, NPO-411<br>1200 New Jersey Ave. SE<br>Washington, D.C. 20590<br>e-mail: tis@nhtsa.dot.gov<br>FAX: 202-493-2833 |

| ***19. Security Class. (of this report)*** | ***20. Security Class. (of this page)*** | ***21. No. of Pages*** | ***22. Price*** |
|---|---|---|---|
| UNCLASSIFIED | UNCLASSIFIED | 188 | |

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# SECTION 1

## TEST PURPOSE AND PROCEDURE

This moving deformable barrier side impact test is part of the MY 2016 New Car Assessment Program Side Impact Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under contract number DTNH22-14-D-00352. The purpose of this test is to generate comparative side impact performance in a 2016 Toyota Avalon four door sedan. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Laboratory Test Procedure dated October 2015.

## SECTION 2

## SUMMARY OF TEST RESULTS

A 2016 Toyota Avalon four door sedan 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 61.67 km/h. 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 the Calspan Corporation's Transportation Test Operations Center in Buffalo, New York on March 16, 2016. Pre-test and post-test photographs of the test vehicle, the MDB and the dummies (ES-2re and SID-IIs) are included in this report.

Dummies were placed in the driver and left rear designated seating positions according to instructions specified in the OCWS Side Impact Laboratory Test Procedure, dated October 2015. The side impact event was documented by 9 high-speed and 2 real-time cameras. Camera locations are included in 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 (T12) tri-axial accelerometers
Public 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 (T12) 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 VALUES

| Measurement Description | Driver ATD (ES-2re) | | |
|---|---|---|---|
| | Units | Threshold | Result |
| Head Injury Criteria (HIC36) | | 1000 | 178.382 |
| Maximum Thorax Rib Deflection | mm | 44 | 15.512 |
| Combined Abdominal Force | N | 2500 | 1009.616 |
| Pubic Symphysis Force | N | 6000 | 1322.509 |

| Measurement Description | Passenger ATD (SID-IIs) | | |
|---|---|---|---|
| | Units | Threshold | Result |
| Head Injury Criteria (HIC36) | | 1000 | 176.187 |
| Lower Spine (T12) Resultant Acceleration | G | 82 | 44.624 |
| Total Pelvic Force (sum of acetabular and iliac forces) | N | 5525 | 1937.668 |
| Maximum Thoracic Rib Deflection | mm | 38* | 24.946 |
| Maximum Abdominal Rib Deflection | mm | 45* | 29.895 |

*Proposed IARV

## SUPPLEMENTAL RESTRAINT INFORMATION

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

**GENERAL COMMENTS:**

1. P1 serial number – F034
2. P4 serial number – 303

**Data Anomalies:**

- None

## SECTION 3

## OCCUPANT AND VEHICLE INFORMATION

This section contains information reporting for the following Data Sheets:

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

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

Data Sheet No. 3 – Dummy Longitudinal Clearance Dimensions

Data Sheet No. 4 – Dummy Lateral Clearance Dimensions

Data Sheet No. 5 – Camera and Instrumentation Data

Data Sheet No. 6 – Test Vehicle Accelerometer Locations

Data Sheet No. 7 – MDB Accelerometer Locations

Data Sheet No. 8 – Post-Test Observations

Data Sheet No. 9 – MDB Summary of Results

Data Sheet No. 10 – Test Vehicle Profile Measurements

Data Sheet No. 11 – Test Vehicle Exterior Crush Measurements

Data Sheet No. 12 – MDB Exterior Static Crush Measurements

Data Sheet No. 13 – Vehicle and MDB Damage Profile Distances

Data Sheet No. 14 – FMVSS No. 301 Static Rollover Results

Data Sheet No. 15 – Dummy/Vehicle Temperature and Humidity Stabilization Data

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

Test Vehicle: 2016 Toyota Avalon four door sedan
NHTSA No.: M20165107
Test Program: NCAP Side MDB Impact Test
Test Date: 3/16/2016

### TEST VEHICLE INFORMATION AND OPTIONS

| | |
|---|---|
| NHTSA No. | M20165107 |
| Model Year | 2016 |
| Make | Toyota |
| Model | Avalon |
| Body Style | Four Door Sedan |
| VIN | 4T1BK1EB5GU198480 |
| Body Color | Charcoal Gray |
| Odometer Reading (km/mi) | 186.7 km / 116 mi |
| Engine Displacement (L) | 3.5 |
| Type/No. Cylinders | V6 |
| Engine Placement | Transverse |
| Transmission Type | Automatic |
| Transmission Speeds | 6-Speed |
| Overdrive | Yes |
| Final Drive | Front Wheel Drive |
| Roof Rack | No |
| Sunroof/T-Top | No |
| 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 (ADL) | Yes |
| Power Window Auto-Reverse | No |
| Other Optional Feature | - |
| 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 | Yes |
| Rear Pass. Pelvis Airbag | No |
| Driver Seat Belt Pretensioners | Yes |
| Rear Pass. Seat Belt Pretensioners | No |
| Driver Load Limiter | Yes |
| Rear Pass. Load Limiter | No |
| Other Safety Restraint | - |

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

### DATA FROM CERTIFICATION LABEL

| | |
|---|---|
| Manufactured By | Toyota Motor Manufacturing, Kentucky, Inc. |
| Date of Manufacture | 11/15 |
| Vehicle Type | Passenger |

| | |
|---|---|
| GVWR (kg) | 2082 |
| GAWR Front (kg) | 1191 |
| GAWR Rear (kg) | 1134 |

### VEHICLE SEATING AND WEIGHT CAPACITY DATA

| Measured Parameter | Front | Rear | Third | Total | |
|---|---|---|---|---|---|
| Designated Seating Capacity (DSC) | 2 | 3 | - | 5 | |
| Capacity Weight (VCW) (kg) | | | | 415 | (A) |
| DSC X 68.04 kg | | | | 340.2 | (B) |
| Cargo Weight (RCLW) (kg) | | | | 74.8 | (A-B) |

### VEHICLE SEAT TYPE

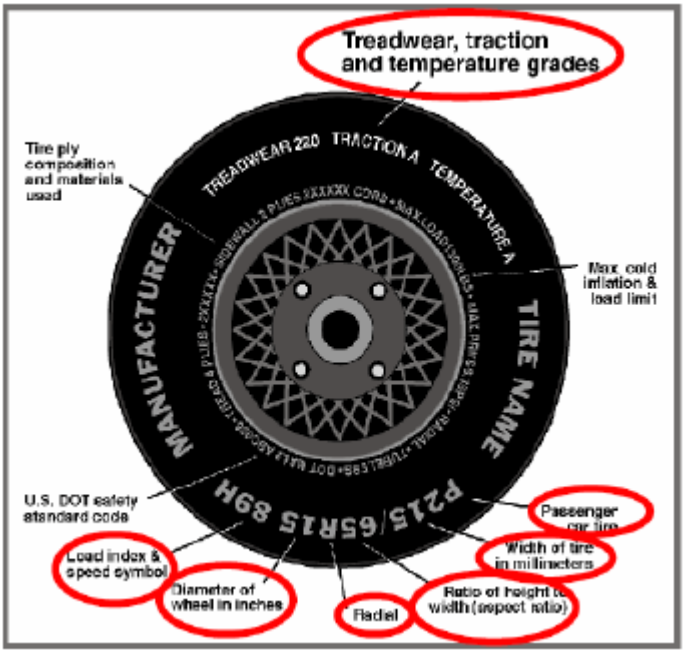
| Seating Location | Type of Seat Pan | | | | Type of Seat Back | | |
|---|---|---|---|---|---|---|---|
| | Bucket | Bench | Split Bench | Contoured | Fixed | Adjustable | |
| | | | | | | W/ Lever | W/ Knob |
| Front Seat | X | | | | | | X |
| Rear or Second Row Seat | | X | | | X | | |
| Third Row seat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

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

| | | | |
|---|---|---|---|
| Test Vehicle: | 2016 Toyota Avalon four door sedan | NHTSA No.: | M20165107 |
| Test Program: | NCAP Side MDB Impact Test | Test Date: | 3/16/2016 |

## VEHICLE TIRE INFORMATION

*Collected for year, make, model, & VIN, all items circled in red, tire manufacturer and tire name.*




## TIRE SIDEWALL INFORMATION

| Measured Parameter | Front | Rear |
|---|---|---|
| Maximum Tire Pressure (kPa) | 350 | 350 |
| Cold Pressure (kPa) | 230 | 230 |
| Recommended Tire Size | P215/55R17 | P215/55R17 |
| Tire Size on Vehicle | P215/55R17 | P215/55R17 |
| Tire Manufacturer | Michelin | Michelin |
| Tire Model | Primacy MXV4 | Primacy MXV4 |
| Treadwear | 500 | 500 |
| Traction | A | A |
| Temperature Grade | A | A |
| Tire Plies Sidewall | 1 Polyester | 1 Polyester |
| Tire Plies Body | 1 Polyester, 1 Polyamide, 2 Steel | 1 Polyester, 1 Polyamide, 2 Steel |
| Load Index/Speed Symbol | 93V | 93V |
| Tire Material | Rubber | Rubber |
| DOT Safety Code Left | M33F009X4415 | M33F009X4415 |
| DOT Safety Code Right | M33F009X4415 | M33F009X4415 |

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

Test Vehicle: 2016 Toyota Avalon four door sedan NHTSA No.: M20165107
Test Program: NCAP Side MDB Impact Test Test Date: 3/16/2016

### TIRE PRESSURES

| | Units | LF | RF | LR | RR |
|---|---|---|---|---|---|
| As Delivered | kPa | 236 | 234 | 238 | 238 |
| Tire Placard | kPa | 230 | 230 | 230 | 230 |
| Owner's Manual | kPa | 230 | 230 | 230 | 230 |
| As Tested | kPa | 230 | 230 | 230 | 230 |

### 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 | 207 | 207 | 207 | 207 |

### TEST VEHICLE WEIGHTS

| | Units | As Delivered (UVW) | | | As Tested (ATW) | | | Fully Loaded | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Front | Rear | Total | Front | Rear | Total | Front | Rear | Total |
| Left | kg | 511 | 300 | | 373 | 547 | | 551 | 396 | |
| Right | kg | 473 | 308 | | 475 | 393 | | 478 | 375 | |
| Ratio | % | 62% | 38% | | 47% | 53% | | 57% | 43% | |
| Totals | kg | 984 | 608 | 1592 | 848 | 940 | 1788 | 1029 | 771 | 1800 |

### TARGET TEST WEIGHT CALCULATION

| Measured Parameter | Units | Value | |
|---|---|---|---|
| Total Delivered Weight (UVW) | kg | 1592 | (A) |
| Sum of Actual Weight of 2 P572 ATDS Used | kg | 127 | (B) |
| Rated Cargo / Luggage Weight (RCLW) | kg | 74.8 | (C) |
| Calculated Target Vehicle Test Weight (TVTW) | kg | 1793.8 | (A+B+C) |

**Does the measured As Test Vehicle Weight lie within the required weight range**

**(i.e. Calculated Test Vehicle Target Weight – 4.5 kg to – 9 kg)?** [X] **Yes** [ ] **No**

### TEST VEHICLE ATTITUDES AND CG

| Measurement Description | Units | Fully Loaded | As Tested | Meets Requirement** |
|---|---|---|---|---|
| LF | mm | 713 | 711 | Yes |
| RF | mm | 722 | 721 | Yes |
| RR | mm | 708 | 709 | Yes |
| LR | mm | 690 | 689 | Yes |
| Vehicle CG (Aft of Front Axle) | mm | 1205 | 1479 | |
| Vehicle CG (Left(+)/Right(-) from Longitudinal Centerline) | mm | +41 | +23 | |

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

**Test height adjustable suspension setting, if applicable:** N/A

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

| | | | |
|---|---|---|---|
| Test Vehicle: | 2016 Toyota Avalon four door sedan | NHTSA No.: | M20165107 |
| Test Program: | NCAP Side MDB Impact Test | Test Date: | 3/16/2016 |

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

| Component Description | Weight (kg) |
|---|---|
| Trunk Carpeting | 8 |
| Spare Tire | 15 |
| Jack | 4 |
| Rear Speaker | 1 |
| Tail Light | 1 |
| Passenger Door Internals | 13 |
| | |
| Ballast / Equipment Added | 38 |

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

| | | | |
|---|---|---|---|
| Test Vehicle: | 2016 Toyota Avalon four door sedan | NHTSA No.: | M20165107 |
| Test Program: | NCAP Side MDB Impact Test | Test Date: | 3/16/2016 |

**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 passengers' seats should be set to the rear-most, lowest, mid-angle position.*

**SCRL ANGLE RANGE**

| Seat | SCRL (°) | | |
|---|---|---|---|
| | Max | Min | Mid |
| Driver Seat | 16.3 | 10.3 | 13.3 |
| Front Passenger Seat | - | Not Adjustable | - |
| Front Center Seat* | | | |
| Struck Side Rear Seat | Fixed | Fixed | Fixed |
| Non-Struck Side Rear Seat | Fixed | Fixed | Fixed |
| Rear Center Seat* | Fixed | Fixed | Fixed |

**if applicable*

**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 | Forward-Most |
| Driver Seat | 13.3 | 10 | Max | 50 | 60 | 70 |
| | | | Mid | 25 | 35 | 45 |
| | | | Min | 0 | 10 | 20 |
| Front Passenger Seat | Not Adjustable | | Max | - | - | - |
| | | | Mid | - | - | - |
| | | | Min | - | - | - |
| Front Center Seat* | N/A | N/A | Max | - | - | - |
| | | | Mid | - | - | - |
| | | | Min | - | - | - |
| Struck Side Rear Seat | Fixed | Fixed | Max | - | - | - |
| | | | Mid | - | - | - |
| | | | Min | - | - | - |
| Non-Struck Side Rear Seat | Fixed | Fixed | Max | - | - | - |
| | | | Mid | - | - | - |
| | | | Min | - | - | - |
| Rear Center Seat* | Fixed | Fixed | Max | - | - | - |
| | | | Mid | - | - | - |
| | | | Min | - | - | - |

**if applicable*

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

Test Vehicle: 2016 Toyota Avalon four door sedan NHTSA No.: M20165107
Test Program: NCAP Side MDB Impact Test Test Date: 3/16/2016

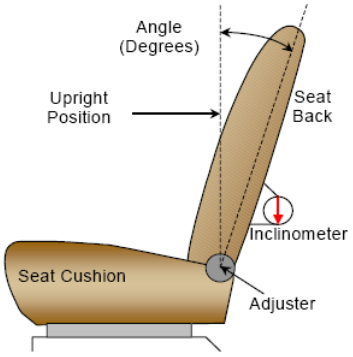
## SEAT FORE / AFT POSITION

| Seat | Total Fore / Aft Travel | | Test Position from Forwardmost Position | |
|---|---|---|---|---|
| | mm | Detents* | mm | Detent* |
| Driver Seat | 240 | N/A | 120 | N/A |
| Front Passenger Seat | 240 | N/A | 120 | N/A |
| Front Center Seat* | N/A | N/A | N/A | N/A |
| Struck Side Rear Seat | FIXED | FIXED | FIXED | FIXED |
| Non-Struck Side Rear Seat | FIXED | FIXED | FIXED | FIXED |
| Rear Center Seat* | FIXED | FIXED | FIXED | FIXED |

**if applicable*

## SEAT BACK ANGLE ADJUSTMENT

*The driver's seat back is positioned to the manufacturer's designated design angle. The front center and front passenger's seat backs are positioned in a similar manner as the driver's seat back. The struck side rear seat back is positioned such that the dummy's head is level. The rear center and non-struck side rear outboard seat backs are positioned in a similar manner as the struck-side rear seat back.*



FRONT SEAT ASSEMBLY

| Seat | Total Seat Back Angle Range | | Test Position from Most Upright | |
|---|---|---|---|---|
| | Degrees | Detents* | Degrees | Detents* |
| Driver Seat w/ Seated Dummy | -9.7 to 46.3 | N/A | 3.5 | N/A |
| Front Passenger Seat | -9.7 to 46.3 | N/A | 3.5 | N/A |
| Front Center Seat* | N/A | N/A | N/A | N/A |
| 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 |

**if applicable*

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

Test Vehicle: 2016 Toyota Avalon four door sedan NHTSA No.: M20165107
Test Program: NCAP Side MDB Impact Test Test Date: 3/16/2016

### SEAT BELT ANCHORAGE ADJUSTMENT

*Seat belt anchorages are adjusted in accordance with the information provided by the manufacturer on Form No. 1. For this test zero is defined as the uppermost position.*

| | Total # of Positions | Placed in Position # |
|---|---|---|
| Driver Seat | 4 (0-3) | 0 – Uppermost |
| Rear Seat | Fixed | Fixed |

### HEAD RESTRAINT ADJUSTMENT

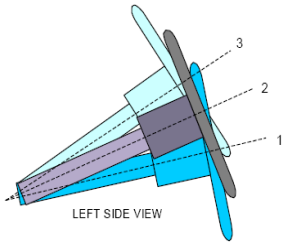
*The driver's head restraint is adjusted to the highest and most full forward in-use position. The struck-side rear passenger's head restraint is adjusted to the lowest and most full forward in-use position.*

| | Total # of Positions | Placed in Position # |
|---|---|---|
| Driver Seat | 2 (0-1) | 0 - Uppermost |
| Rear Seat | 2 (0-1) | 2 - Lowest |

### STEERING COLUMN ADJUSTMENT

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

| | Degrees | Fore/Aft Position (mm) |
|---|---|---|
| Lowermost – Position 1 | 21.8 | |
| Geometric Center – Position 2 | 23.8 | |
| Uppermost – Position 3 | 25.8 | |
| Telescoping Steering Wheel Travel | | 40 |
| Test Position | 23.8 | 20 |

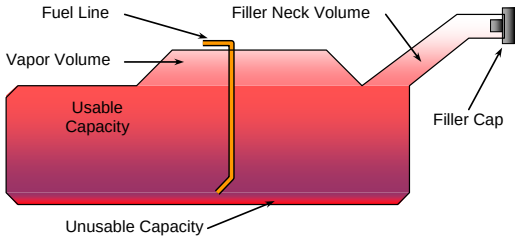


*STEERING COLUMN ASSEMBLY*

### FUEL PUMP

*Describe the fuel pump type, details about how it operates, and the location of the fuel filler neck.*

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



*VEHICLE FUEL TANK ASSEMBLY*

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

Test Vehicle: 2016 Toyota Avalon four door sedan NHTSA No.: M20165107
Test Program: NCAP Side MDB Impact Test Test Date: 3/16/2016

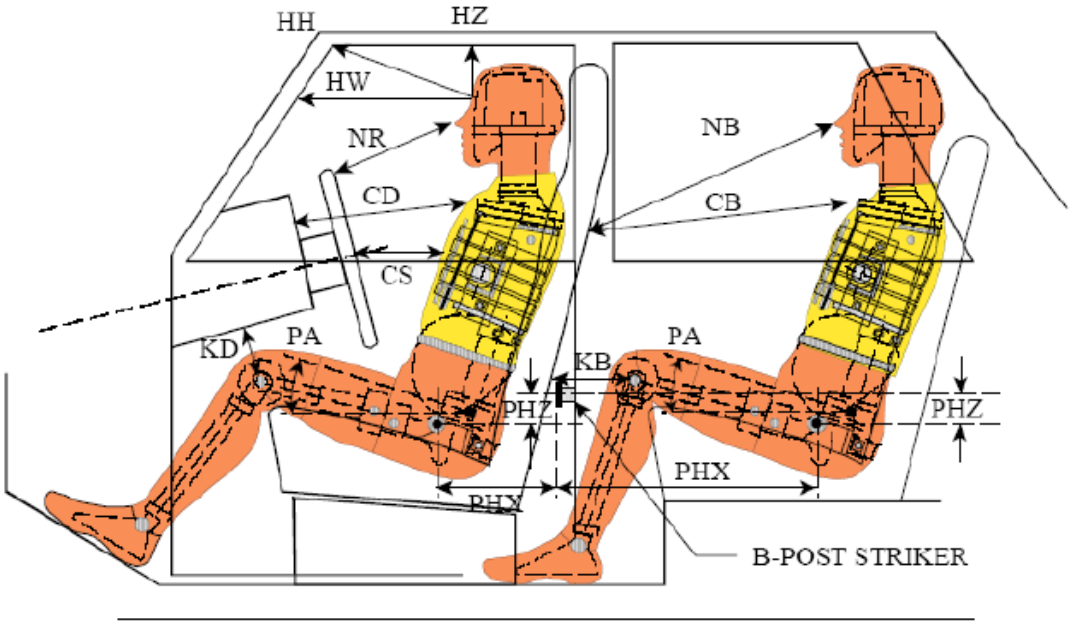
**FUEL TANK CAPACITY**

| | **Liters** |
|---|---|
| Usable Capacity of "Standard Tank" (see Form No. 1) | 63.44 |
| Usable Capacity of "Optional Tank" (see Form No. 1) | |
| Usable Capacity of Standard Tank (see Owner's Manual) | 64.35 |
| Usable Capacity of Optional Tank (see Owner's Manual) | |
| 93% of Usable Capacity | 59.0 |
| Actual Amount of Solvent Used in Test | 59.0 |
| 1/3 of Usable Capacity | 21.15 |

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

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

| | | | |
|---|---|---|---|
| Test Vehicle: | 2016 Toyota Avalon four door sedan | NHTSA No.: | M20165107 |
| Test Program: | NCAP Side MDB Impact Test | Test Date: | 3/16/2016 |




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

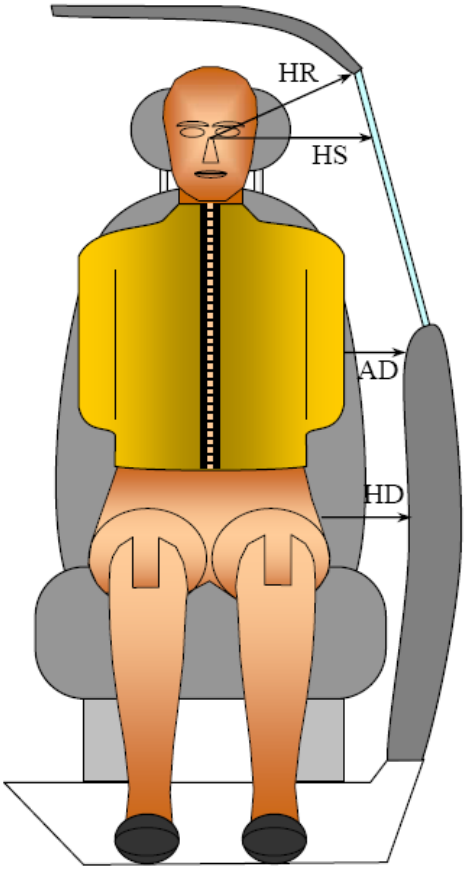
**LEFT SIDE VIEW**

**DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION**

| Driver Code | Pass. Code | Description | Driver (Serial No. F034) | | Passenger (Serial No. 303) | |
|---|---|---|---|---|---|---|
| | | | Length (mm) | Angle | Length (mm) | Angle |
| HH | | Header to Header | 414 | | | |
| HW | | Header to Windshield | 732 | | | |
| HZ | HZ | Head to Roof Liner | 189 | | 265 | |
| NR | NB | Nose to Rim/Seat Back | 480 | | 634 | |
| CD | CB | Chest to Dash/Seat Back | 576 | | 619 | |
| CS | | Chest to Steering Wheel | 378 | | | |
| KD(L)/KDA(L)° | KB(L)/KBA(L)° | Left Knee to Dash/Seat Back | 180 | 31.4 | 332 | 18.0 |
| KD(R)/KDA(R)° | KB(R)/KBA(R)° | Right Knee to Dash/Seat Back | 195 | 5.3 | 320 | 13.2 |
| PAX° | PAX° | Pelvic Tilt Angle X | | 23.2 | | 24.5 |
| | PAY° | Pelvic Tilt Angle Y | | | | 0.3 |
| PHX | PHX | Hip Point to Striker (X-Axis) | 199 | | 329 | |
| PHZ | PHZ | Hip Point to Striker (Z-Axis) | 220 | | 309 | |

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

| | | | |
|---|---|---|---|
| Test Vehicle: | 2016 Toyota Avalon four door sedan | NHTSA No.: | M20165107 |
| Test Program: | NCAP Side MDB Impact Test | Test Date: | 3/16/2016 |



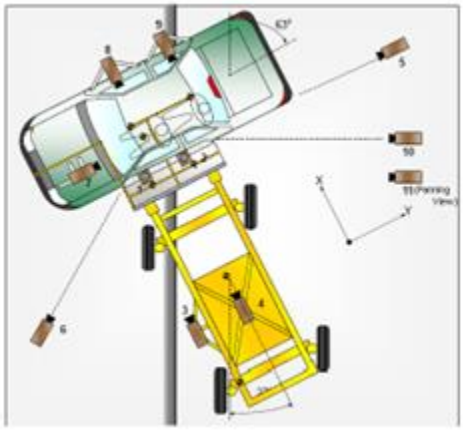

*FRONT VIEW OF DUMMY*

**DUMMY LATERAL CLEARANCE DIMENSION INFORMATION**

| Code | Measurement Description | Units | Driver (Serial No. F034) | Passenger (Serial No. 303) |
|---|---|---|---|---|
| HR | Head to Side Header | mm | 188 | 238 |
| HS | Head to Side Window | mm | 323 | 362 |
| AD | Arm to Door | mm | 102 | 161 |
| HD | Hip Point to Door | mm | 144 | 170 |

**DATA SHEET NO. 5**
**CAMERA AND INSTRUMENTATION DATA**

Test Vehicle: 2016 Toyota Avalon four door sedan NHTSA No.: M20165107
Test Program: NCAP Side MDB Impact Test Test Date: 3/16/2016



**CAMERA LOCATIONS AND DATA**

| No. | Camera View | Coordinates (mm) | | | Lens Length (mm) | Operating Frame Rate (fps) |
|---|---|---|---|---|---|---|
| | | X | Y | Z | | |
| 1 | Overhead Overall | 0 | 923 | -5326 | 14 | 1000 |
| 2 | Overhead Close-up | 315 | 1306 | -5326 | 28 | 1000 |
| 3 | Left Impact Point (MDB) | -1470 | 0 | -847 | 25 | 1000 |
| 4 | Side Overall (MDB) | -1140 | 838 | -1587 | 12.5 | 1000 |
| 5 | Rear | 0 | 9826 | -1034 | 24 | 1000 |
| 6 | Left Front | -2351 | -4873 | -1162 | 24 | 1000 |
| 7 | Driver Front (OB) | | | | 25 | 1000 |
| 8 | Driver Side (OB) | | | | 12.5 | 1000 |
| 9 | Passenger Side (OB) | | | | 12.5 | 1000 |
| 10 | Real-time Left Rear | | | | Zoom | 60 |
| 11 | Real-time In run | | | | Zoom | 60 |

*Notes:* *Reference: Impact Point projected to Ground*
*+X = To Front of MDB, +Y = To Right of MDB, +Z = Down*
**All measurements accurate to ± 6 mm.*

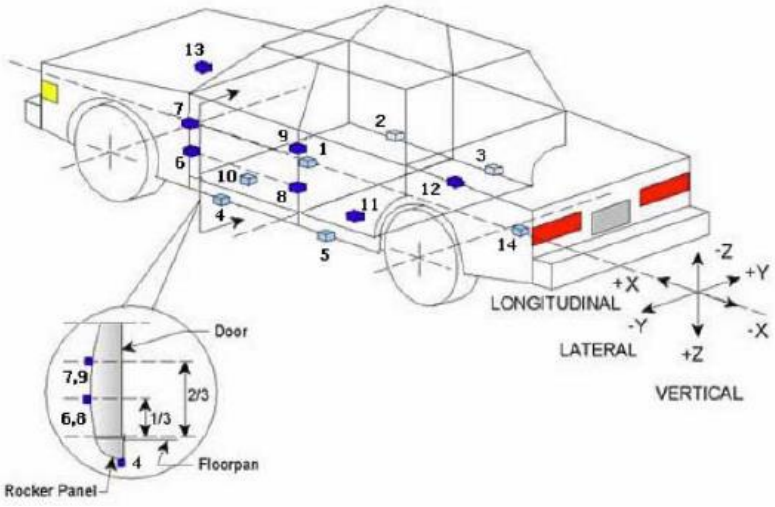
If applicable, explain why camera(s) did not operate as intended: All cameras operated normally

**INSTRUMENTATION**

| | |
|---|---|
| Driver Dummy Channels | 16 |
| Passenger Dummy Channels | 16 |
| Vehicle Structure Accelerometers | 23 |
| MDB Accelerometers | 7 |
| Total | 62 |

**DATA SHEET NO. 6**
**TEST VEHICLE ACCELEROMETER LOCATIONS**

Test Vehicle: 2016 Toyota Avalon four door sedan NHTSA No.: M20165107
Test Program: NCAP Side MDB Impact Test Test Date: 3/16/2016



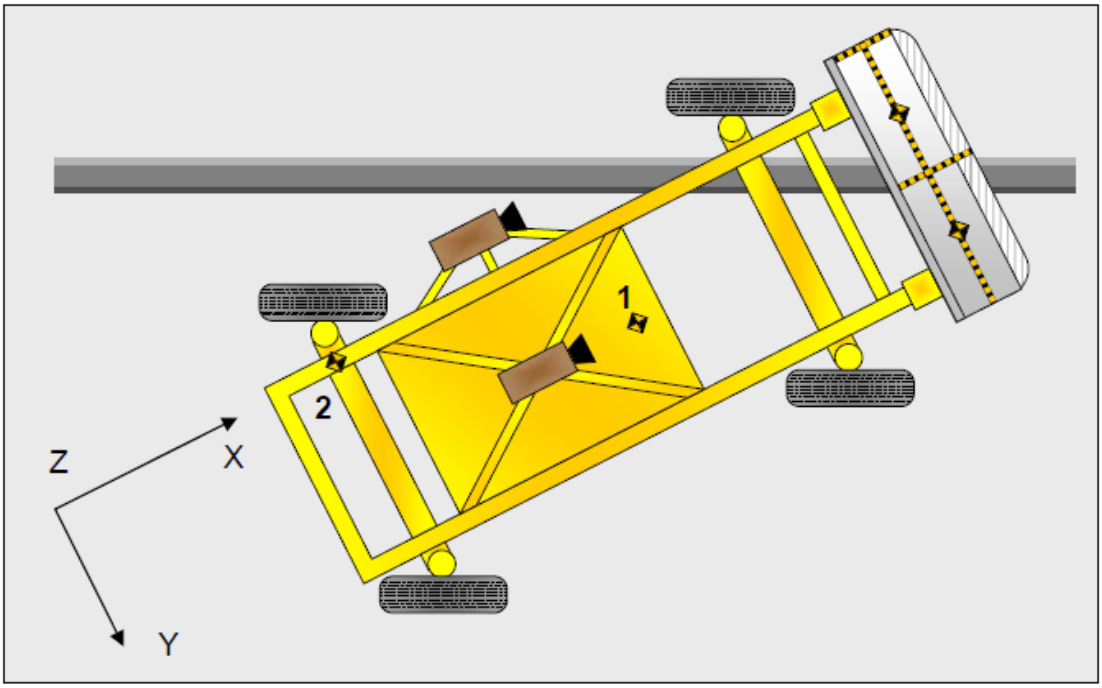

**TEST VEHICLE ACCELEROMETER LOCATIONS**

| No. | Accelerometer Location | Coordinates (mm) | | |
|---|---|---|---|---|
| | | X | Y | Z |
| 1 | Vehicle CG | 2556 | 7 | -110 |
| 2 | Right Sill at Front Seat | 3014 | 695 | -218 |
| 3 | Right Sill at Rear Seat | 2053 | 695 | -210 |
| 4 | Left Sill at Front Door | 3056 | -688 | -226 |
| 5 | Left Sill at Rear Door | 2050 | -690 | -216 |
| 6 | A-Post Lower | 3478 | -637 | -55 |
| 7 | A-Post Middle | 3424 | -671 | 432 |
| 8 | B-Post Lower | 2439 | -690 | -78 |
| 9 | B-Post Middle | 2392 | -694 | 170 |
| 10 | Front Seat Track | 2633 | -556 | -254 |
| 11 | Rear Seat Structure | 1560 | -649 | -185 |
| 12 | Rt. Rear Occ. Compartment | 2217 | 426 | -346 |
| 13 | Engine Block | 4283 | -18 | 199 |
| 14 | Rear Above Axle | 1124 | 36 | -88 |

*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: | 2016 Toyota Avalon four door sedan | NHTSA No.: | M20165107 |
| Test Program: | NCAP Side MDB Impact Test | Test Date: | 3/16/2016 |




**MDB ACCELEROMETER LOCATIONS**

| No. | Accelerometer Location | Coordinates (mm) | | |
|---|---|---|---|---|
| | | X | Y | Z |
| 1 | MDB CG | 1859 | 0 | -330 |
| 2 | MDB Rear | 386 | -660 | -660 |

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

## DATA SHEET NO. 8
## POST-TEST OBSERVATIONS

Test Vehicle: 2016 Toyota Avalon four door sedan NHTSA No.: M20165107
Test Program: NCAP Side MDB Impact Test Test Date: 3/16/2016

### 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 & Side Header | Curtain Airbag |
| Back of Head | Side Header/ Curtain Airbag/ Headrest | Seat Back |
| Left Shoulder | Door Panel | Torso/Pelvis Airbag & Seat Back |
| Upper Torso | Torso/Pelvis Airbag & Seat Back | Torso/Pelvis Airbag & Seat Back |
| Lower Torso | Torso/Pelvis Airbag & Seat Back | Torso/Pelvis Airbag & Seat Back |
| Left Hip | Door Panel & Torso/Pelvis Airbag & Seatpan | Door Panel & Torso/Pelvis Airbag & Seatback |
| Left Knee | Door Panel | Door Panel |

### 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 Systems 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, Width of Opening at Striker (mm) | 0 | 0 | 0 | 0 | 0 |

*Tailgate opened during impact but is still operational.

### 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 | B Pillar buckled |
| Sill Separation | None |
| Windshield Damage | None |
| Side Window Damage | Struck Side windows Shattered |
| Other Notable Effects | None |

## DATA SHEET NO. 8 … (CONTINUED)
## POST-TEST OBSERVATIONS

Test Vehicle: 2016 Toyota Avalon four door sedan NHTSA No.: M20165107
Test Program: NCAP Side MDB Impact Test Test Date: 3/16/2016

### SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

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

### IMPACT POINT LOCATION DATA

| Measured Parameter | Units | Tolerance | Value |
|---|---|---|---|
| Vehicle Wheel Base | mm | | 2814 |
| Vertical Impact Reference Line (Aft of Front Axle - Intended Impact Point) | mm | | 467 |
| Actual Impact Point (Aft of Frontal Axle) | mm | | 479 |
| Horizontal Offset (+ forward / - rearward) | mm | +/- 50 of Intended Impact Point | -12 |
| Vertical Offset (+ down / - up) | mm | +/- 20 of Intended Impact Point | -3 |

**DATA SHEET NO. 9**
**MDB SUMMARY OF RESULTS**

Test Vehicle: 2016 Toyota Avalon four door sedan NHTSA No.: M20165107
Test Program: NCAP Side MDB Impact Test Test Date: 3/16/2016

## MDB SPECIFICATIONS

| Measurement Description | Length (mm) |
|---|---|
| Overall Width of Framework Carriage | 1,250 |
| Overall Length Including Honeycomb Frame | 4,120 |
| Wheelbase of Framework Carriage | 2,600 |
| CG Location of Front Axle | 1,120 |

## MDB WEIGHTS

| | Units | Front Axle | Rear Axle | Total |
|---|---|---|---|---|
| Left | kg | 392.5 | 297.5 | 690.0 |
| Right | kg | 386.0 | 291.5 | 677.5 |
| Ratio | % | 57.4% | 42.6% | 100.0% |
| Totals | kg | 778.5 | 589.0 | 1367.5 |

## SPEED AND ANGLE AT IMPACT DATA

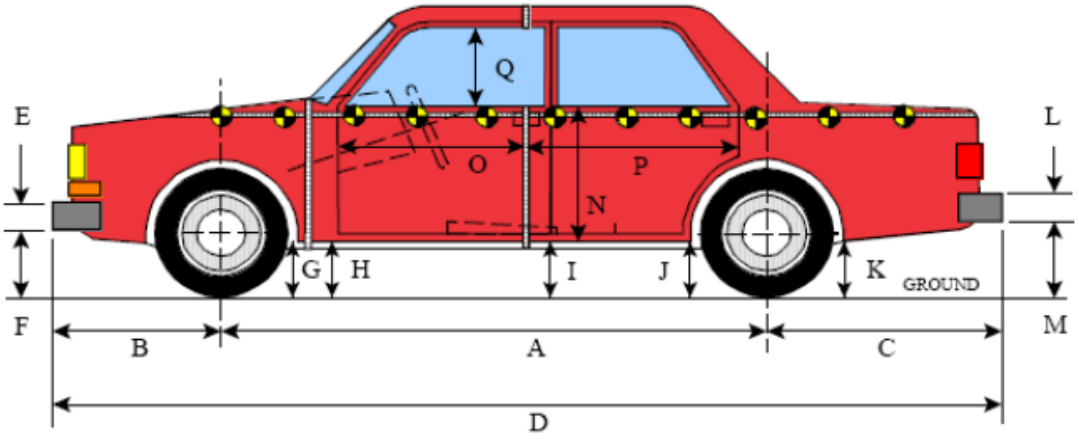
| Measured Parameter | Units | Requirement | Value |
|---|---|---|---|
| Trap No. 1 Velocity (Primary) | km/h | 61.10 to 62.70 | 61.67 |
| Trap No. 2 Velocity (Redundant) | km/h | 61.10 to 62.70 | 61.68 |
| MDB CL to Target Vehicle CL | degrees | 88.5 to 91.5 | 89.5 |
| MDB Forward Line of Motion to Target Vehicle CL | degrees | 62.5 to 63.5 | 63.0 |
| MDB Crabbed angle to MDB Forward Line of Motion | degrees | 26.0 to 28.0 | 27.0 |

## MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE

| Vertical Location | | | From Centerline | | Maximum Crush (mm) |
|---|---|---|---|---|---|
| Row | Description | Height (mm) | Distance (mm) | Direction | |
| A | Center of Bumper | 432 | 800 | Right | 246 |
| B | Top of Bumper | 533 | 800 | Right | 144 |
| C | Mid-Level | 686 | 800 | Right | 102 |
| D | Top of Stack | 813 | 800 | Right | 128 |

**DATA SHEET NO. 10**
**TEST VEHICLE PROFILE MEASUREMENTS**

Test Vehicle: 2016 Toyota Avalon four door sedan NHTSA No.: M20165107
Test Program: NCAP Side MDB Impact Test Test Date: 3/16/2016



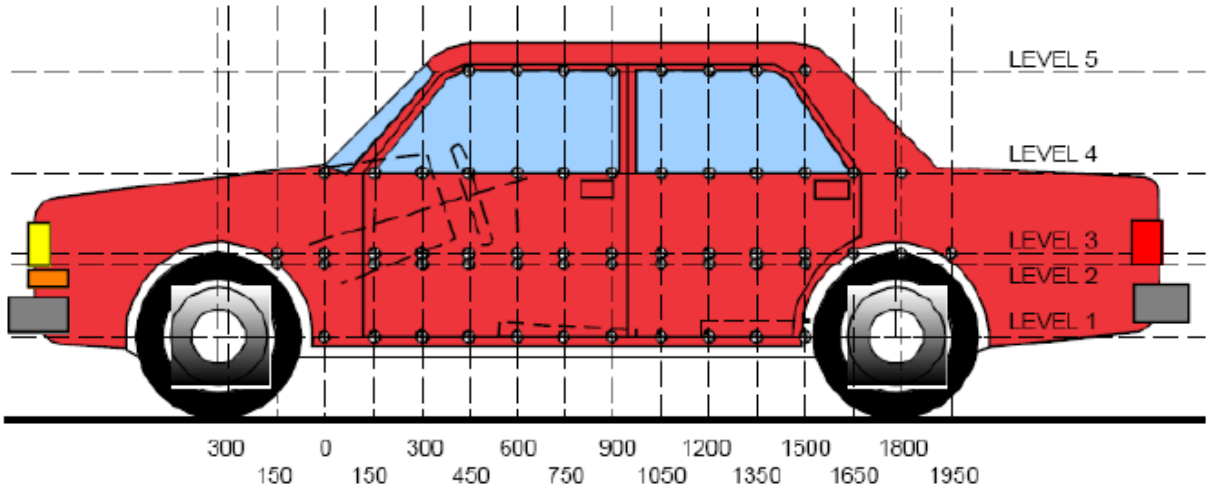

**LEFT SIDE VIEW**
All MEASUREMENTS IN (mm) WITH TOLERANCE OF ± 3mm

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

| Code | Description | Pre-Test | Post-Test | Difference |
|---|---|---|---|---|
| A | Wheelbase | 2814 | 2805 | -8 |
| B | Front Axle to FSOV | 994 | 1002 | 8 |
| C | Rear Axle to RSOV | 1162 | 1157 | -5 |
| D | Total Length at Centerline | 4969 | 4964 | -5 |
| E | Front Bumper Thickness | 140 | 140 | 0 |
| F | Front Bumper Bottom to Ground | 412 | 415 | 3 |
| G | Sill Height at Front Wheel Well | 161 | 165 | 4 |
| H | Sill Height at Front Door Leading Edge | 166 | 170 | 4 |
| I | Sill Height at B Pillar | 180 | 198 | 18 |
| J1 | Sill Height at Rear Wheel Well | 167 | 168 | 1 |
| J2 | Pinch Weld Height at Rear Wheel Well | 190 | 187 | -3 |
| K | Sill Height Aft of Rear Wheel Well | 202 | 205 | 3 |
| L | Rear Bumper Thickness | 155 | 155 | 0 |
| M | Rear Bumper Bottom to Ground | 432 | 430 | -2 |
| N | Sill Height to Window Bottom of Front Window Sill | 720 | 656 | -64 |
| O | Front Door Leading Edge to Impact CL | 837 | 822 | -14 |
| P | Rear Door Trailing Edge to Impact CL | 1420 | 1375 | -45 |
| Q | Front Window Opening | 393 | 379 | -14 |
| R | Right Side Length | 4844 | 4842 | -2 |
| S | Left Side Length | 4845 | 4840 | -5 |
| T | Maximum Vehicle Width | 1835 | 1651 | -184 |

**DATA SHEET NO. 11**
**TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS**

Test Vehicle: 2016 Toyota Avalon four door sedan
Test Program: NCAP Side MDB Impact Test
NHTSA No.: M20165107
Test Date: 3/16/2016




**LEFT SIDE VIEW**

**MAXIMUM EXTERIOR CRUSH MEASUREMENTS**

| Level | Measurement Description | Units | Height Above Ground | Maximum Exterior Static Crush | Distance from Impact |
|---|---|---|---|---|---|
| 1 | Sill Top | mm | 295 | 16 | 1650 |
| 2 | Driver Hip Point | mm | 525 | 211 | 1200 |
| 3 | Mid-Door | mm | 622 | 240 | 1200 |
| 4 | Window Sill | mm | 914 | 222 | 1500 |
| 5 | Window Top | mm | 1394 | 41 | 1500 |

*window top level bent outward from original position

***NOTE:*** *The above measurements should be taken along the vertical impact reference line. Vehicle measurements forward of the vertical impact reference line are negative.*

## DATA SHEET NO. 11 … (CONTINUED)
## TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2016 Toyota Avalon four door sedan NHTSA No.: M20165107
Test Program: NCAP Side MDB Impact Test Test Date: 3/16/2016

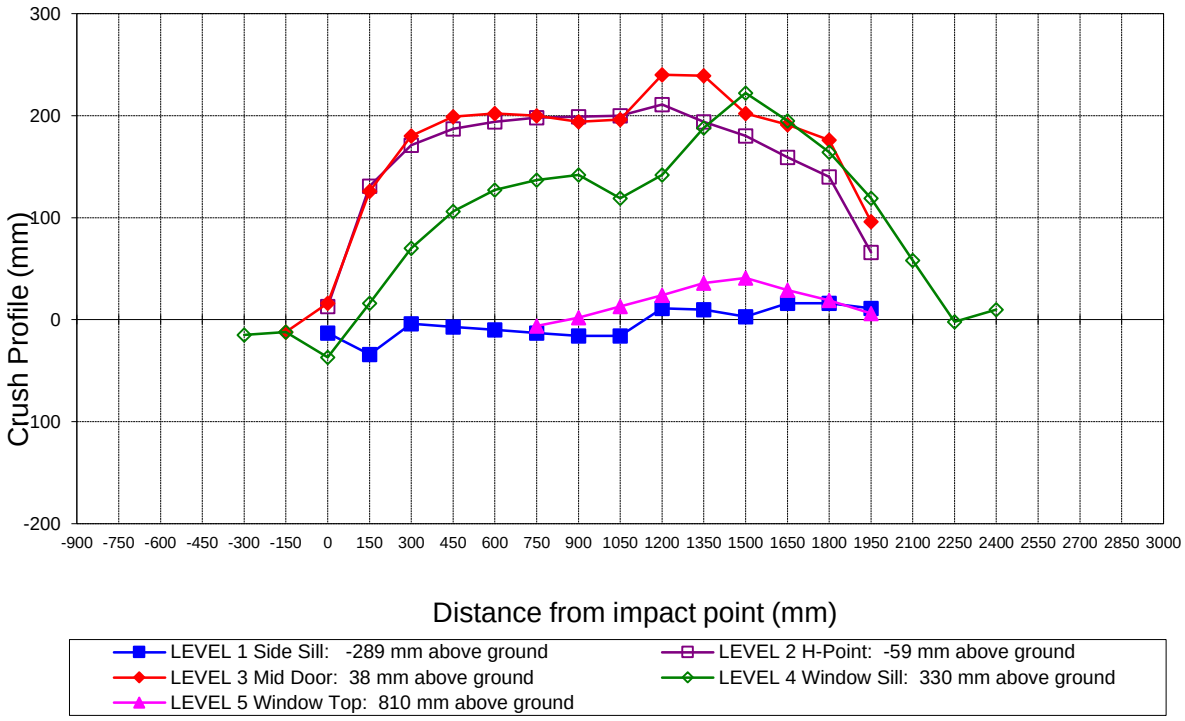
### EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

| | Pre-Test | | | | | Post-Test | | | | | Difference | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| -900 | | | | | | | | | | | | | | | |
| -750 | | | | | | | | | | | | | | | |
| -600 | | | | | | | | | | | | | | | |
| -450 | | | | | | | | | | | | | | | |
| -300 | | | | 799 | | | | | 814 | | | | | -15 | |
| -150 | | | 917 | 816 | | | | 929 | 828 | | | | -12 | -12 | |
| 0 | 885 | 907 | 907 | 828 | | 898 | 894 | 892 | 865 | | -13 | 13 | 15 | -37 | |
| 150 | 863 | 904 | 909 | 837 | | 897 | 773 | 783 | 821 | | -34 | 131 | 126 | 16 | |
| 300 | 860 | 905 | 911 | 845 | | 864 | 734 | 731 | 775 | | -4 | 171 | 180 | 70 | |
| 450 | 858 | 905 | 913 | 853 | | 865 | 718 | 714 | 747 | | -7 | 187 | 199 | 106 | |
| 600 | 856 | 906 | 914 | 861 | | 866 | 712 | 712 | 734 | | -10 | 194 | 202 | 127 | |
| 750 | 854 | 907 | 914 | 870 | 599 | 867 | 709 | 714 | 733 | 605 | -13 | 198 | 200 | 137 | -6 |
| 900 | 853 | 907 | 915 | 877 | 620 | 869 | 708 | 721 | 735 | 618 | -16 | 199 | 194 | 142 | 2 |
| 1050 | 853 | 908 | 915 | 879 | 626 | 869 | 708 | 719 | 760 | 613 | -16 | 200 | 196 | 119 | 13 |
| 1200 | 852 | 907 | 914 | 879 | 628 | 841 | 696 | 674 | 737 | 604 | 11 | 211 | 240 | 142 | 24 |
| 1350 | 851 | 905 | 912 | 879 | 629 | 841 | 711 | 673 | 691 | 593 | 10 | 194 | 239 | 188 | 36 |
| 1500 | 850 | 903 | 909 | 878 | 627 | 847 | 723 | 707 | 656 | 586 | 3 | 180 | 202 | 222 | 41 |
| 1650 | 853 | 901 | 907 | 876 | 623 | 837 | 742 | 716 | 681 | 594 | 16 | 159 | 191 | 195 | 29 |
| 1800 | 861 | 900 | 905 | 874 | 617 | 845 | 760 | 729 | 710 | 598 | 16 | 140 | 176 | 164 | 19 |
| 1950 | 882 | 907 | 910 | 866 | 597 | 871 | 841 | 814 | 747 | 591 | 11 | 66 | 96 | 119 | 6 |
| 2100 | | | | 885 | | | | | 827 | | | | | 58 | |
| 2250 | | | | 864 | | | | | 866 | | | | | -2 | |
| 2400 | | | | 856 | | | | | 846 | | | | | 10 | |
| 2550 | | | | | | | | | | | | | | | |
| 2700 | | | | | | | | | | | | | | | |
| 2850 | | | | | | | | | | | | | | | |
| 3000 | | | | | | | | | | | | | | | |

***NOTE:*** *Pre-test measurements are taken when the vehicle is in the "As Tested" weight condition.*
*Vehicle measurements forward of the vertical impact reference line are negative.*
*The crush profile grid is established prior to test based on an estimated impact point.*

## DATA SHEET NO. 11 (CONTINUED)
## TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

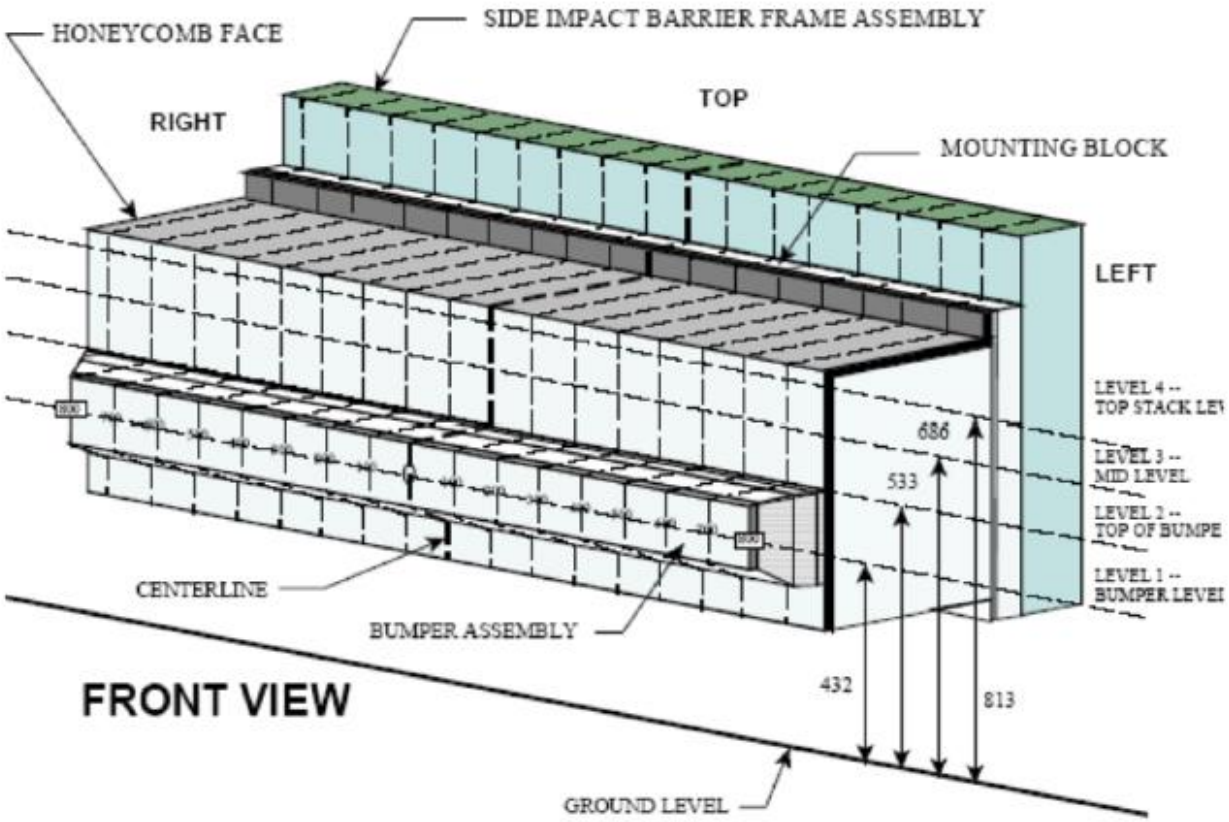
| | | | |
|---|---|---|---|
| Test Vehicle: | 2016 Toyota Avalon four door sedan | NHTSA No.: | M20165107 |
| Test Program: | NCAP Side MDB Impact Test | Test Date: | 3/16/2016 |




***Vehicle Exterior Crush Measurements - Visual Representation***

**DATA SHEET NO. 12**
**MDB EXTERIOR STATIC CRUSH MEASUREMENTS**

| | | | |
|---|---|---|---|
| Test Vehicle: | 2016 Toyota Avalon four door sedan | NHTSA No.: | M20165107 |
| Test Program: | NCAP Side MDB Impact Test | Test Date: | 3/16/2016 |




NOTE: Dimensions are shown in millimeters, mm

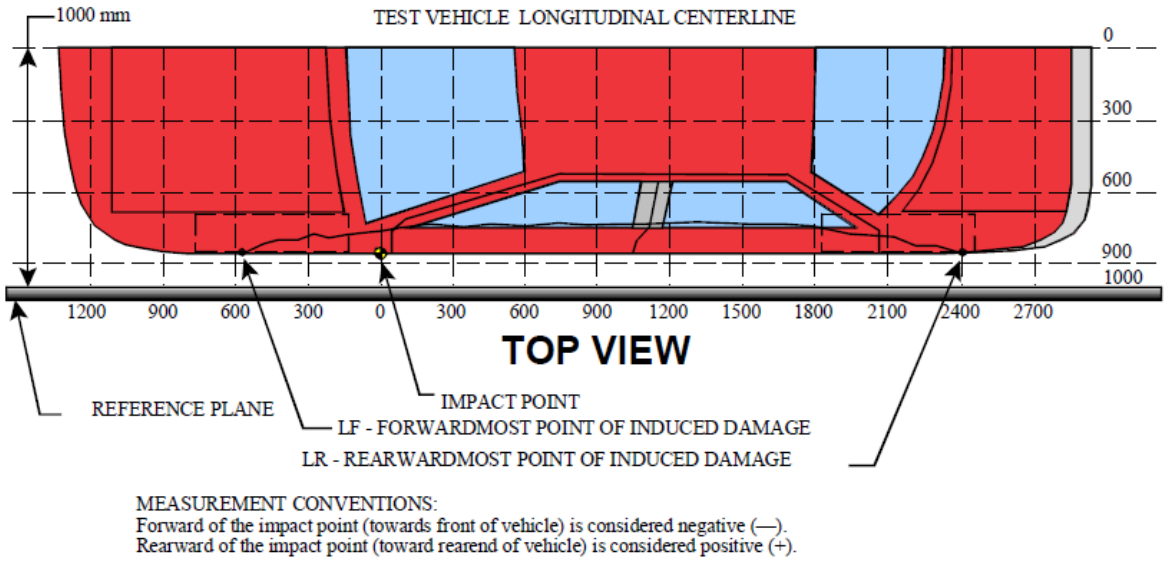
**DEFORMABLE BARRIER STATIC CRUSH**

| 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 | 800 |
| 1 | 246 | 237 | 224 | 210 | 203 | 202 | 195 | 193 | 192 | 185 | 181 | 178 | 174 | 171 | 172 | 177 | 185 |
| 2 | 144 | 141 | 128 | 114 | 106 | 102 | 96 | 98 | 100 | 93 | 89 | 86 | 93 | 89 | 86 | 93 | 101 |
| 3 | 57 | 42 | 37 | 41 | 50 | 59 | 83 | 102 | 78 | 43 | 27 | 24 | 26 | 30 | 41 | 57 | 88 |
| 4 | 46 | 27 | 12 | 21 | 38 | 66 | 108 | 128 | 113 | 76 | 37 | 32 | 32 | 39 | 48 | 77 | 115 |

**DATA SHEET NO. 13**
**MDB EXTERIOR STATIC CRUSH MEASUREMENTS**

| | | | |
|---|---|---|---|
| Test Vehicle: | 2016 Toyota Avalon four door sedan | NHTSA No.: | M20165107 |
| Test Program: | NCAP Side MDB Impact Test | Test Date: | 3/16/2016 |

For guidance regarding damage profile distance measurements, pelase refer to the latest version of the *NHTSA Test Reference Guide, Volume 1: Vehicle Tests.*




MEASUREMENT CONVENTIONS:
Forward of the impact point (towards front of vehicle) is considered negative (—).
Rearward of the impact point (toward rearend of vehicle) is considered positive (+).

**VEHICLE DAMAGE PROFILE DISTANCES**

| DPD | Distance From Impact Point (mm) | Level | Post-Test (mm) | Pre-Test (mm) | Crush (mm) |
|---|---|---|---|---|---|
| 1 | 150 | 3 | 71 | 83 | -12 |
| 2 | 270 | 3 | 259 | 89 | 170 |
| 3 | 690 | 3 | 287 | 86 | 201 |
| 4 | 1110 | 3 | 299 | 85 | 214 |
| 5 | 1530 | 3 | 291 | 91 | 200 |
| 6 | 1950 | 3 | 186 | 90 | 96 |

**MDB DAMAGE PROFILE DISTANCES**

| DPD | Distance From Center of MDB | Level | Post-Test (mm)* |
|---|---|---|---|
| 1 | 800 mm left of center | 1 | 185 |
| 2 | 480 mm left of center | 1 | 172 |
| 3 | 160 mm left of center | 1 | 183 |
| 4 | 160 mm right of center | 1 | 194 |
| 5 | 480 mm right of center | 1 | 209 |
| 6 | 800 mm right of center | 1 | 246 |

**DATA SHEET NO. 14**
**FMVSS NO. 301 STATIC ROLLOVER RESULTS**

| | | | |
|---|---|---|---|
| Test Vehicle: | 2016 Toyota Avalon four door sedan | NHTSA No.: | M20165107 |
| Test Program: | NCAP Side MDB Impact Test | Test Date: | 3/16/2016 |
| Test Time: | 4:05 PM | Temperature: | 21˚C |

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

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

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

D. Spillage Details: — No Spillage Occurred

**FMVSS NO. 301 STATIC ROLLOVER DATA**


**ROLLOVER SOLVENT COLLECTION TIME TABLE IN SECONDS**

| Test Phase | Rotation Time | Hold Time | Total Time |
|---|---|---|---|
| 0° to 90° | 72 | 300 | 372 |
| 90° to 180° | 68 | 300 | 368 |
| 180° to 270° | 62 | 300 | 362 |
| 270° to 360° | 70 | 300 | 370 |

**FMVSS NO. 301 ROLLOVER SPILLAGE TABLE**

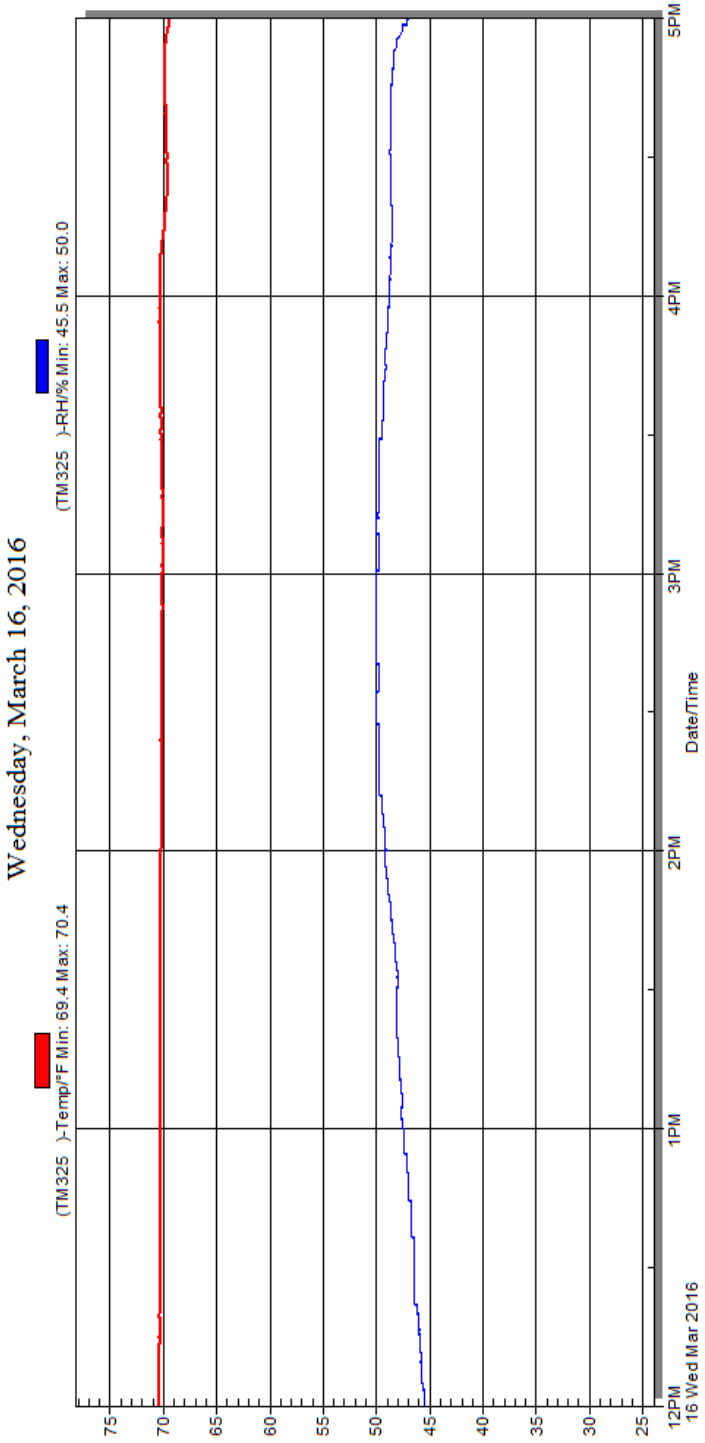
| Test Phase | First 5 Minutes | Sixth Minute | Seventh Minute | Eighth Minute |
|---|---|---|---|---|
| 0° to 90° | 0 | 0 | 0 | |
| 90° to 180° | 0 | 0 | 0 | |
| 180° to 270° | 0 | 0 | 0 | |
| 270° to 360° | 0 | 0 | 0 | |

**ROLLOVER SOLVENT SPILLAGE LOCATION TABLE**

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

**DATA SHEET NO. 15**
**DUMMY/VEHICLE TEMPERATURE AND HUMIDITY STABILIZATION DATA**

| | | | |
|---|---|---|---|
| Test Vehicle: | 2016 Toyota Avalon four door sedan | NHTSA No.: | M20165107 |
| Test Program: | NCAP Side MDB Impact Test | Test Date: | 3/16/2016 |




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

# APPENDIX A

# PHOTOGRAPHS

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**Figure A-2: As-Delivered Left Rear 3/4 View of Test Vehicle**

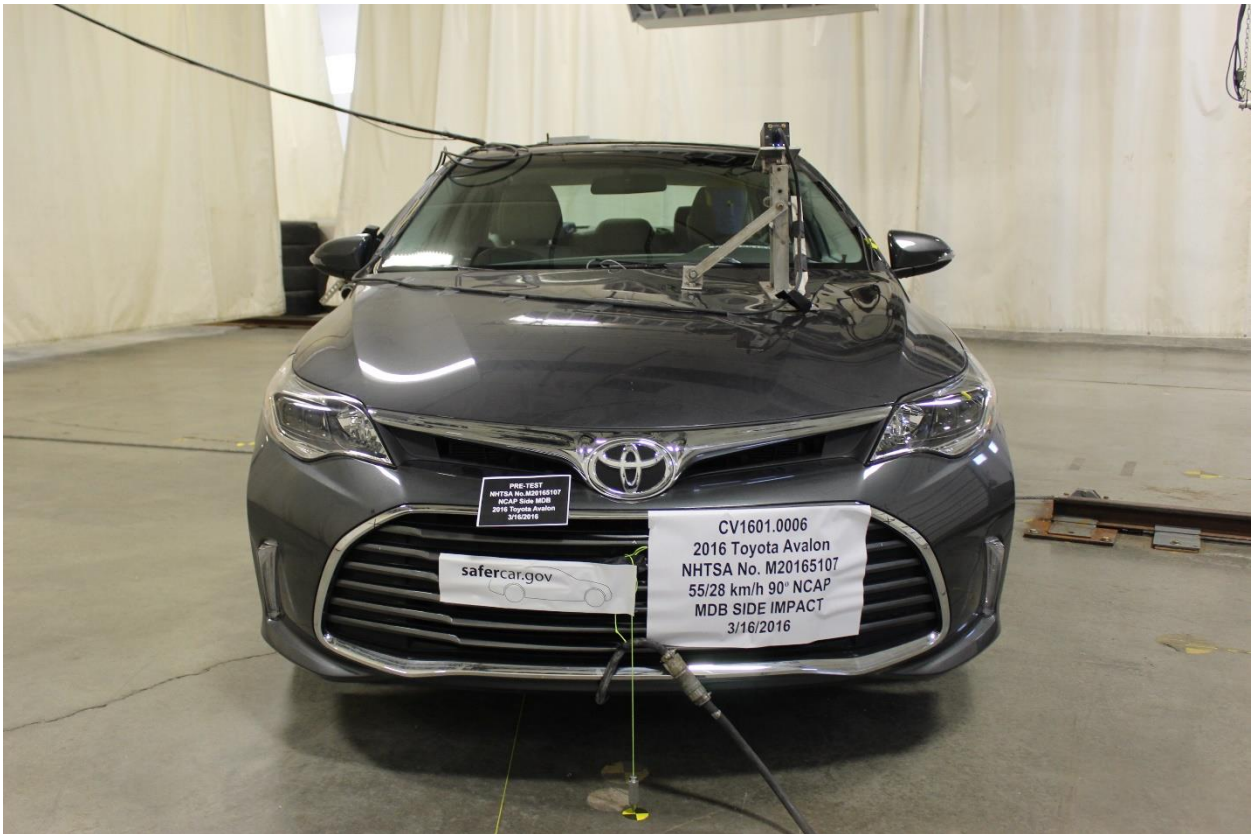


**Figure A-3: Pre-Test Frontal View of Test Vehicle**


**Figure A-4: Post-Test Frontal View of Test Vehicle**

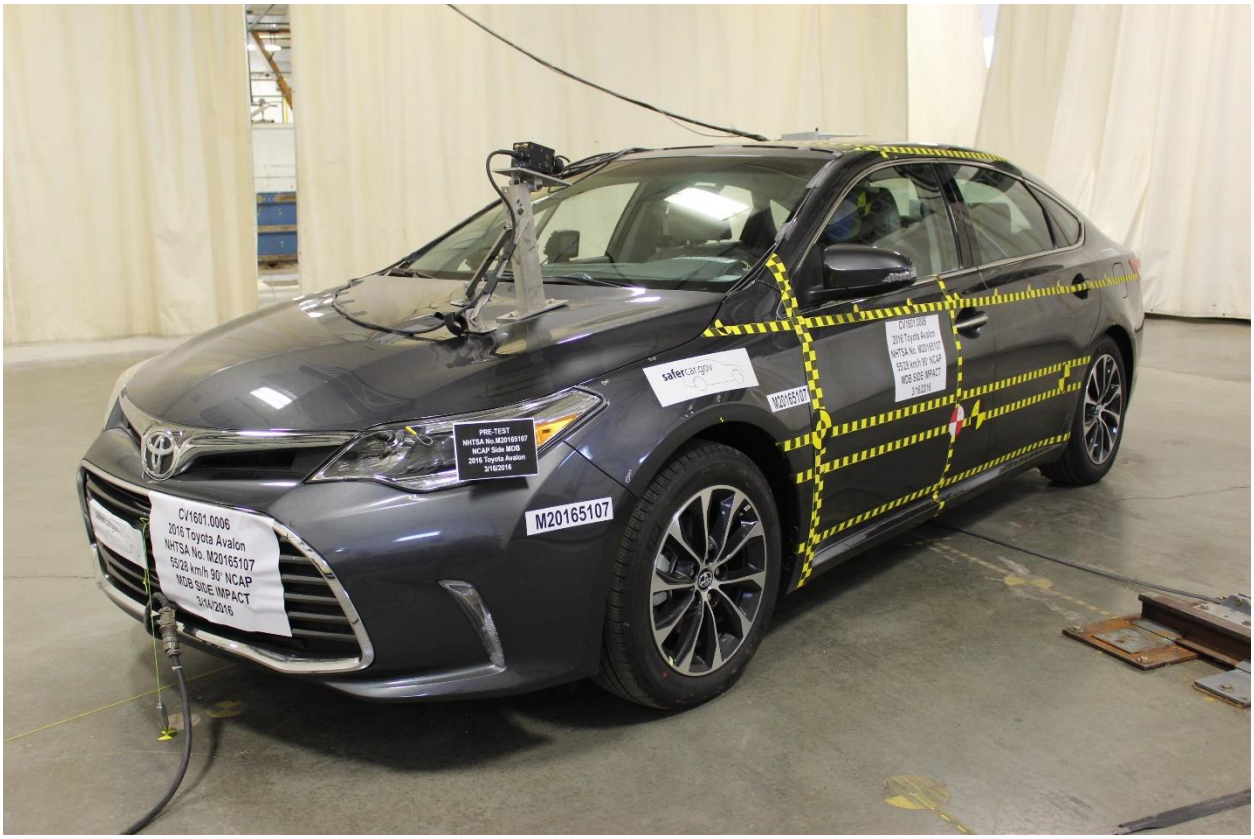


**Figure A-5: Pre-Test Left Front ¾ View of Test Vehicle**

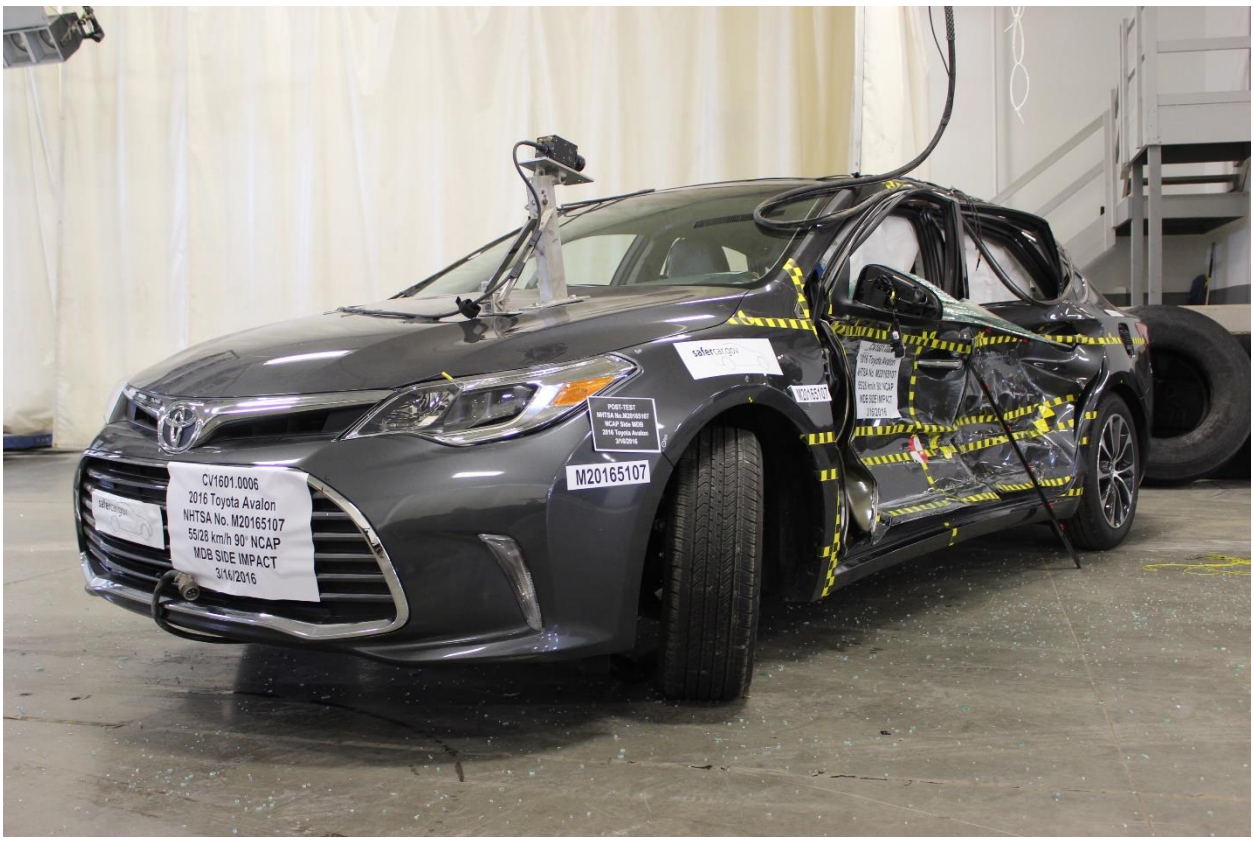


**Figure A-6: Post-Test Left Front ¾ View of Test Vehicle**

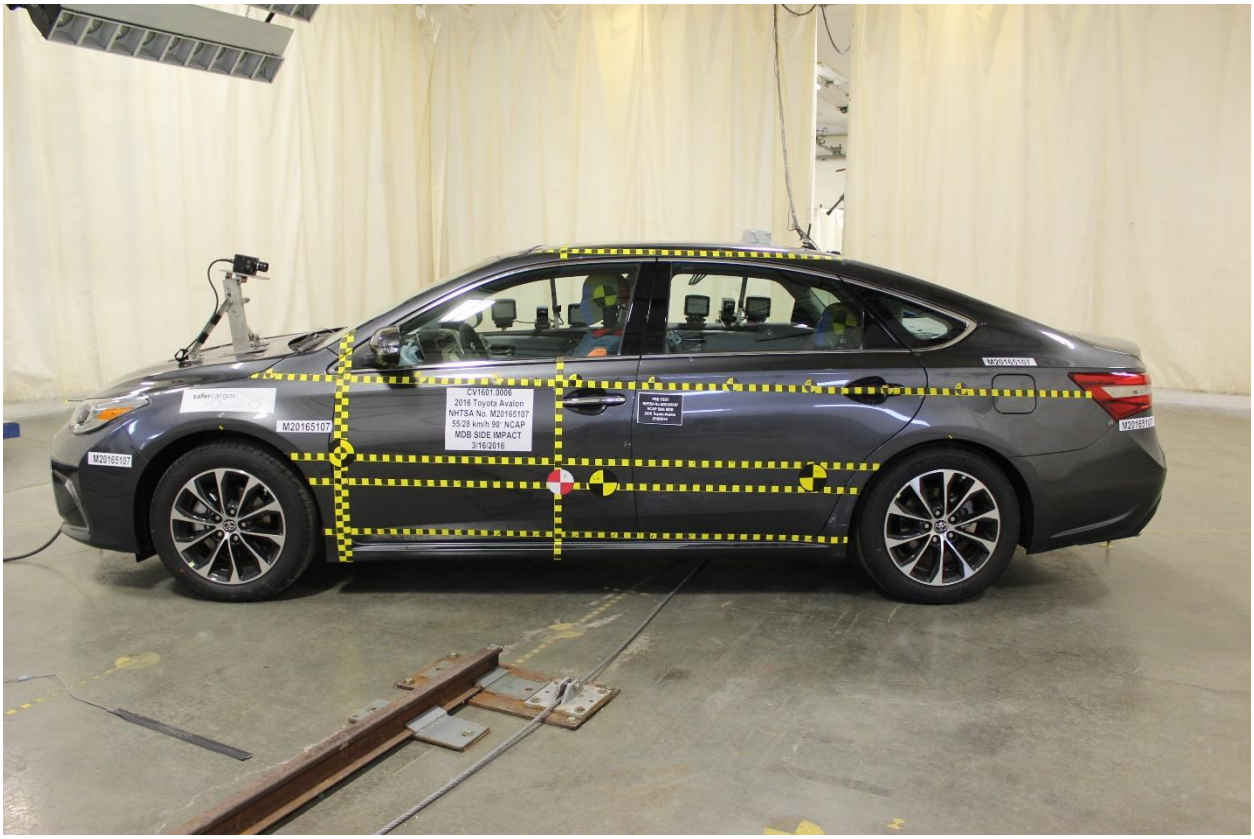


**Figure A-7: Pre-Test Left Side View of Test Vehicle**

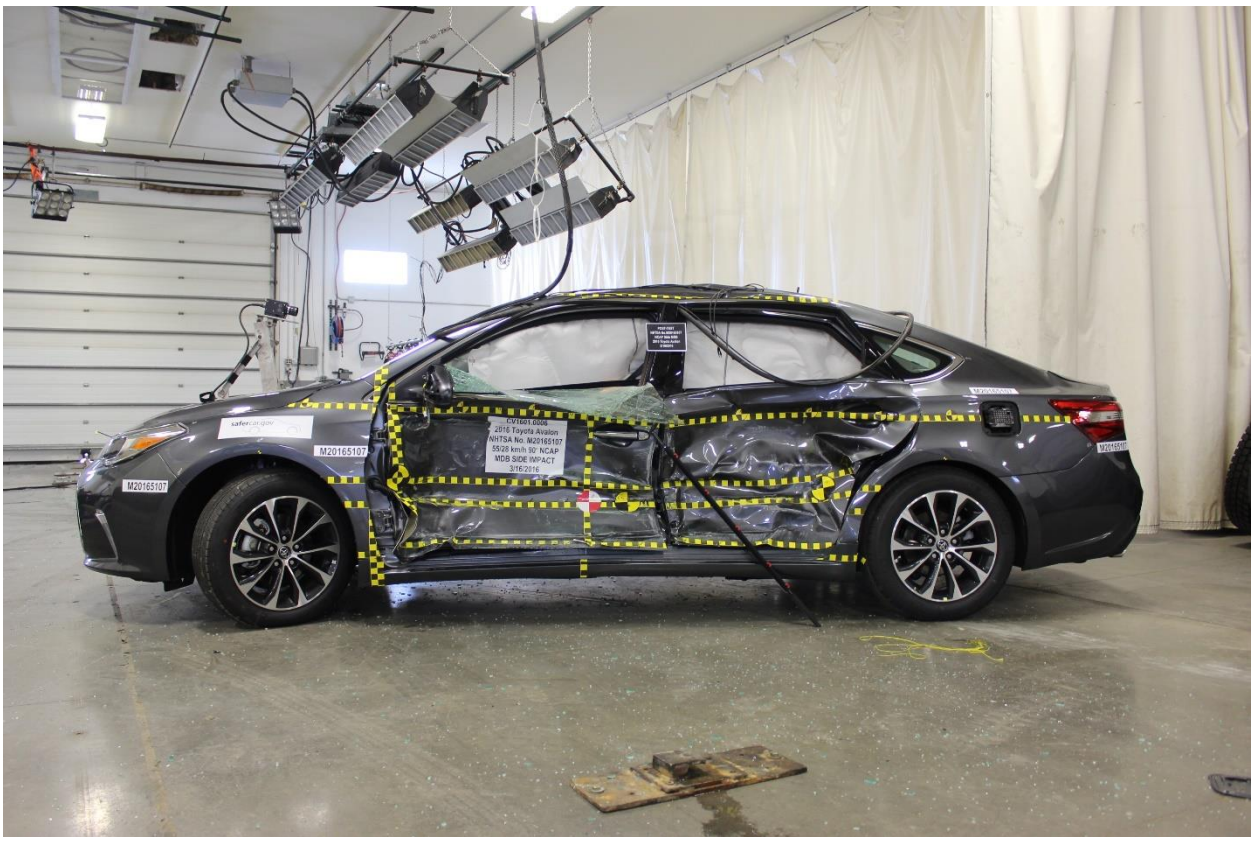


**Figure A-8: Post-Test Left Side View of Test Vehicle**


**Figure A-9: Pre-Test Left Rear ¾ View of Test Vehicle**

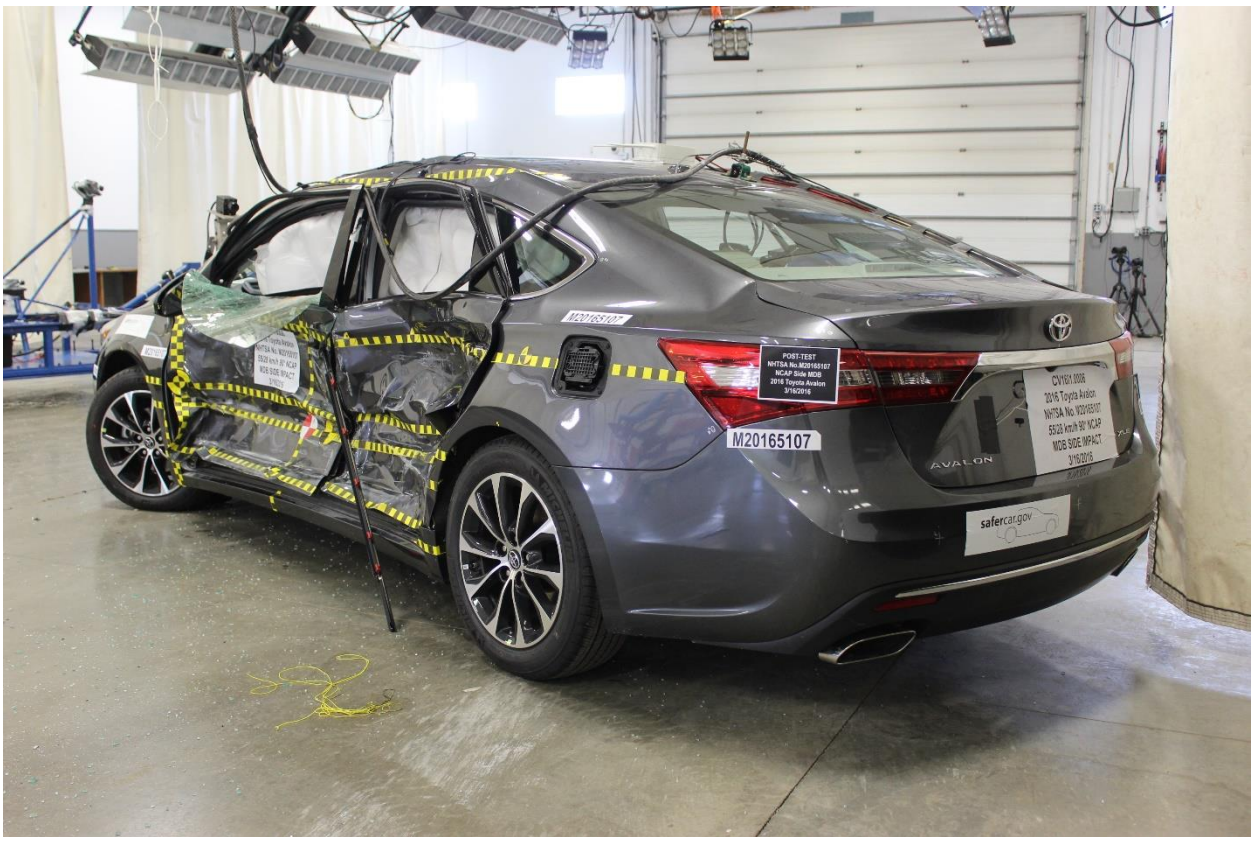


**Figure A-10: Post-Test Left Rear ¾ View of Test Vehicle**


**Figure A-11: Pre-Test Rear View of Test Vehicle**


**Figure A-12: Post-Test Rear Side View of Test Vehicle**


**Figure A-13: Pre-Test Right Side View of Test Vehicle**


**Figure A-14: Post-Test Right Side View of Test Vehicle**

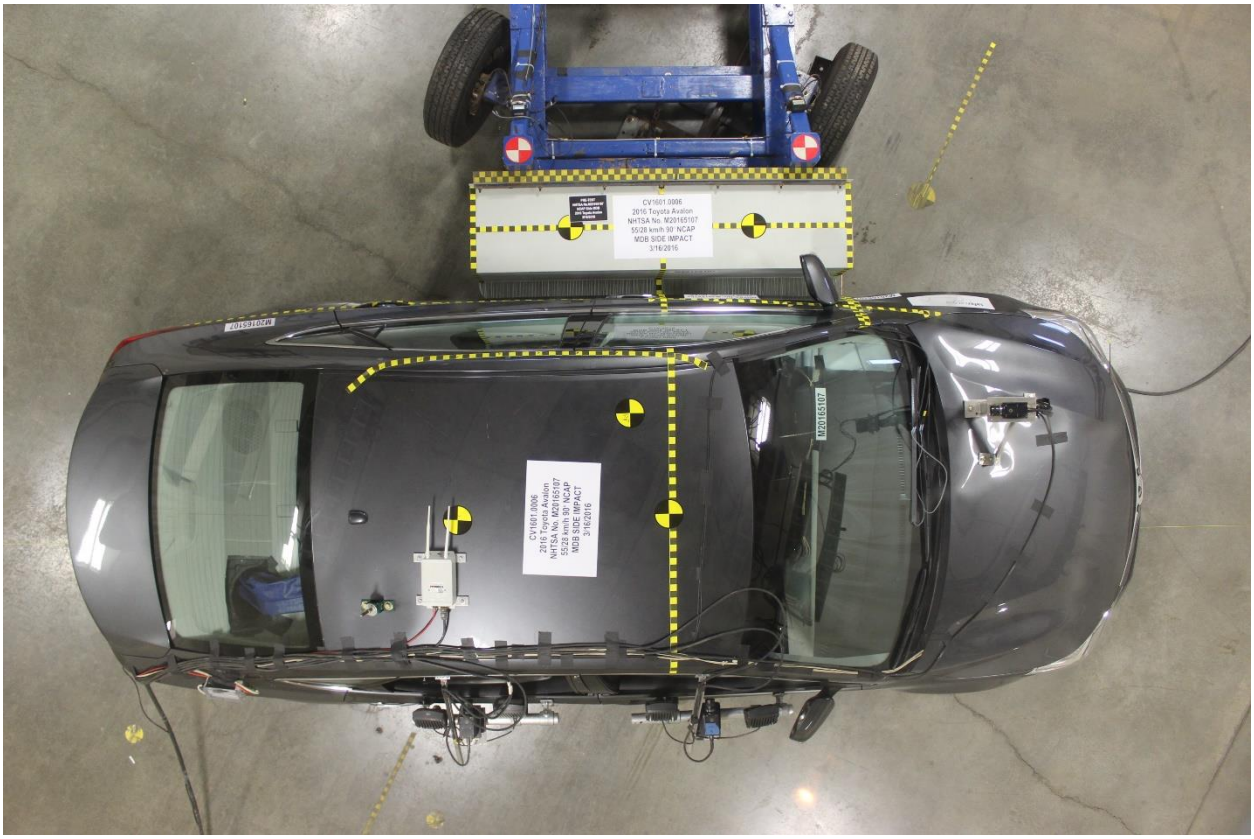


**Figure A-15: Pre-Test Overhead View of the Test Area**


**Figure A-16: Post-Test Overhead View of Test Area**

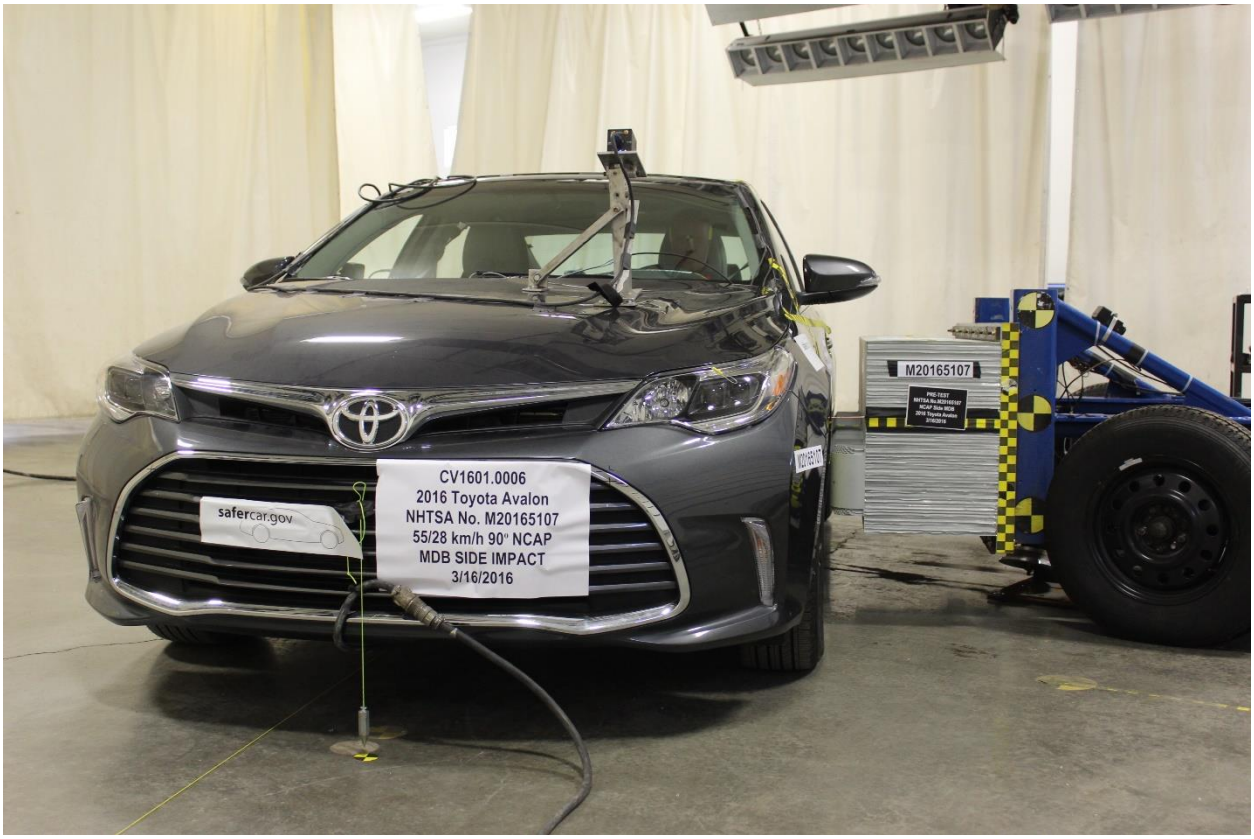


**Figure A-17: Pre-Test Left Side View of MDB Positioned Against Side of Test Vehicle**


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**Figure A-22: Post-Test Left Front Door Latch Close-Up**


**Figure A-23: Pre-Test Left Rear Door Latch Close-Up**


**Figure A-24: Post-Test Left Rear Door Latch Close-Up**

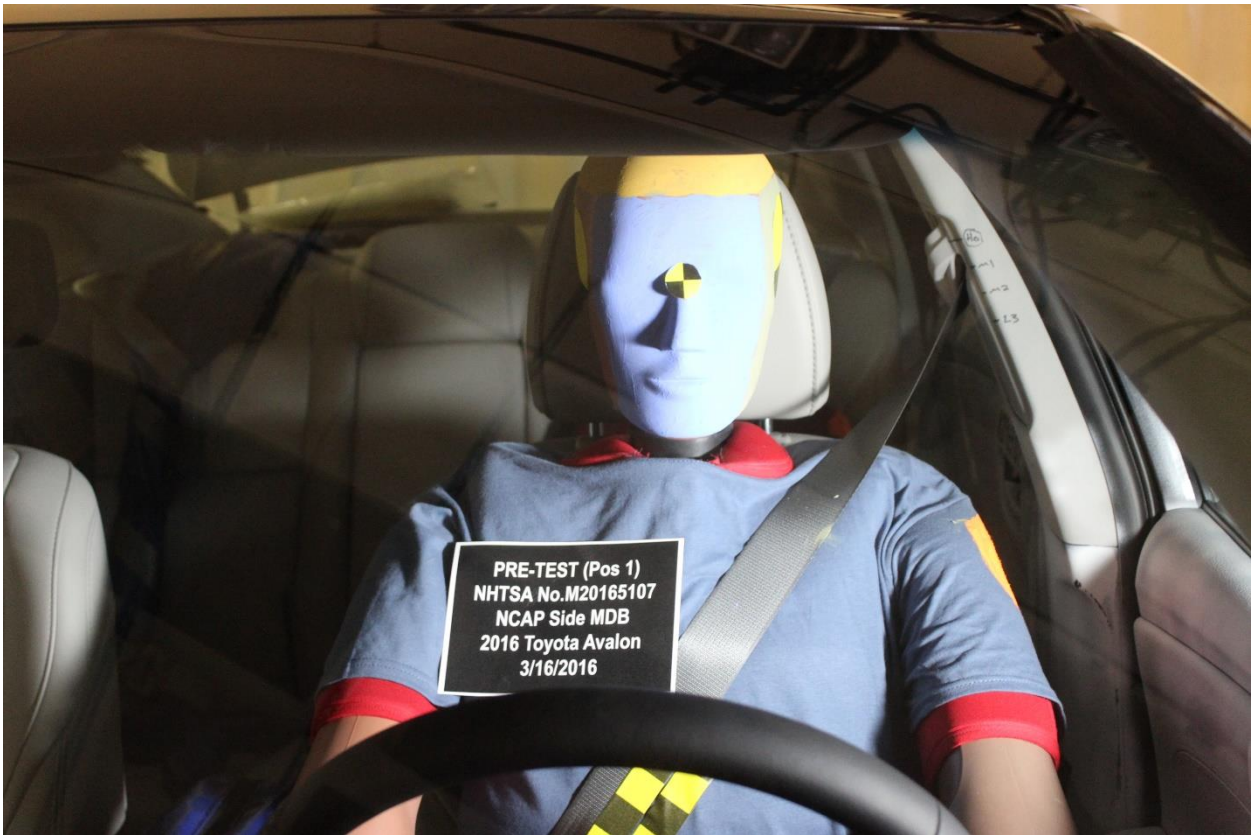


**Figure A-25: Pre-Test Front Close-up View of Driver Dummy**


**Figure A-26: Post-Test Front Close-up View of Driver Dummy**


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**Figure A-30: Pre-Test Frontal View of Driver Seat Back Prior to Dummy Positioning**

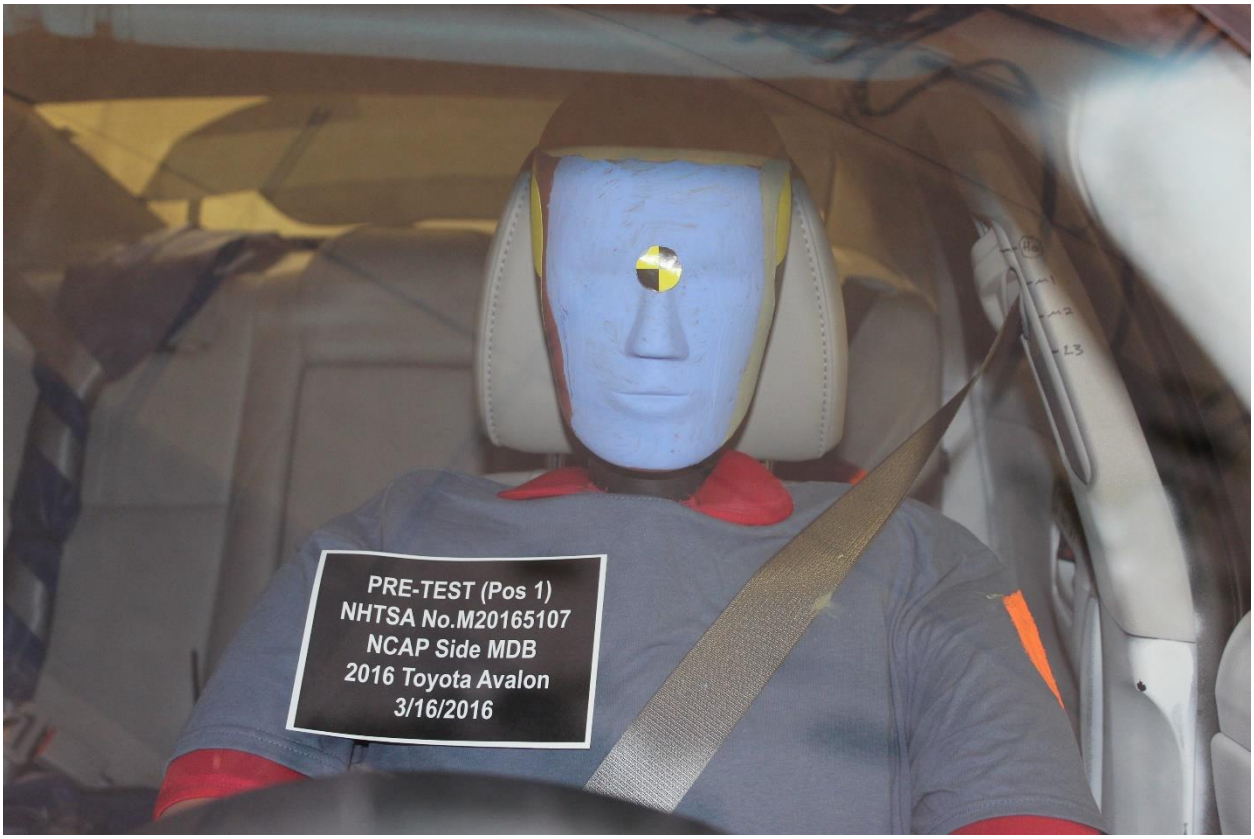


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**Figure A-32: Pre-Test Frontal View of Driver Seat Pan Prior to Dummy Positioning**


**Figure A-33: Pre-Test Overhead View of Driver Dummy Thighs on Seat Pan**

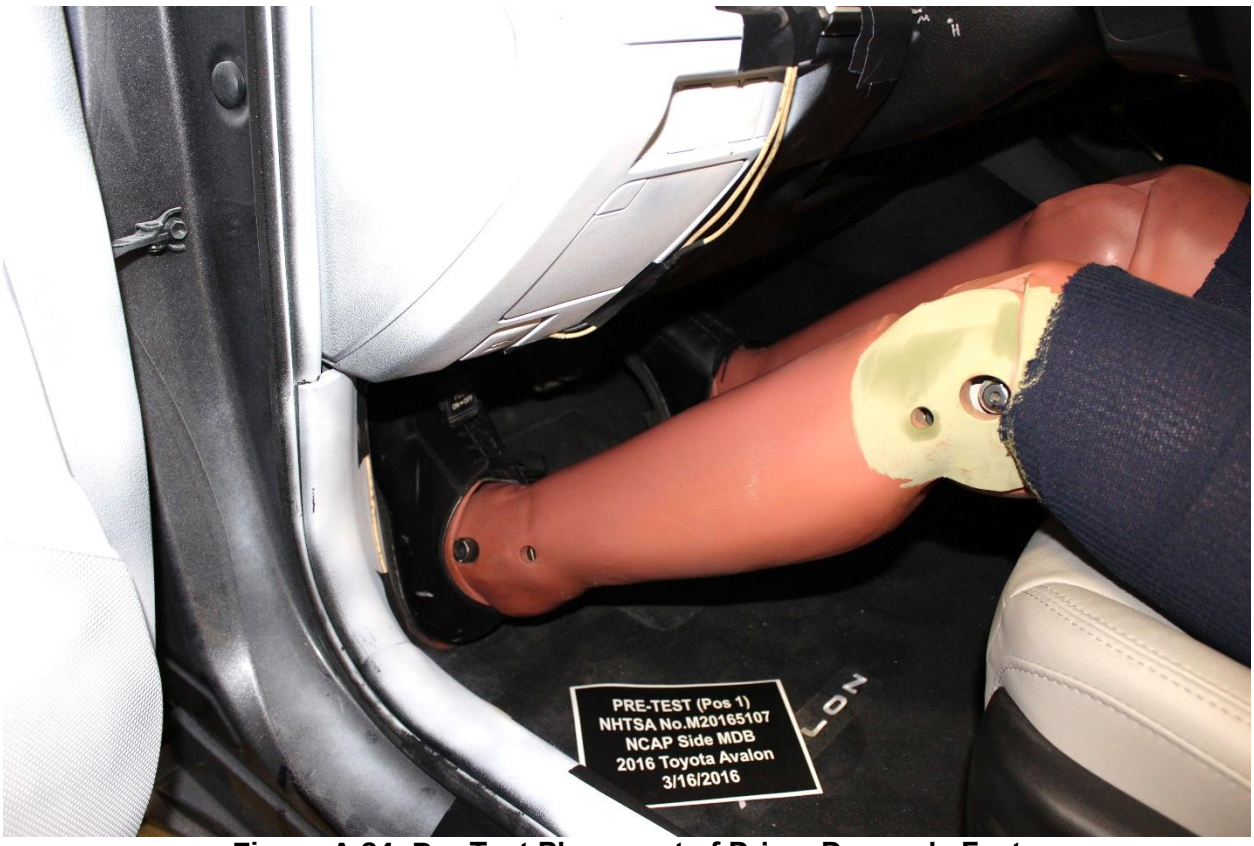


**Figure A-34: Pre-Test Placement of Driver Dummy's Feet**


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**Figure A-50: Post-Test Driver Dummy Close-Up Torso Contact with Vehicle Interior View**

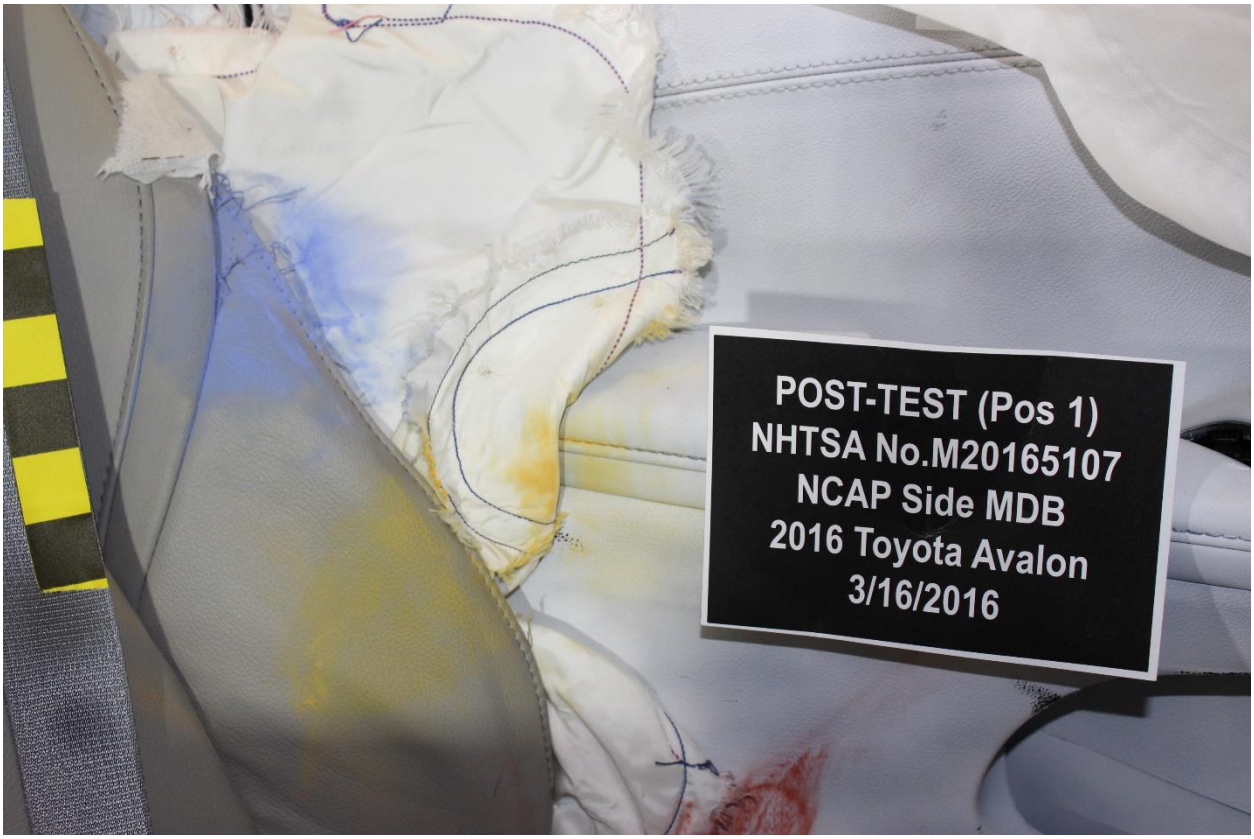


**Figure A-51: Post-Test Driver Dummy Close-Up Torso Contact with Side Airbag View**

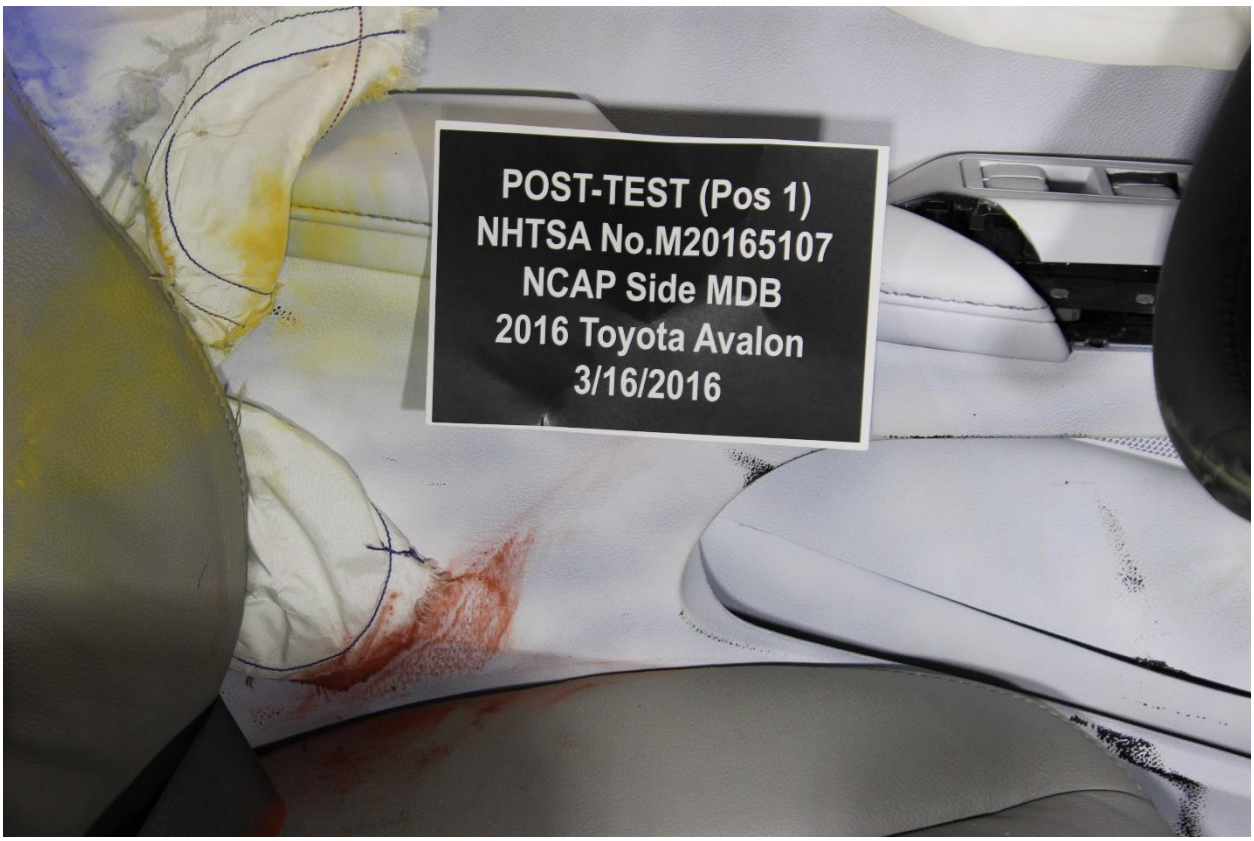


**Figure A-52: Post-Test Driver Dummy Close-Up Pelvis Contact View**


**Figure A-53: Post-Test Driver Dummy Close-Up Pelvis Contact with Side Airbag View**

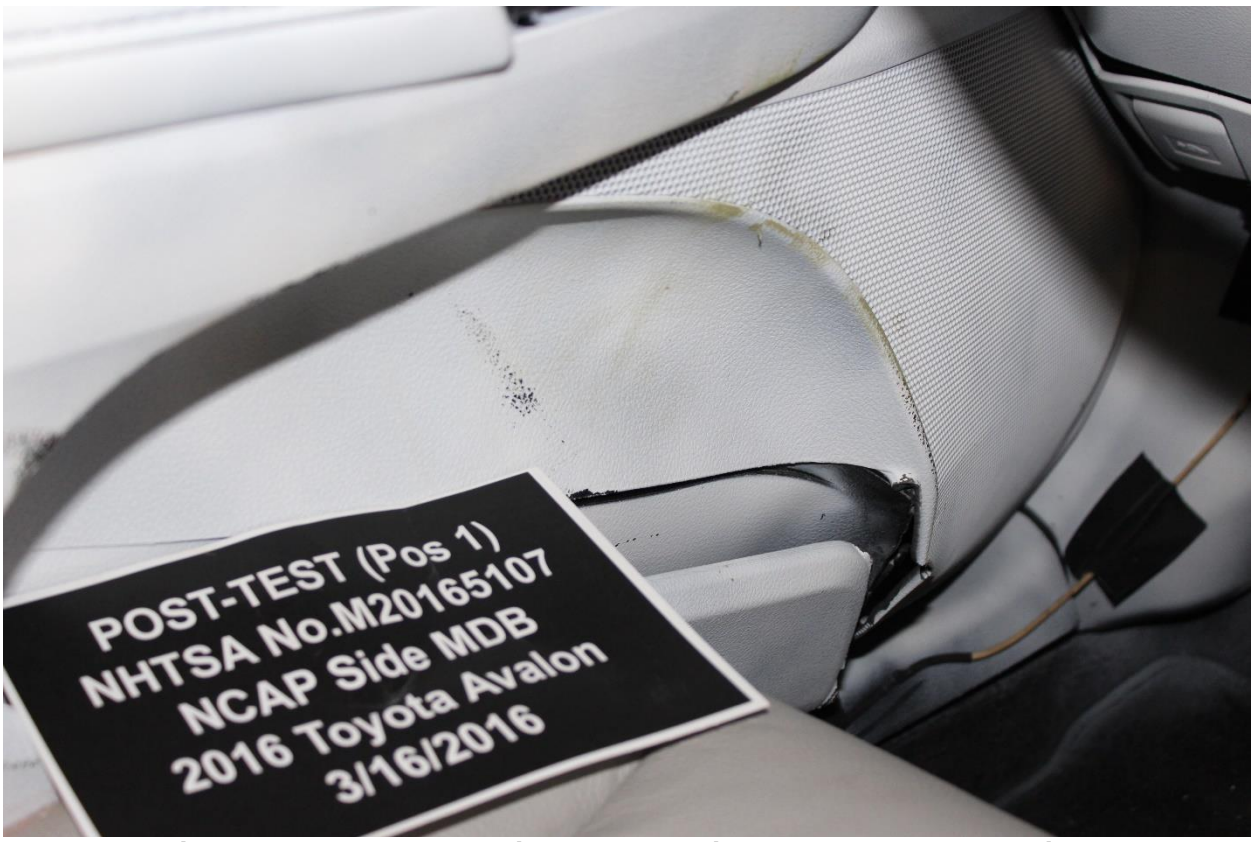


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**Figure A-56: Pre-Test Left Side View of Passenger Dummy Shoulder and Door Top View**


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**Figure A-58: Pre-Test Frontal View of Rear Passenger Seat Back Prior to Dummy Positioning**

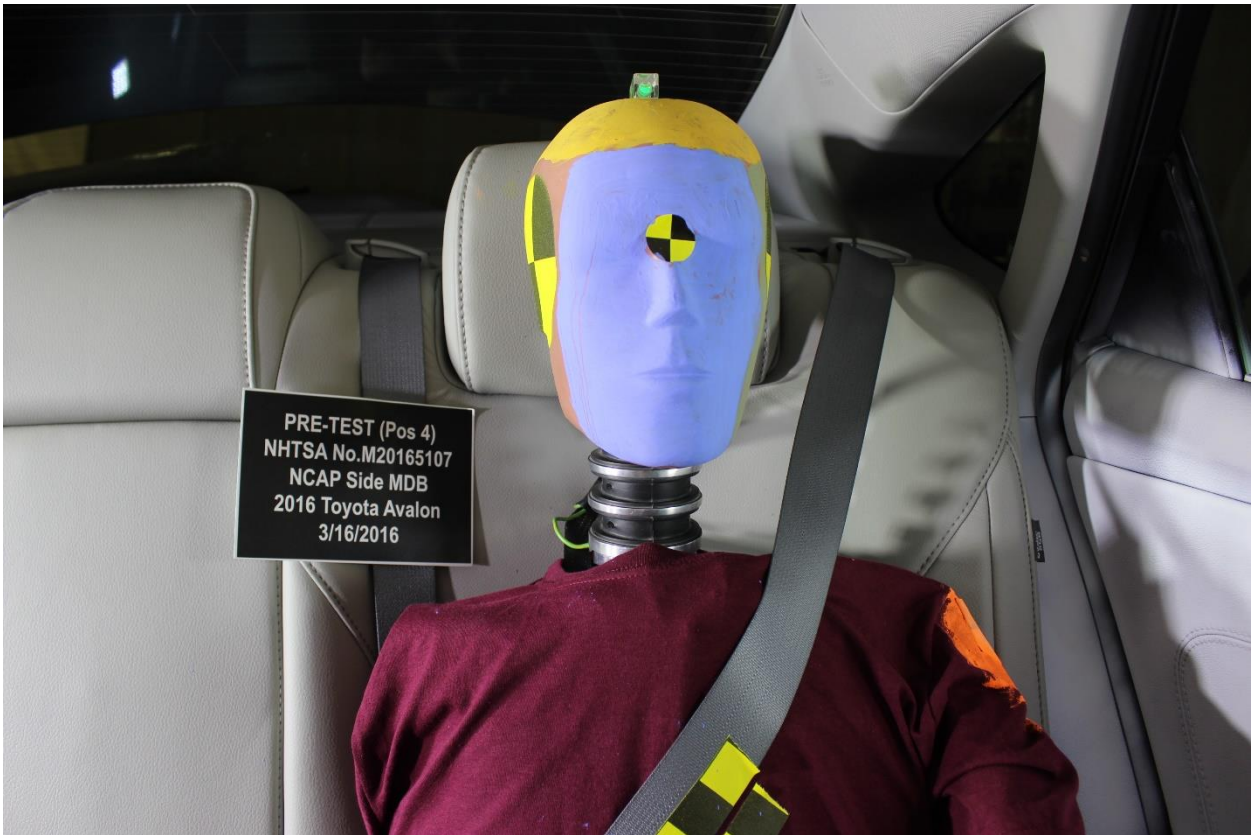


**Figure A-59: Pre-Test Frontal View of Rear Passenger Dummy Head and Shoulders in Relation to Head Restraint**


**Figure A-60: Pre-Test Overhead View of Rear Passenger Seat Pan Prior to Dummy Positioning**

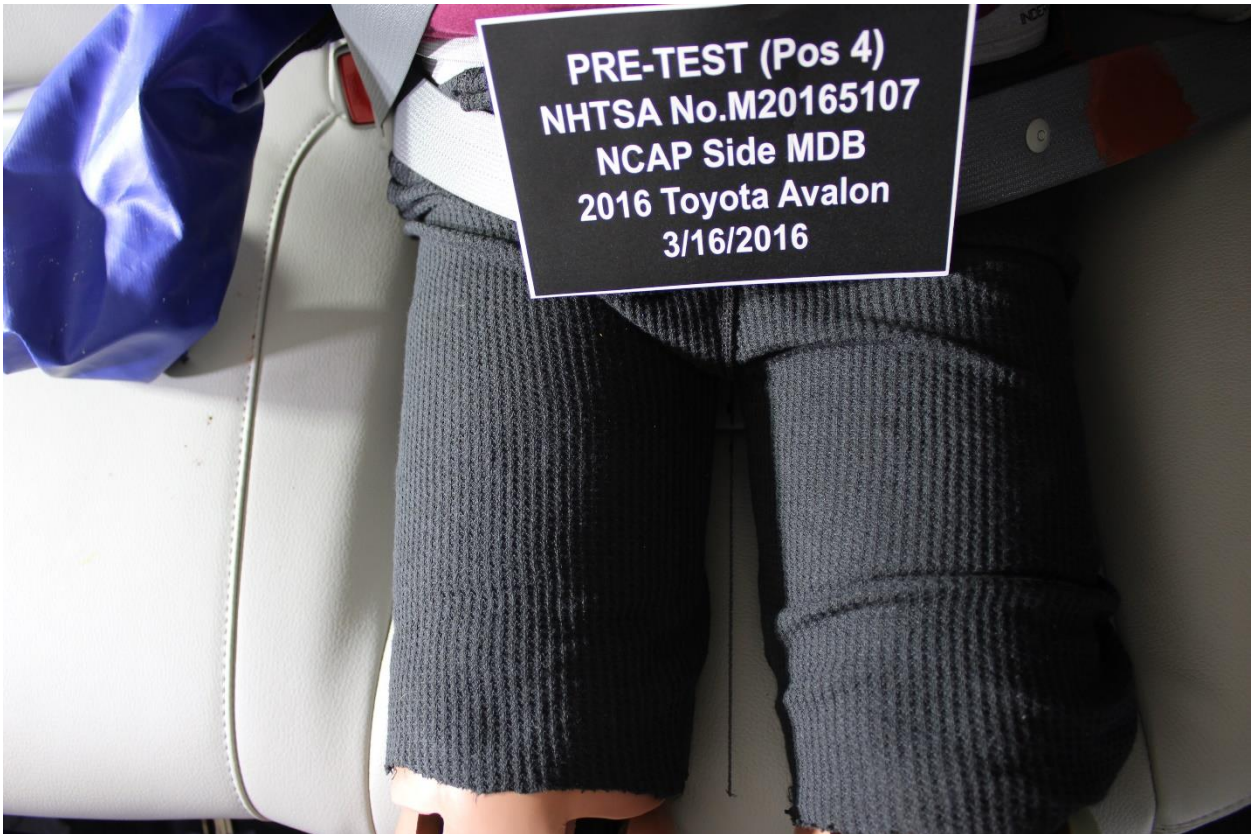


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**Figure A-64: Pre-Test Placement of Rear Passenger Dummy's Feet**


**Figure A-65: Pre-Test View of Belt Anchorage for Rear Passenger Dummy**

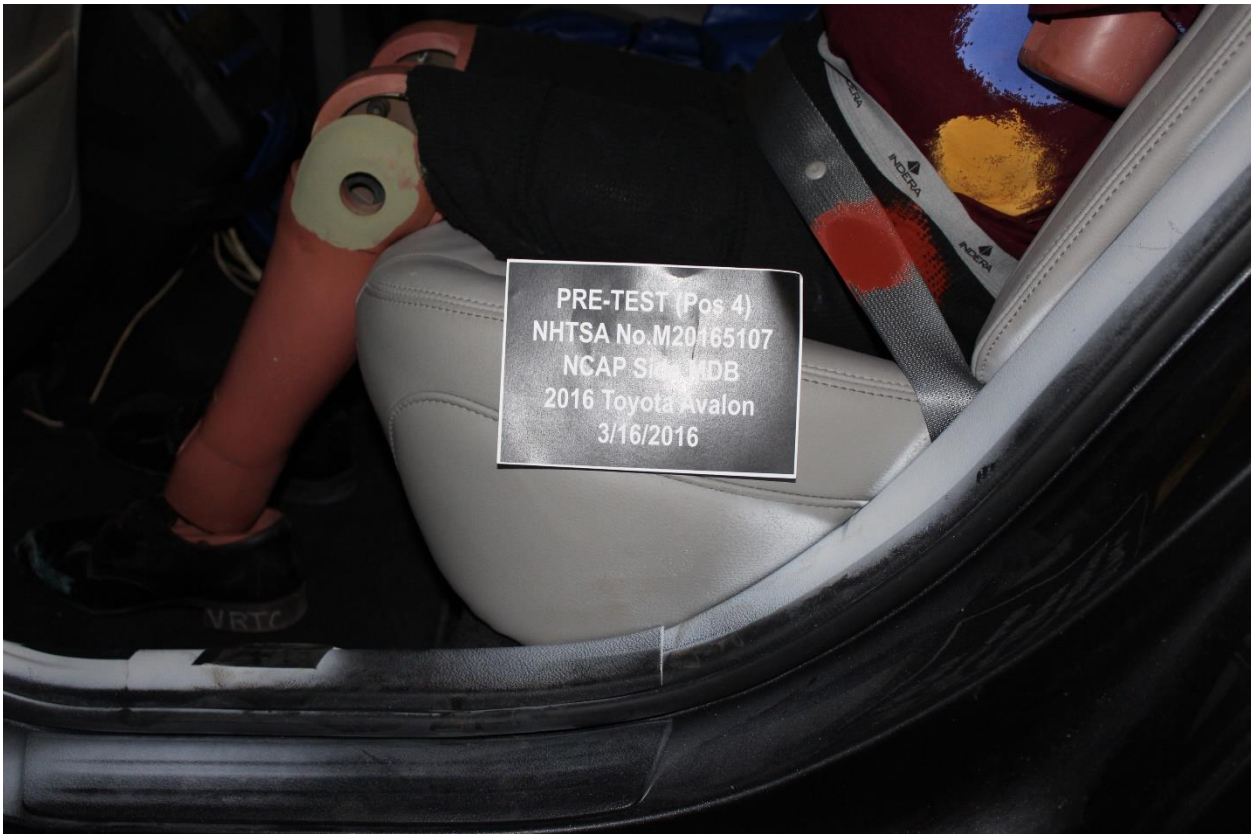


**Figure A-66: Pre-Test Close-Up Left Side View of Rear Passenger Seat Track**

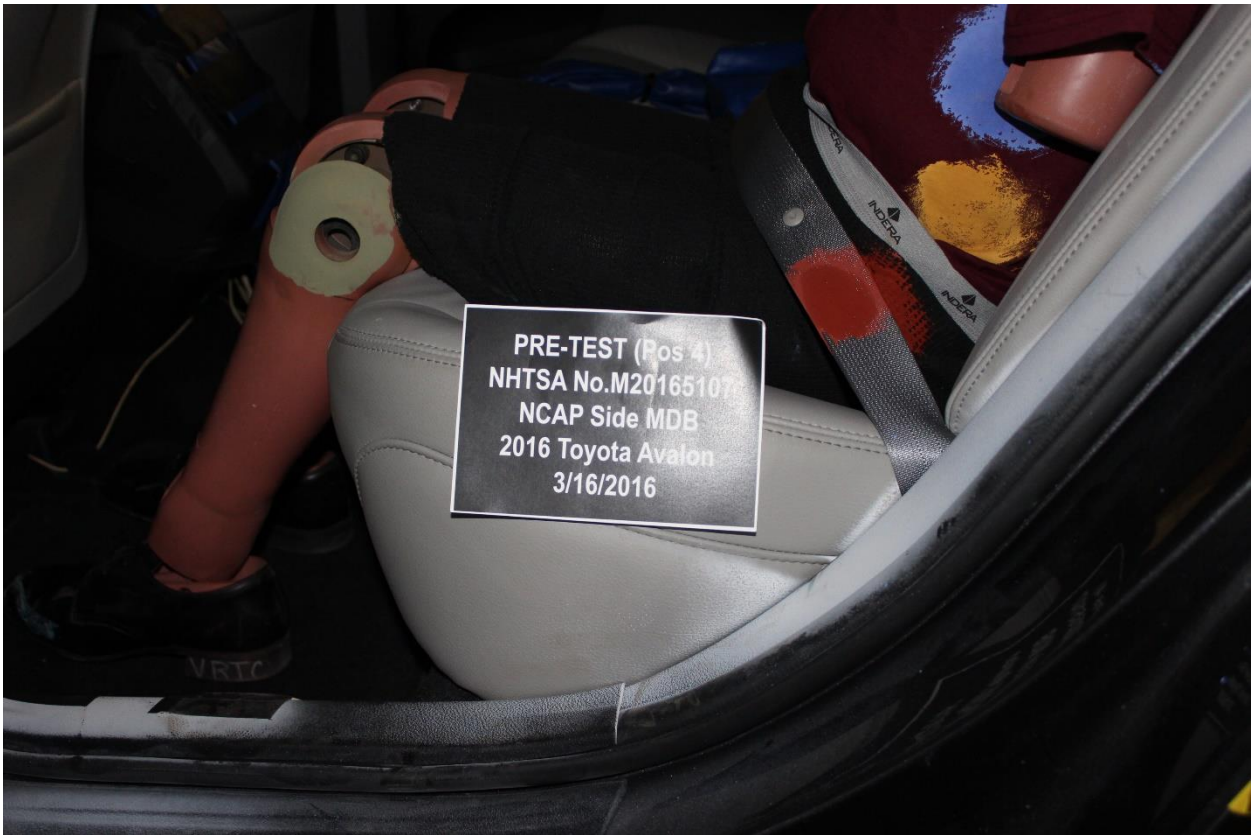


**Figure A-67: Pre-Test Close-Up Left Side View of Rear Passenger Seat Back**


**Figure A-68: Pre-Test Close-Up View of Rear Passenger Seat Back or Head Restraint**


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**Figure A-71: Pre-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment**


**Figure A-72: Post-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment**

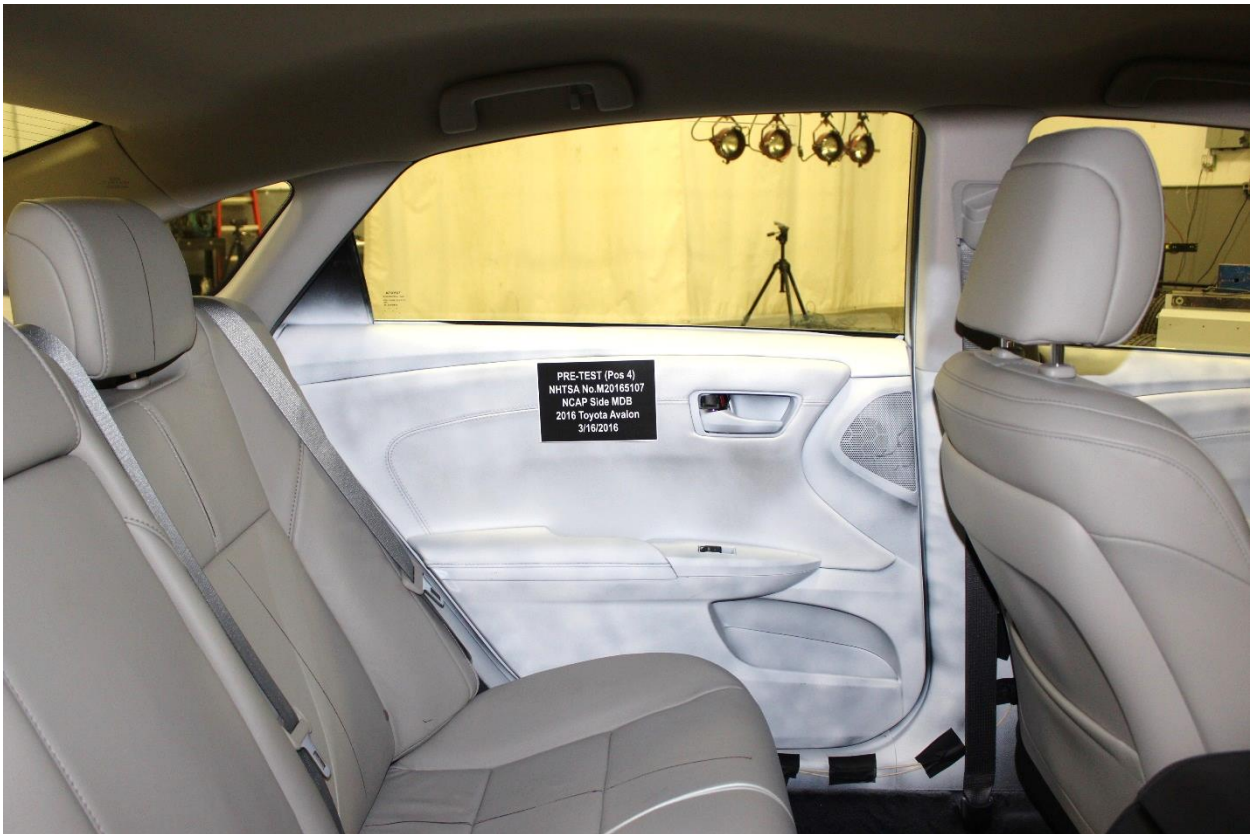



**Figure A-73: Pre-Test Passenger Inner Door Panel View**


**Figure A-74: Post-Test Passenger Inner Door Panel View**


**Figure A-75: Post-Test Rear Passenger Dummy Close-Up Head Contact with Vehicle View**


**Figure A-76: Post-Test Rear Passenger Dummy Close-Up Head Contact with Side Airbag View**


**Figure A-77: Post-Test Rear Passenger Dummy Close-Up Torso Contact with Vehicle Interior View**


**Figure A-78: Post-Test Rear Passenger Dummy Close-Up Torso Contact with Side Airbag View**

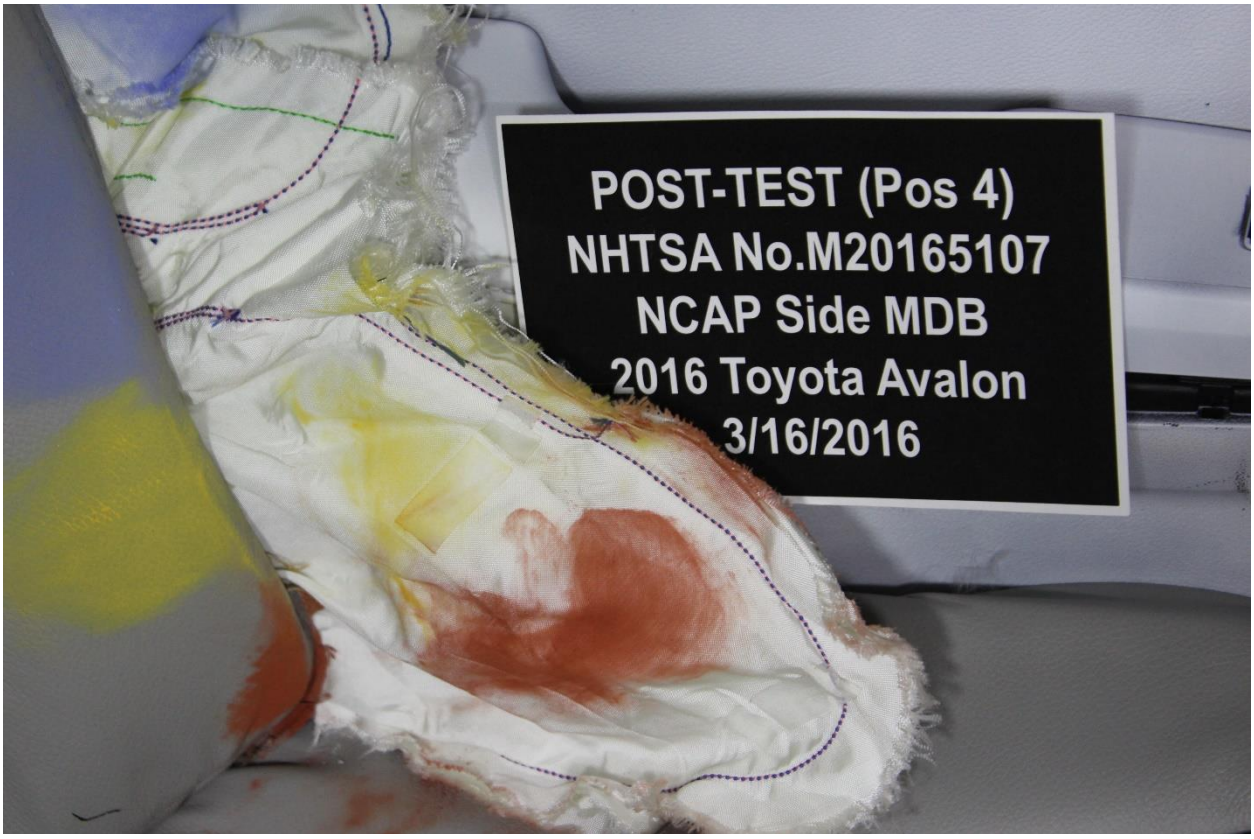



**Figure A-79: Post-Test Rear Passenger Dummy Close-Up Pelvis Contact View**

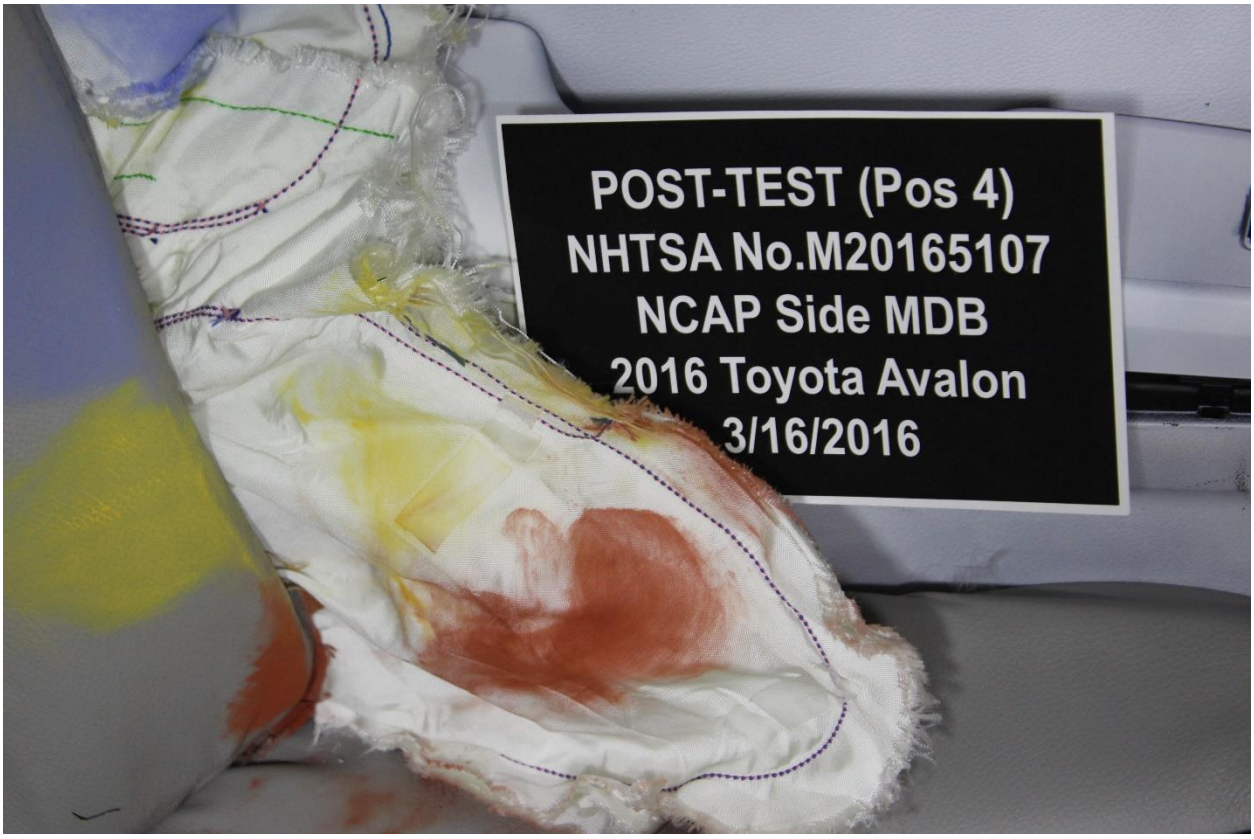



**Figure A-80: Post-Test Rear Passenger Dummy Close-Up Pelvis Contact with Side Airbag View**


**Figure A-81: Post-Test Rear Passenger Dummy Close-Up Knee Contact View**


**Figure A-82: Pre-Test View of Fuel Filler Cap or Fuel Filler Neck**


**Figure A-83: Post-Test View of Fuel Filler Cap or Fuel Filler Neck**

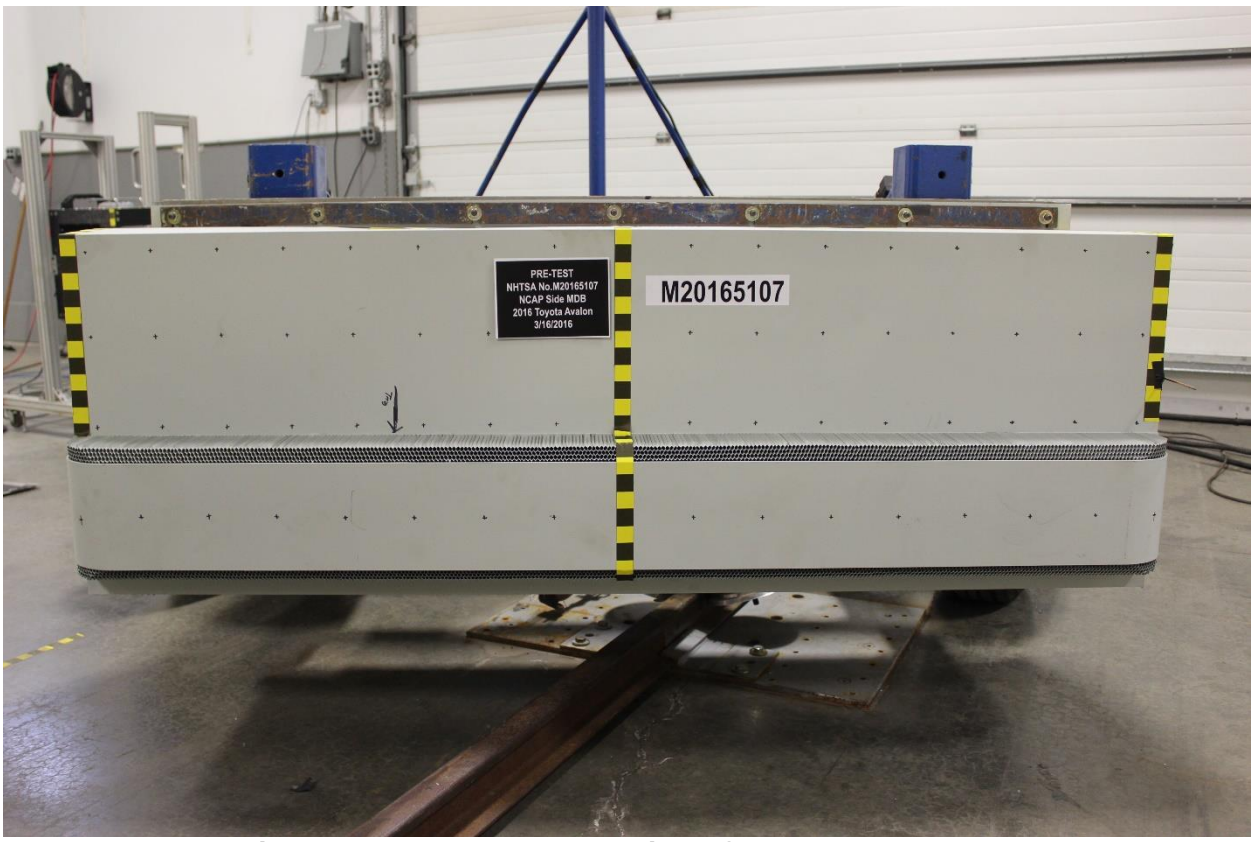



**Figure A-84: Pre-Test Front View of MDB Impactor Face**

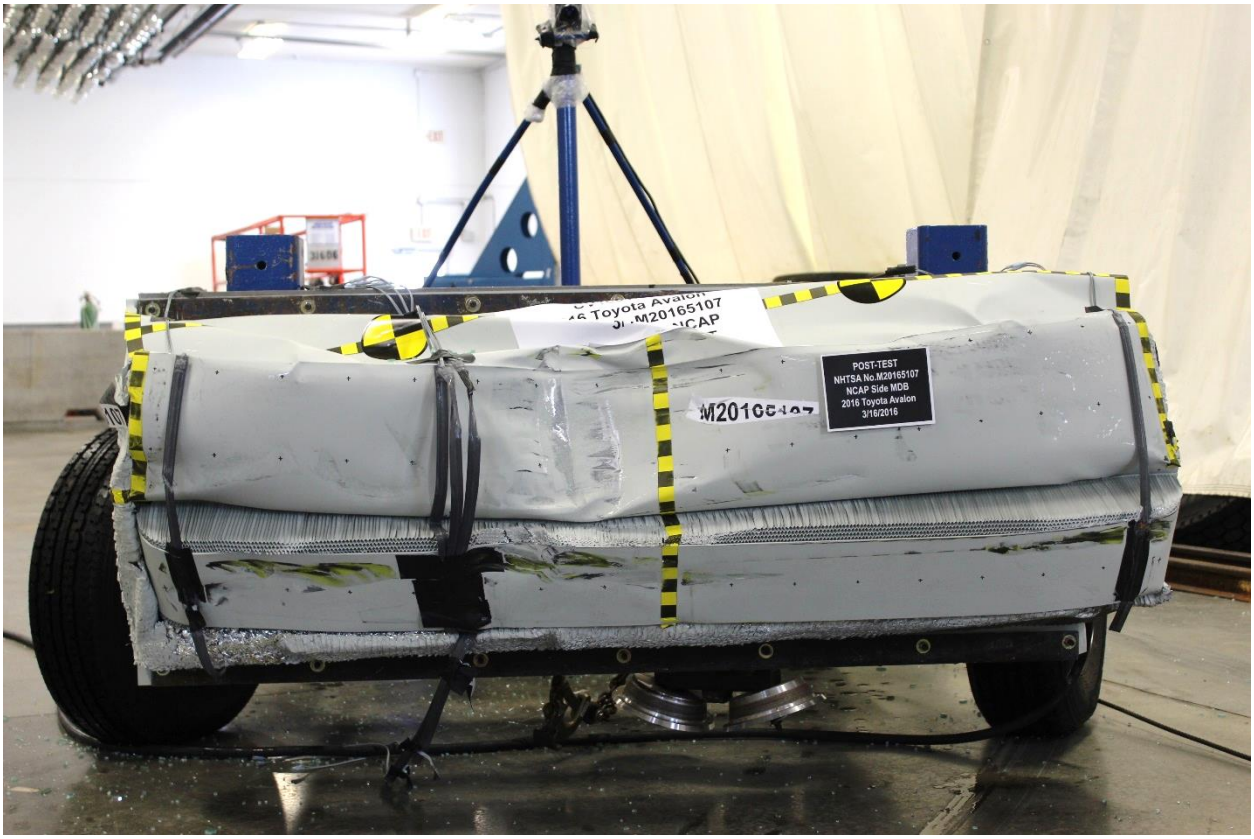



**Figure A-85: Post-Test Front View of MDB Impactor Face**

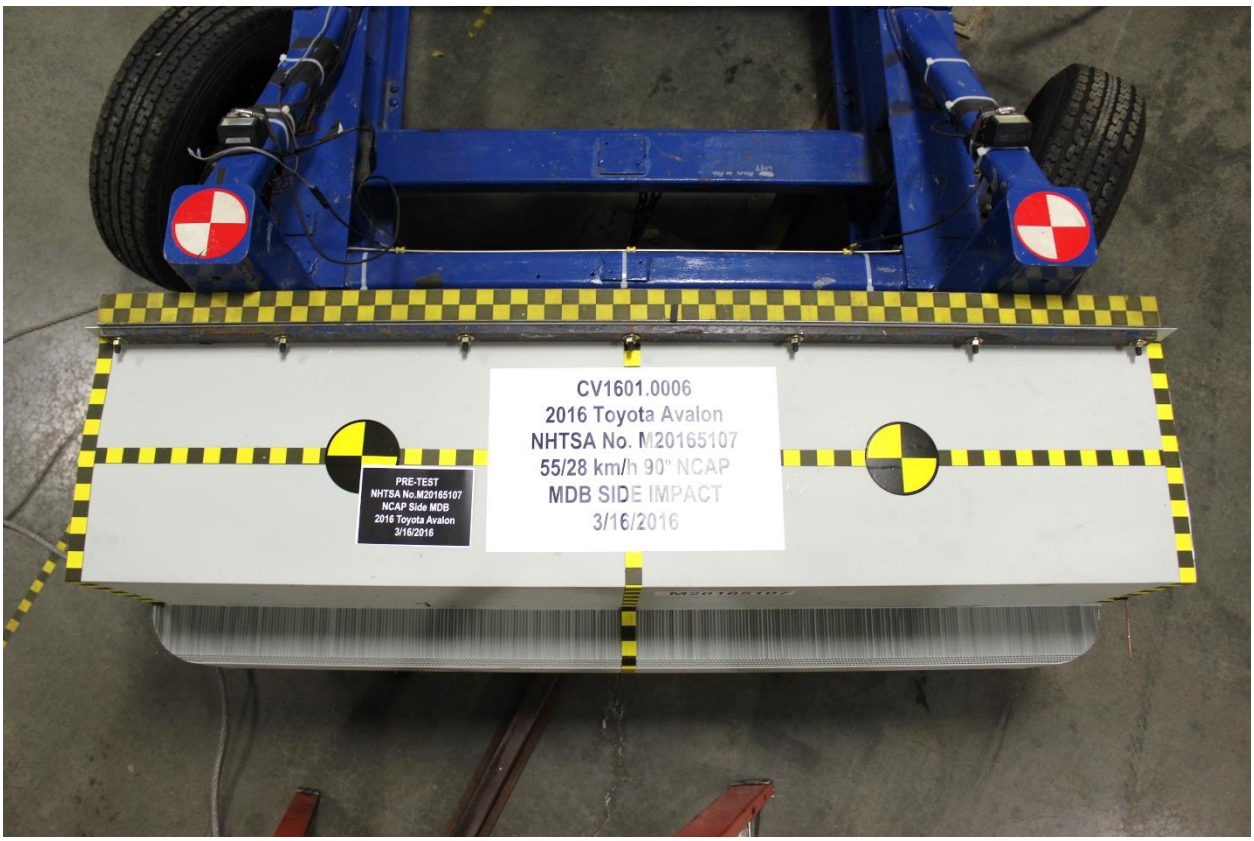



**Figure A-86: Pre-Test Top View of MDB Impactor Face**


**Figure A-87: Post-Test Top View of MDB Impactor Face**


**Figure A-88: Pre-Test Left Side View of MDB Impactor Face**

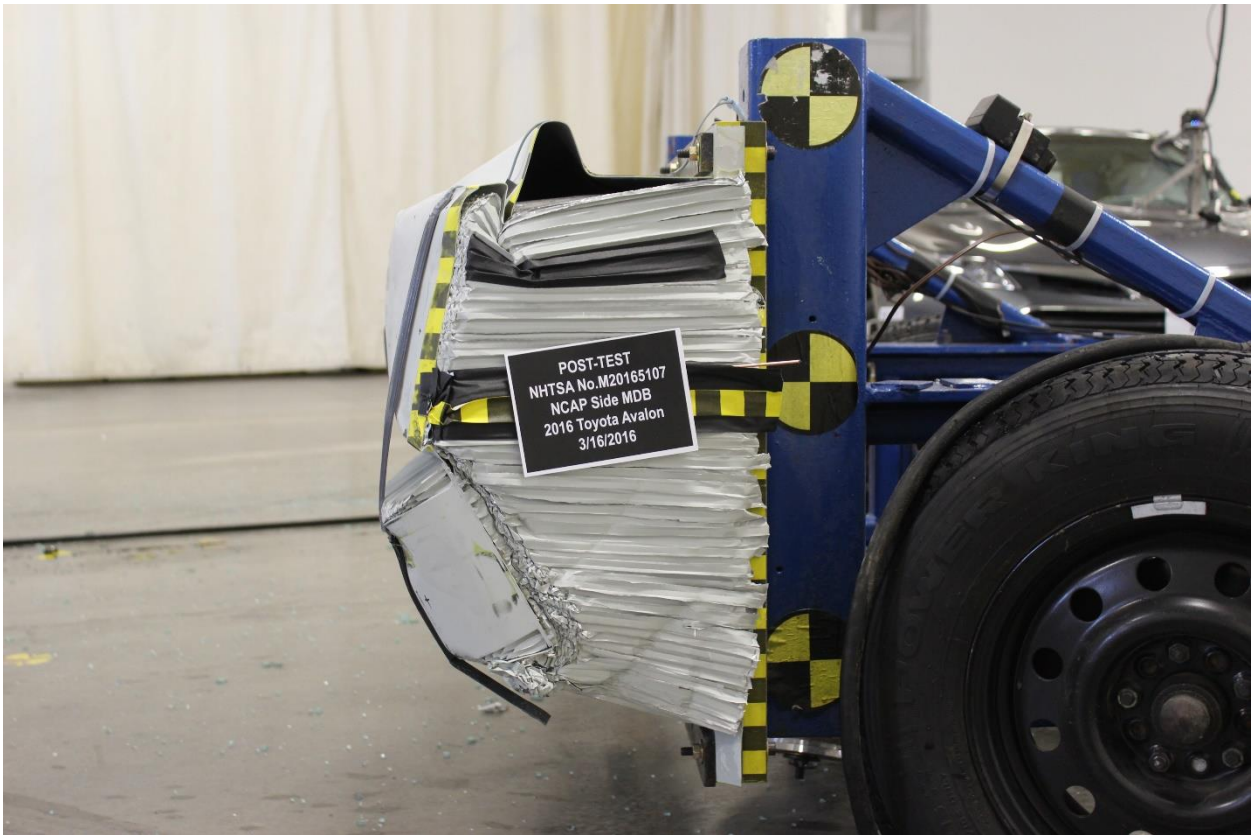



**Figure A-89: Post-Test Left Side View of MDB Impactor Face**

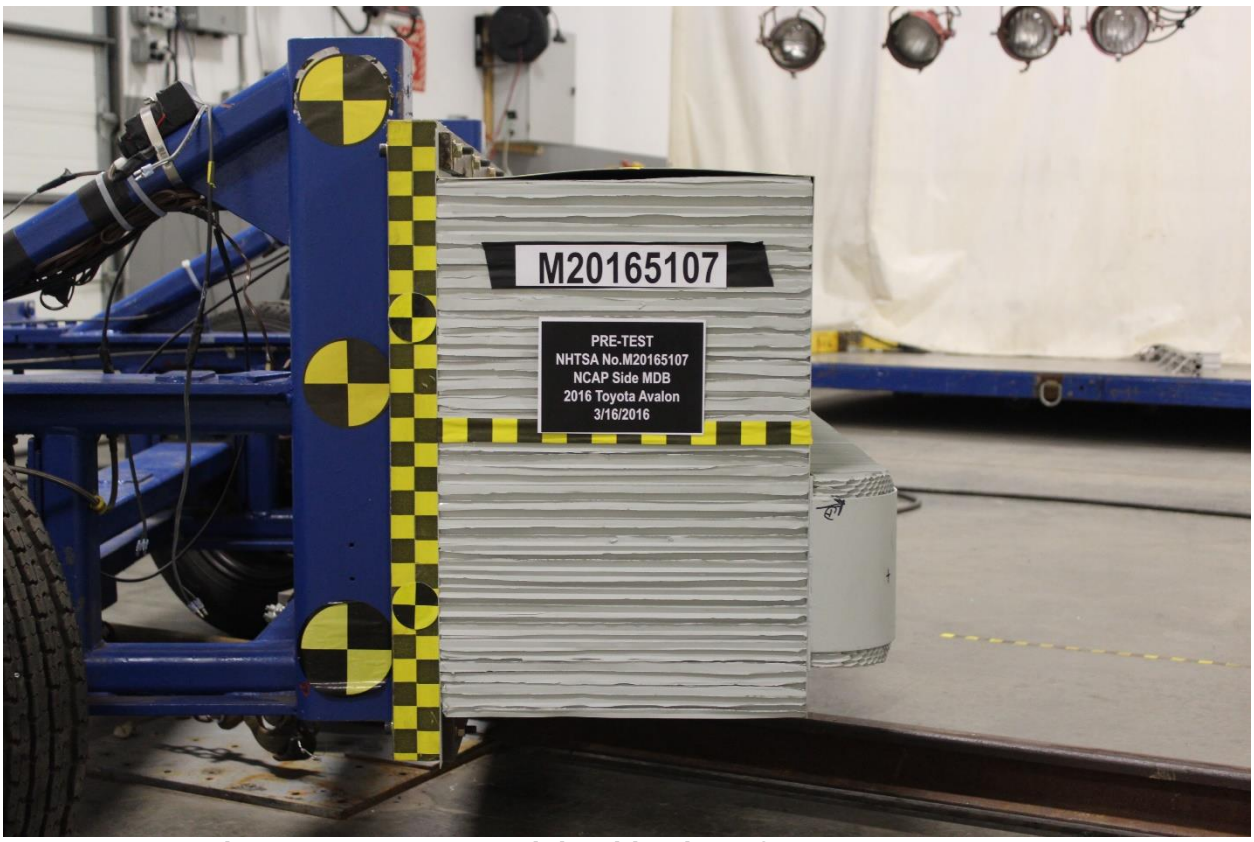



**Figure A-90: Pre-Test Right Side View of MDB Impactor Face**


**Figure A-91: Post-Test Right Side View of MDB Impactor Face**

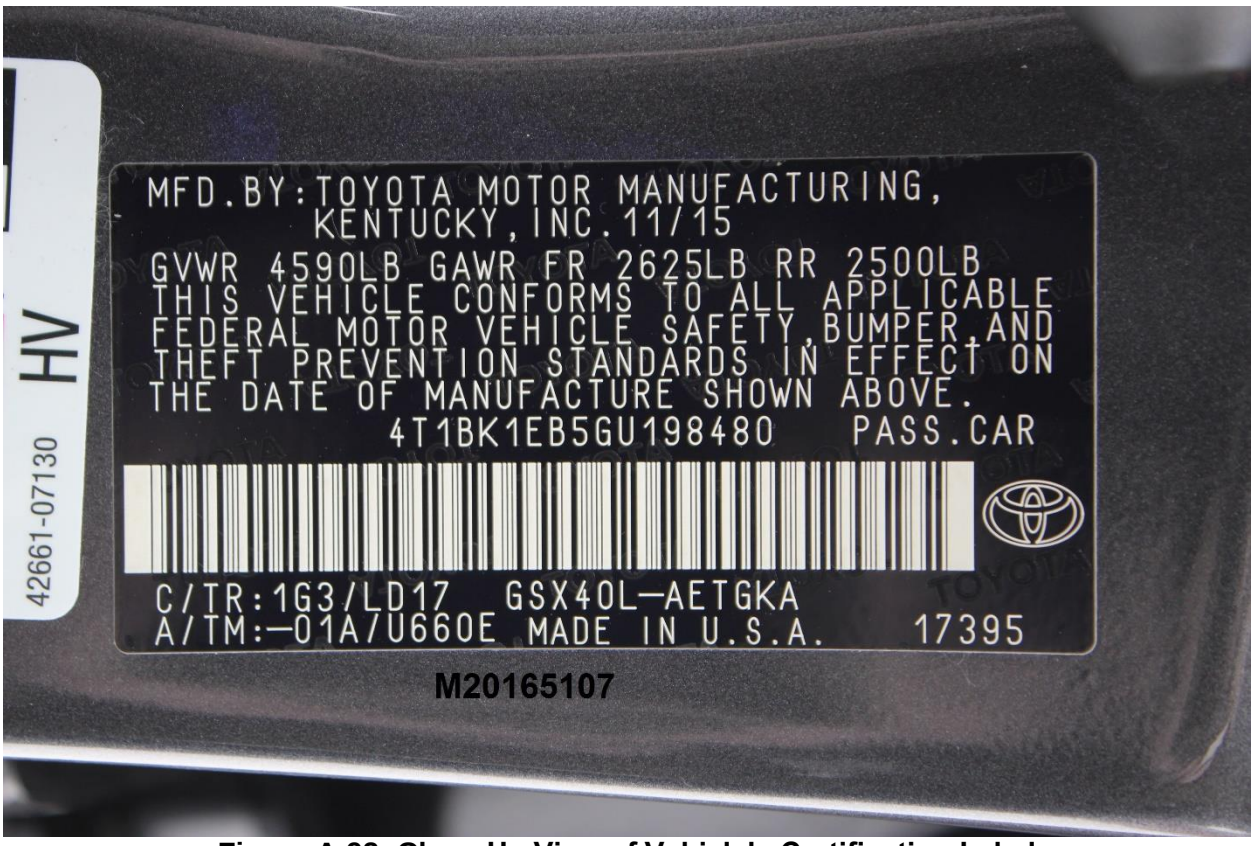



**Figure A-92: Close-Up View of Vehicle's Certification Label**


**Figure A-93: Close-Up View of Vehicle's Tire Information Placard or Label**

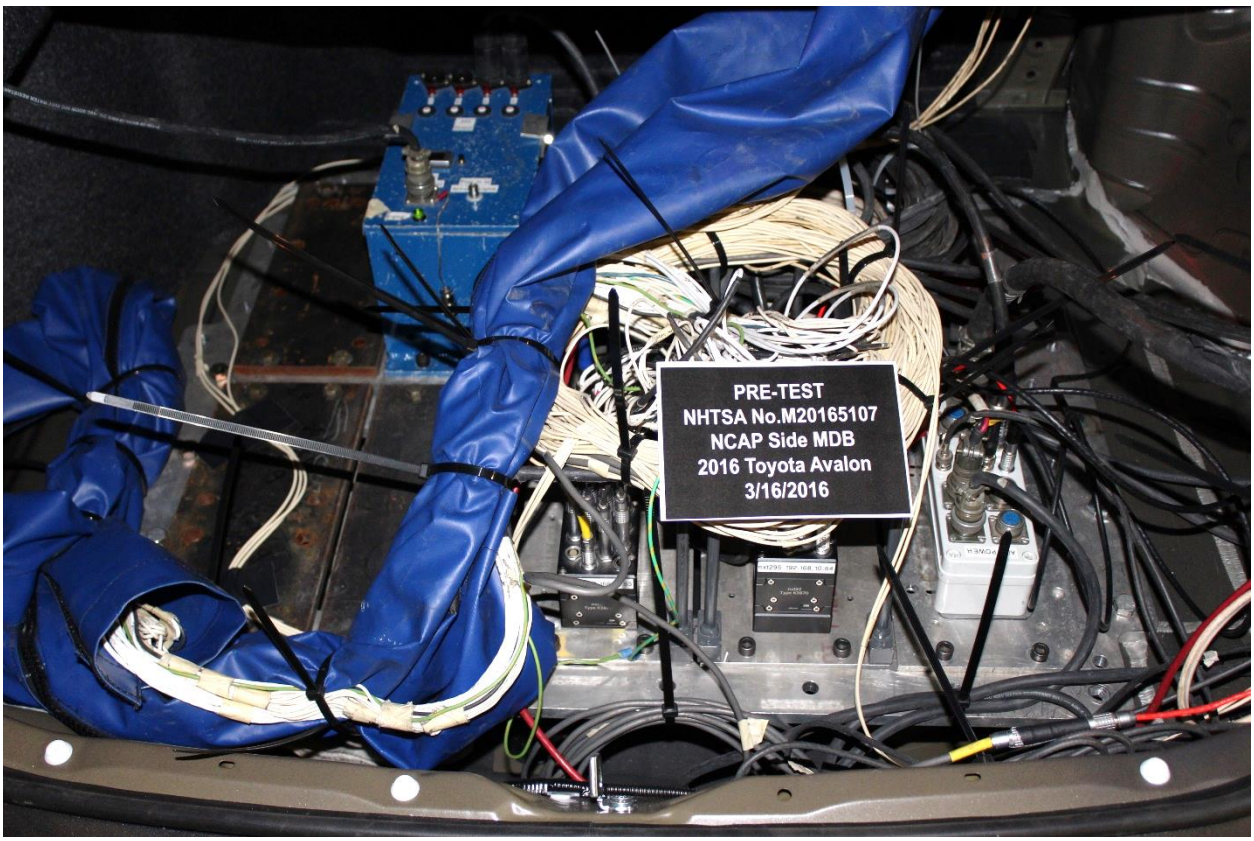



**Figure A-94: Pre-Test Ballast View**


**Figure A-95: Post-Test Primary and Redundant Speed Trap Read-Out**


**Figure A-96: FMVSS No. 301 Static Rollover 0 Degrees**

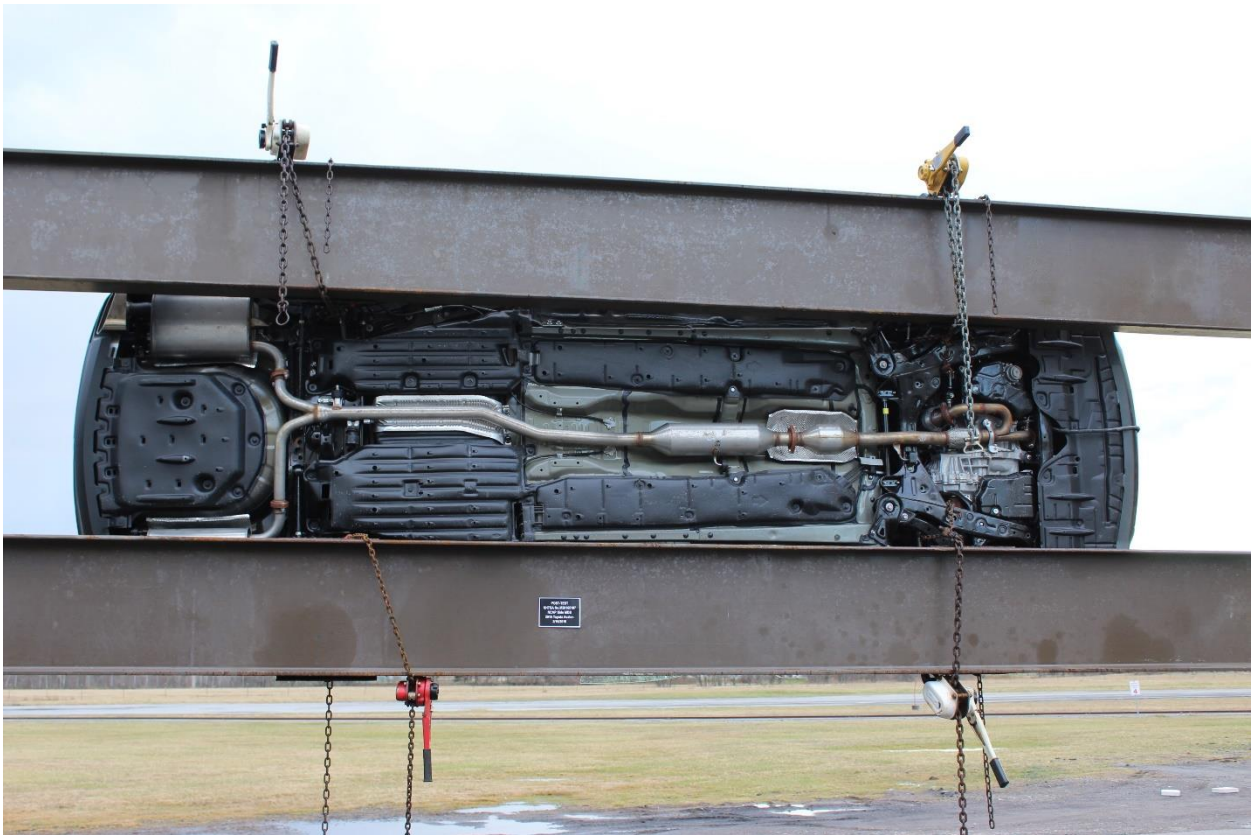


**Figure A-97: FMVSS No. 301 Static Rollover 90 Degrees**

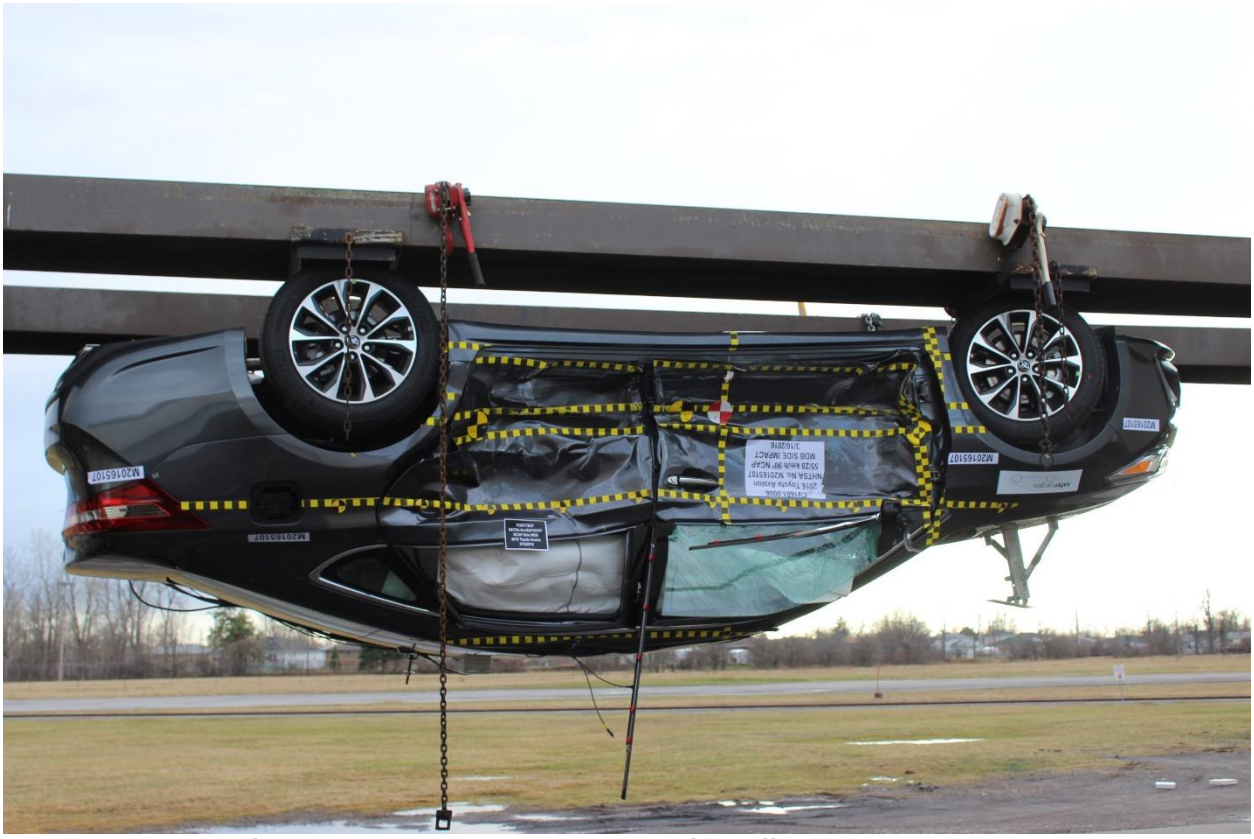


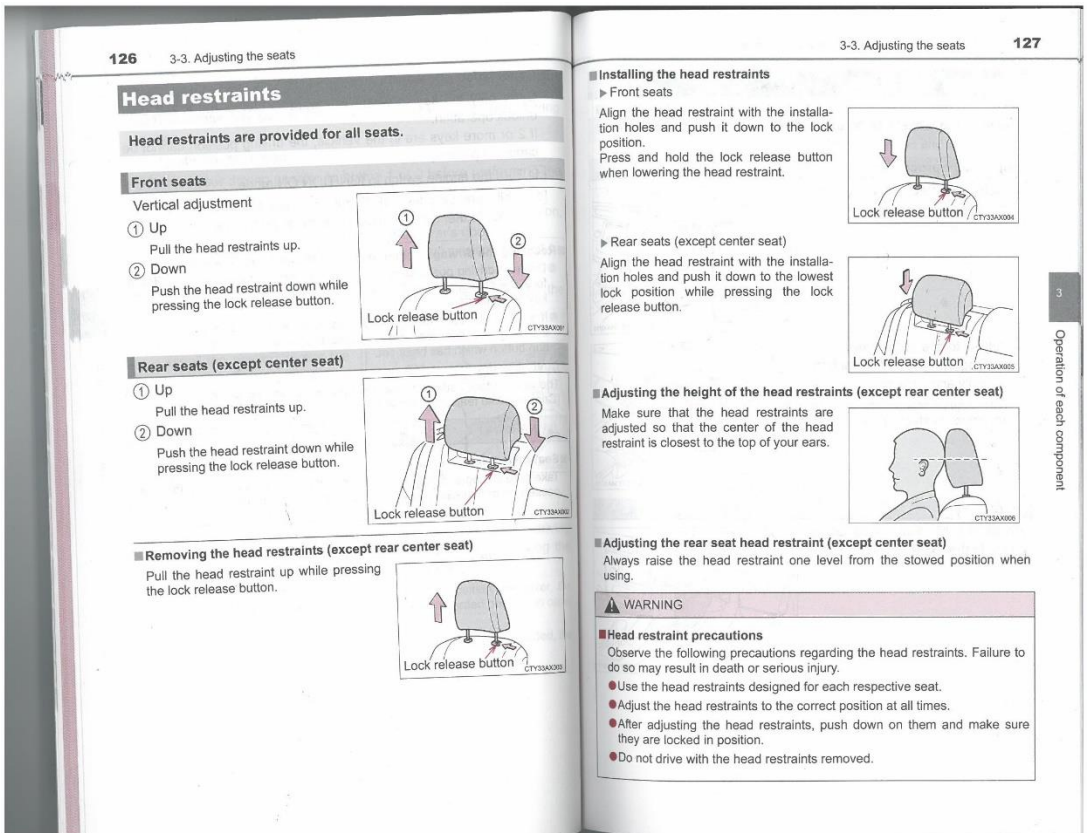
**Figure A-98: FMVSS No. 301 Static Rollover 180 Degrees**


**Figure A-99: FMVSS No. 301 Static Rollover 270 Degrees**


**Figure A-100: FMVSS No. 301 Static Rollover 360 Degrees**


**Figure A-101: Impact Event**


**Figure A-102: Monroney Label**



126 3-3. Adjusting the seats

## Head restraints

**Head restraints are provided for all seats.**

### Front seats

Vertical adjustment

① Up

Pull the head restraints up.

② Down

Push the head restraint down while pressing the lock release button.



### Rear seats (except center seat)

① Up

Pull the head restraints up.

② Down

Push the head restraint down while pressing the lock release button.



**Removing the head restraints (except rear center seat)**

Pull the head restraint up while pressing the lock release button.





**Installing the head restraints**

▶ Front seats

Align the head restraint with the installation holes and push it down to the lock position.
Press and hold the lock release button when lowering the head restraint.



▶ Rear seats (except center seat)

Align the head restraint with the installation holes and push it down to the lowest lock position while pressing the lock release button.



**Adjusting the height of the head restraints (except rear center seat)**

Make sure that the head restraints are adjusted so that the center of the head restraint is closest to the top of your ears.



**Adjusting the rear seat head restraint (except center seat)**

Always raise the head restraint one level from the stowed position when using.

**⚠ WARNING**

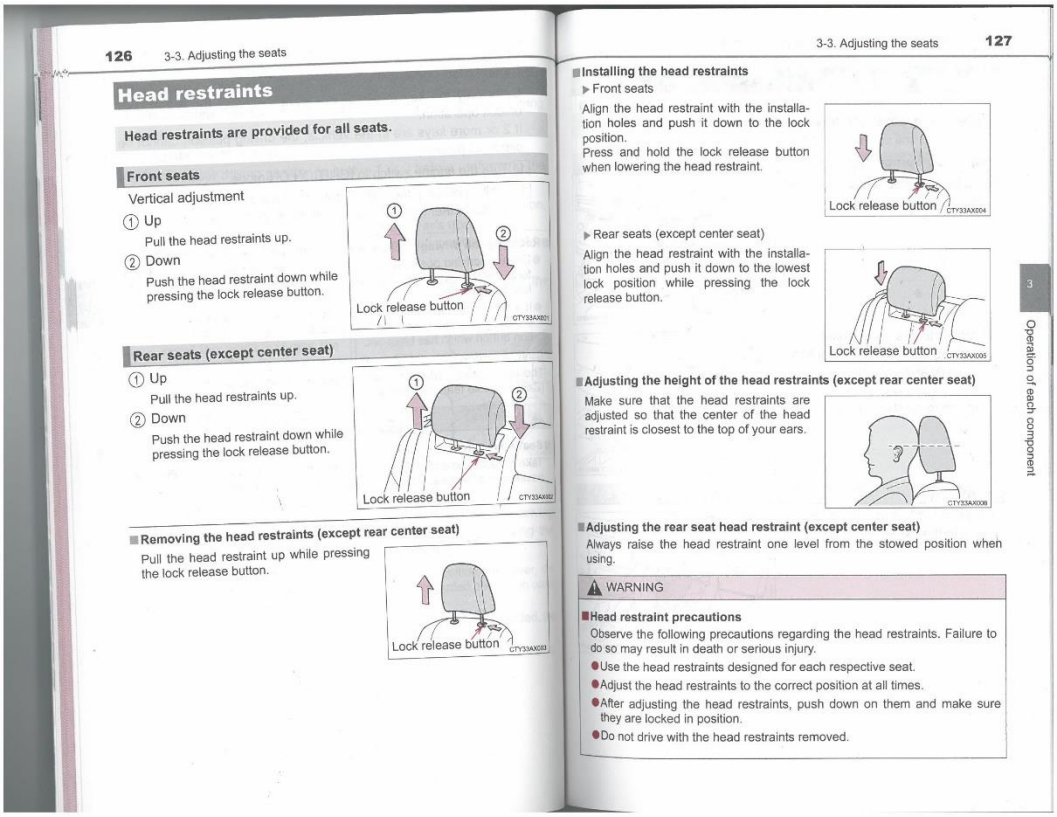
**Head restraint precautions**

Observe the following precautions regarding the head restraints. Failure to do so may result in death or serious injury.

- Use the head restraints designed for each respective seat.
- Adjust the head restraints to the correct position at all times.
- After adjusting the head restraints, push down on them and make sure they are locked in position.
- Do not drive with the head restraints removed.



**Figure A-103: Driver Head Restraint Use and Adjustment Information from Vehicle Owner's Manual**



126 3-3. Adjusting the seats

## Head restraints

**Head restraints are provided for all seats.**

### Front seats

Vertical adjustment

① Up

Pull the head restraints up.

② Down

Push the head restraint down while pressing the lock release button.



### Rear seats (except center seat)

① Up

Pull the head restraints up.

② Down

Push the head restraint down while pressing the lock release button.



**Removing the head restraints (except rear center seat)**

Pull the head restraint up while pressing the lock release button.





**Installing the head restraints**

▶ Front seats

Align the head restraint with the installation holes and push it down to the lock position.
Press and hold the lock release button when lowering the head restraint.



▶ Rear seats (except center seat)

Align the head restraint with the installation holes and push it down to the lowest lock position while pressing the lock release button.



**Adjusting the height of the head restraints (except rear center seat)**

Make sure that the head restraints are adjusted so that the center of the head restraint is closest to the top of your ears.



**Adjusting the rear seat head restraint (except center seat)**

Always raise the head restraint one level from the stowed position when using.

**⚠ WARNING**

**Head restraint precautions**

Observe the following precautions regarding the head restraints. Failure to do so may result in death or serious injury.

- Use the head restraints designed for each respective seat.
- Adjust the head restraints to the correct position at all times.
- After adjusting the head restraints, push down on them and make sure they are locked in position.
- Do not drive with the head restraints removed.



**Figure A-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

### Driver & Passenger Dummy Instrumentation 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.dot.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)
Passenger Upper Thorax Rib Deflection (Y)
Passenger Middle Thorax Rib Deflection (Y)
Passenger Lower Thorax Rib Deflection (Y)
Passenger Upper Abdomen Rib Deflection (Y)
Passenger Lower Abdomen Rib Deflection (Y)
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)

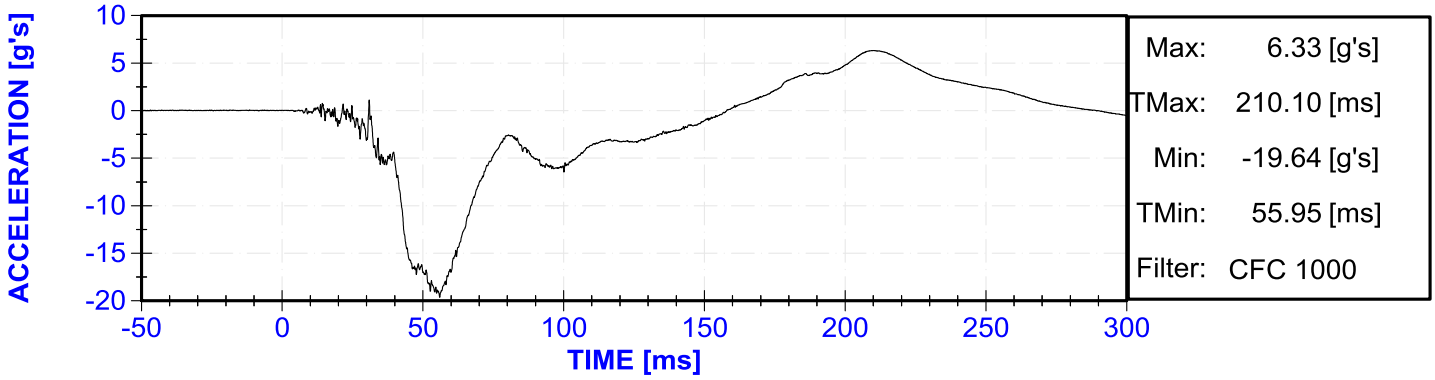
## Vehicle Instrumentation Data

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)

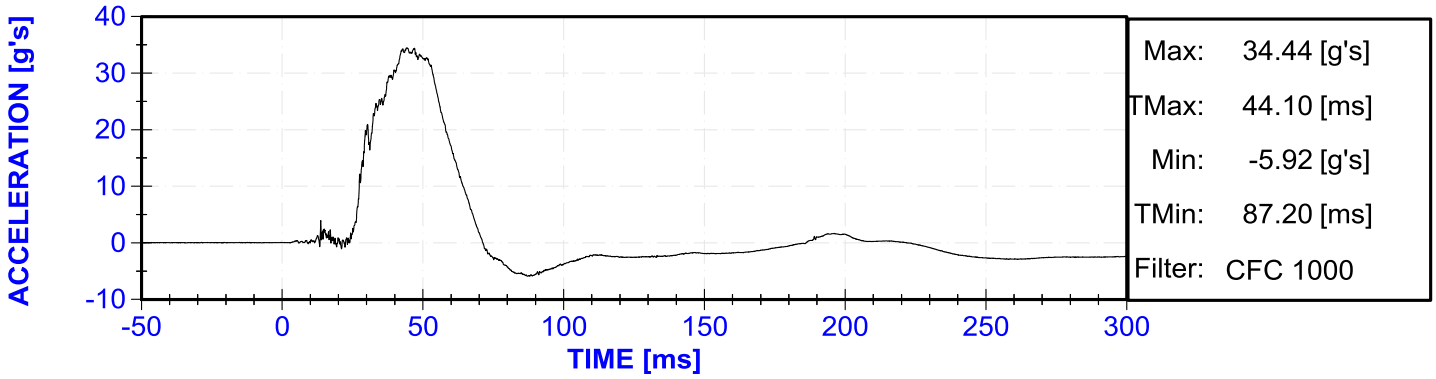
**MDB Instrumentation Data**

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

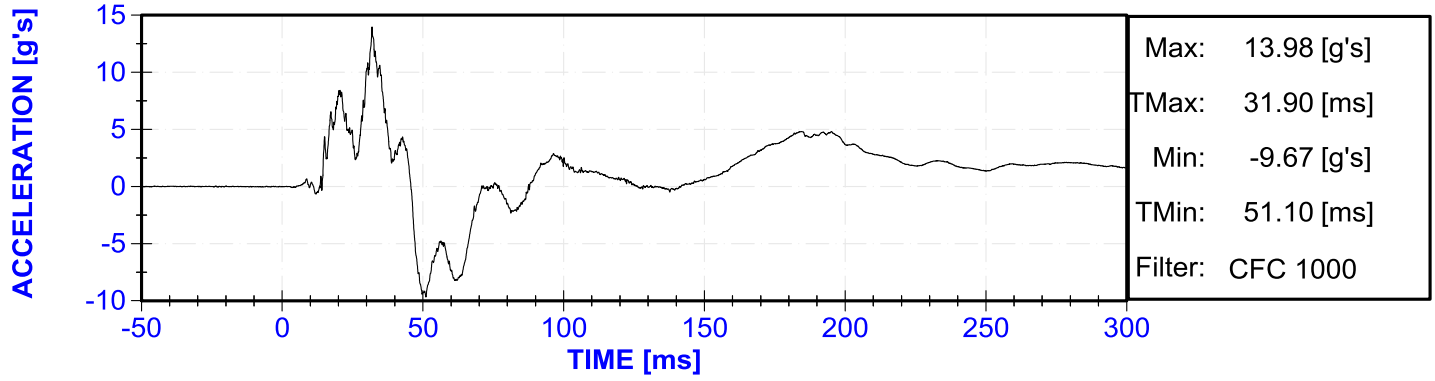
Driver Head Acceleration (X) Primary vs. Time



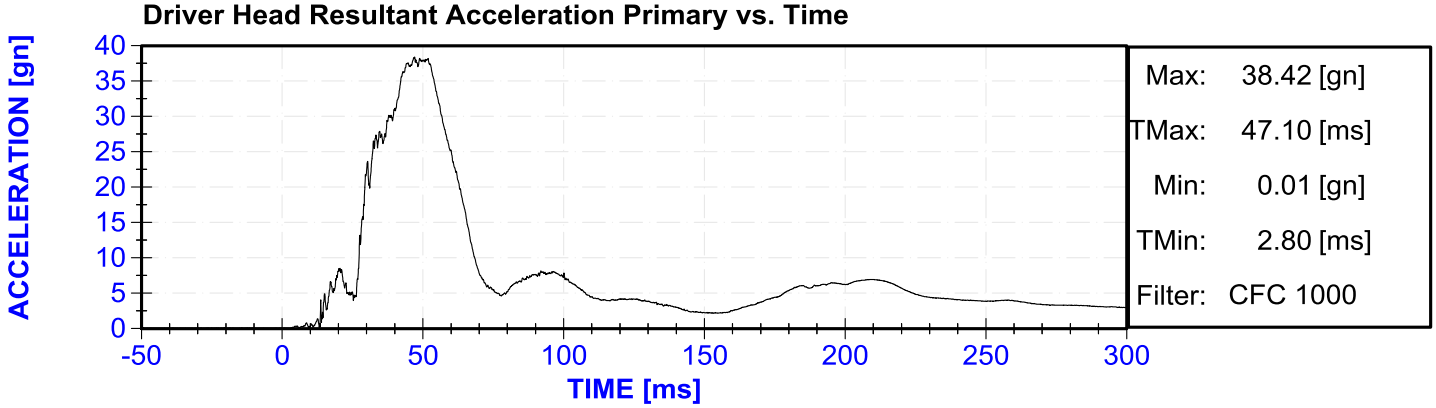

Driver Head Acceleration (Y) Primary vs. Time



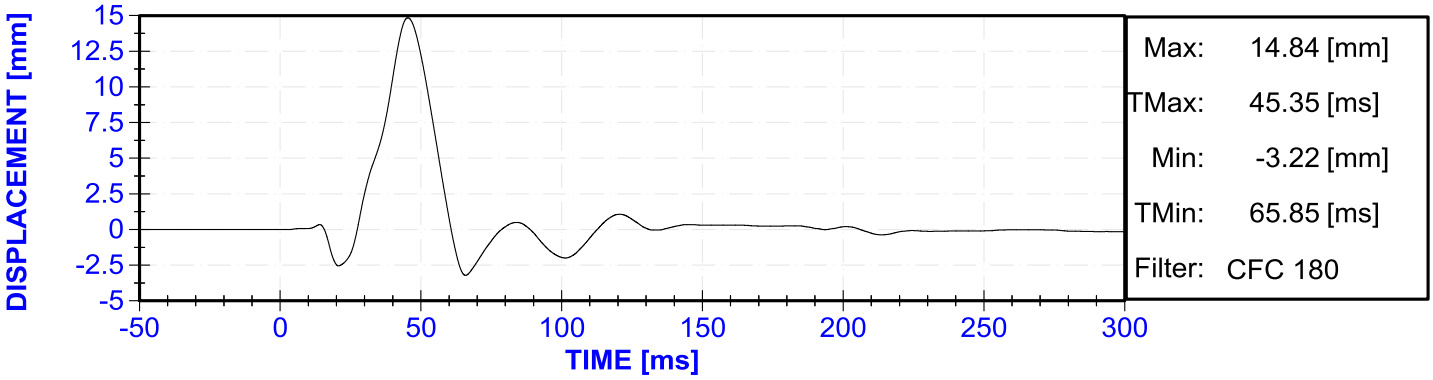

Driver Head Acceleration (Z) Primary vs. Time



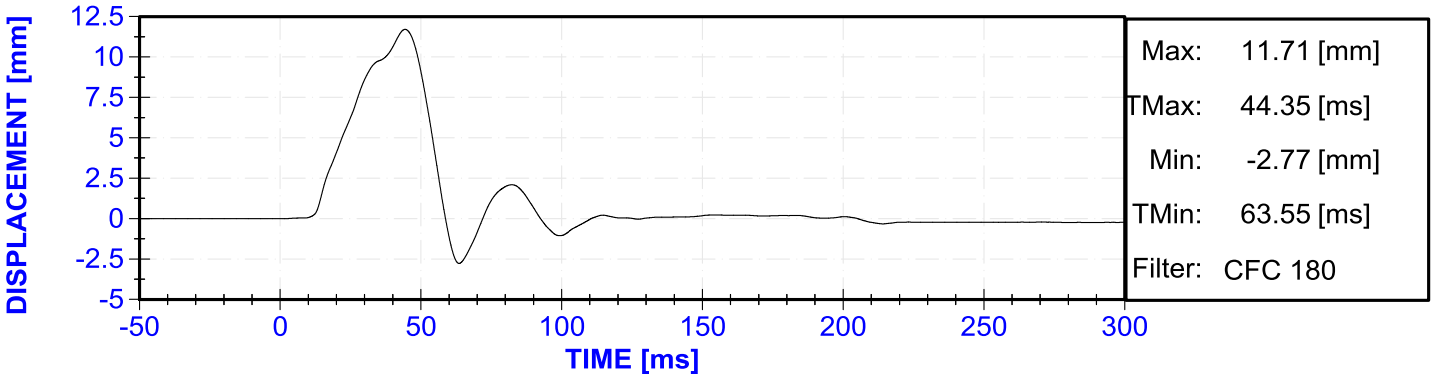

Driver Head Resultant Acceleration Primary vs. Time



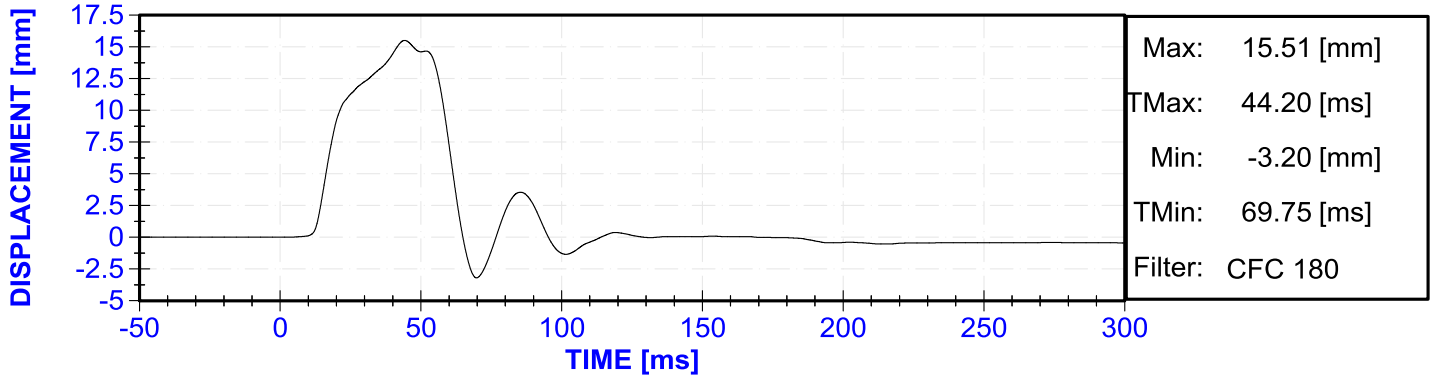
**Driver Upper Thorax Rib Deflection (Y) vs. Time**



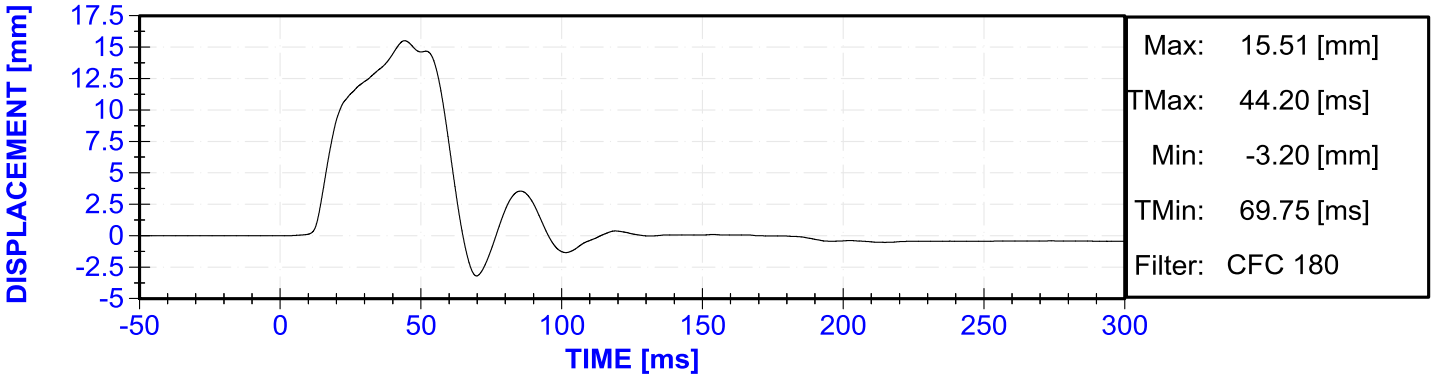

**Driver Middle Thorax Rib Deflection (Y) vs. Time**



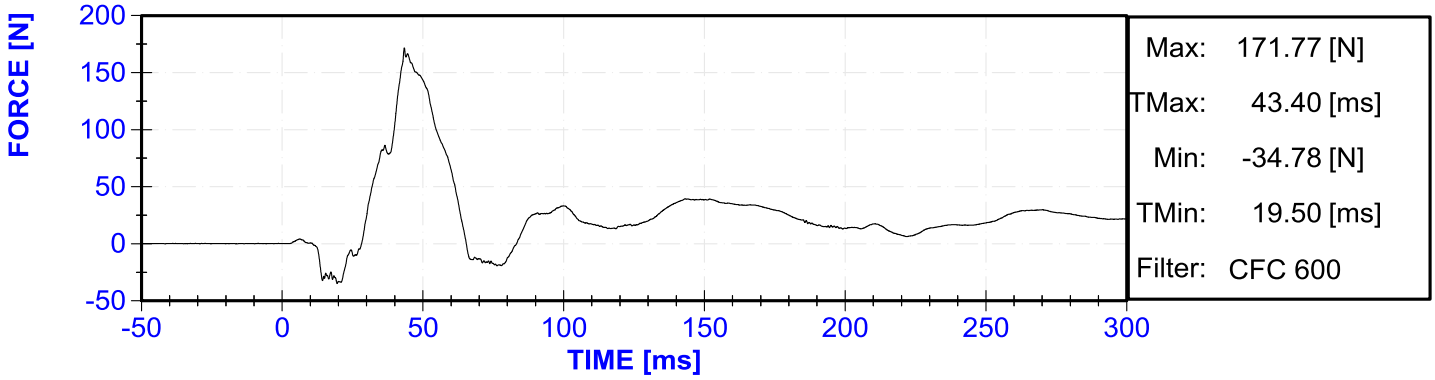

**Driver Lower Thorax Rib Deflection (Y) vs. Time**



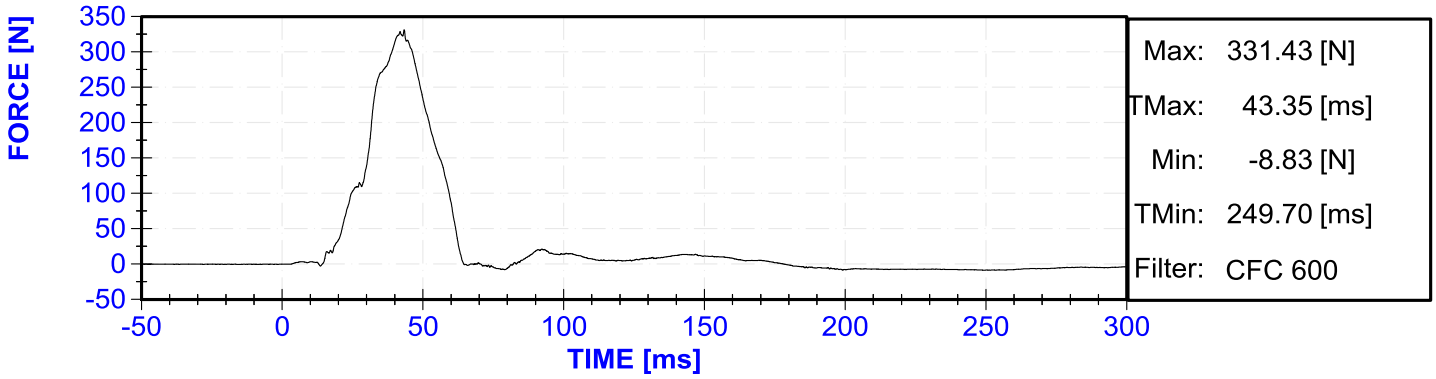

**Driver Thorax Rib Deflection Maximum vs. Time**



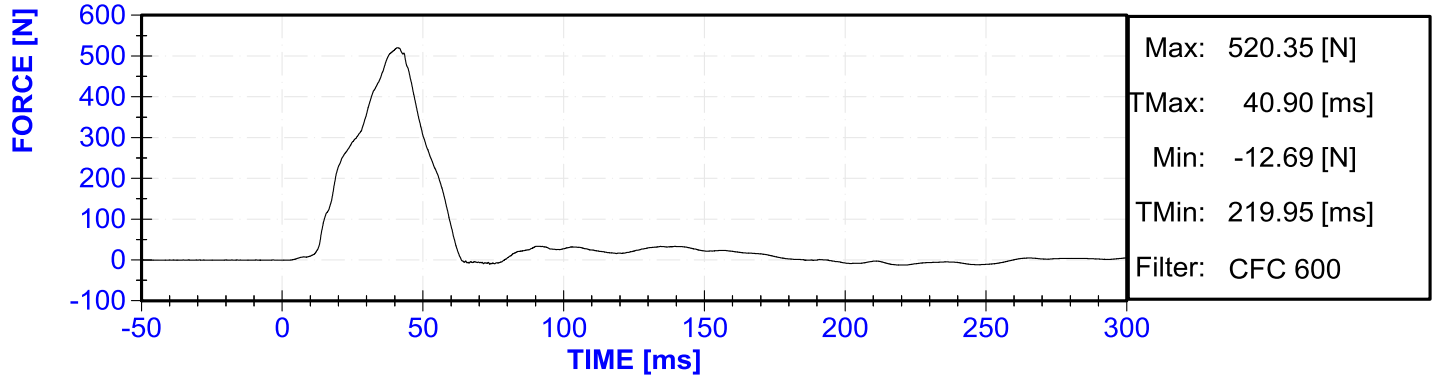
## Driver Anterior Abdominal Force (Y) vs. Time



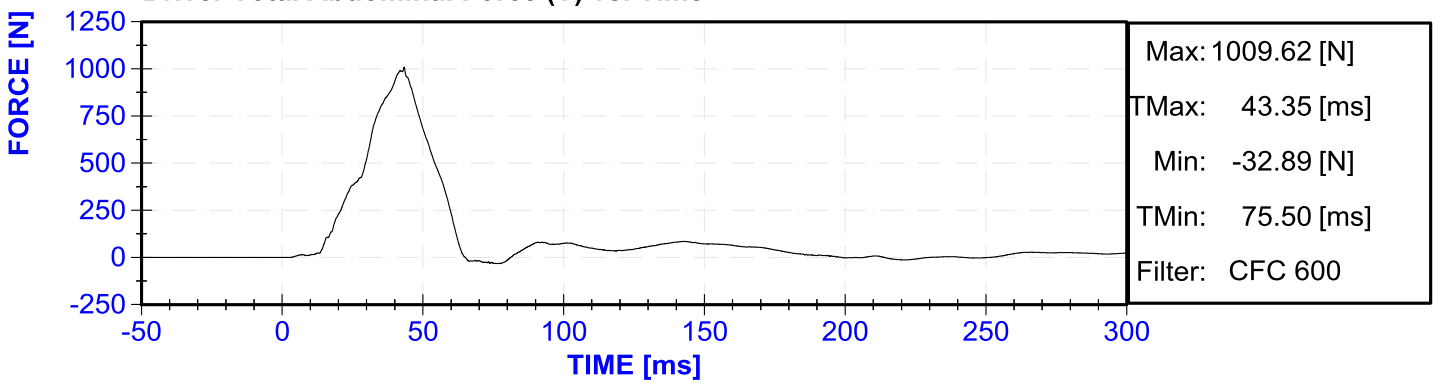

## Driver Middle Abdominal Force (Y) vs. Time



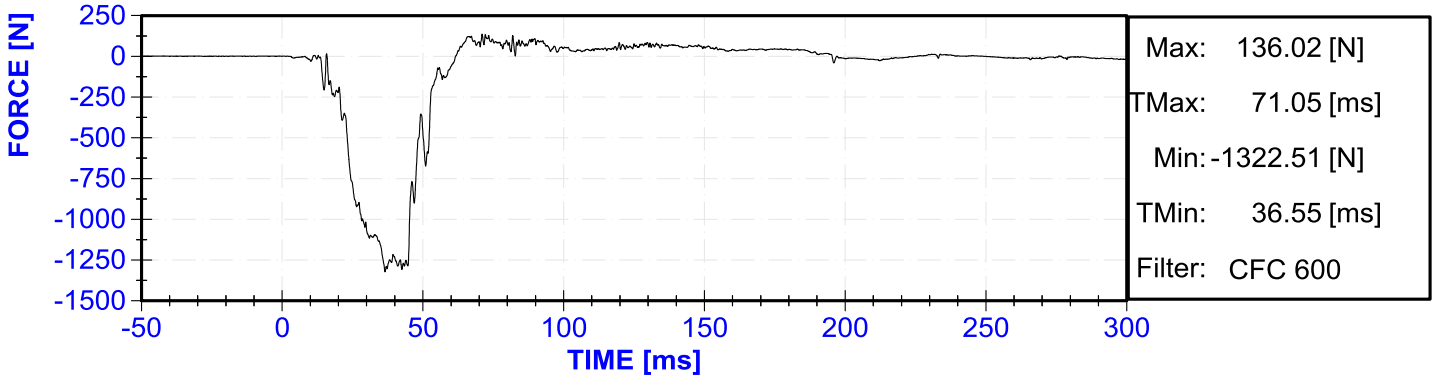

## Driver Posterior Abdominal Force (Y) vs. Time



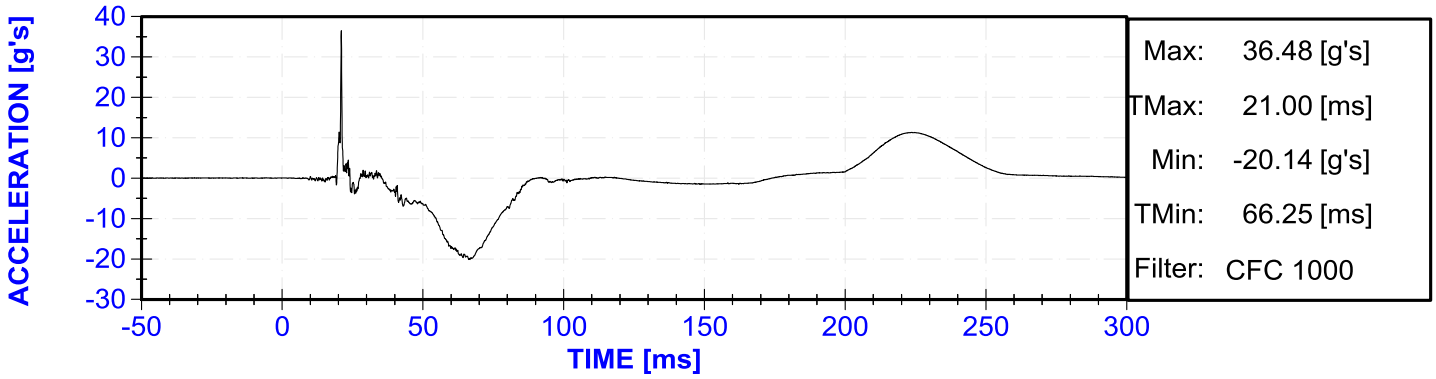

## Driver Total Abdominal Force (Y) vs. Time



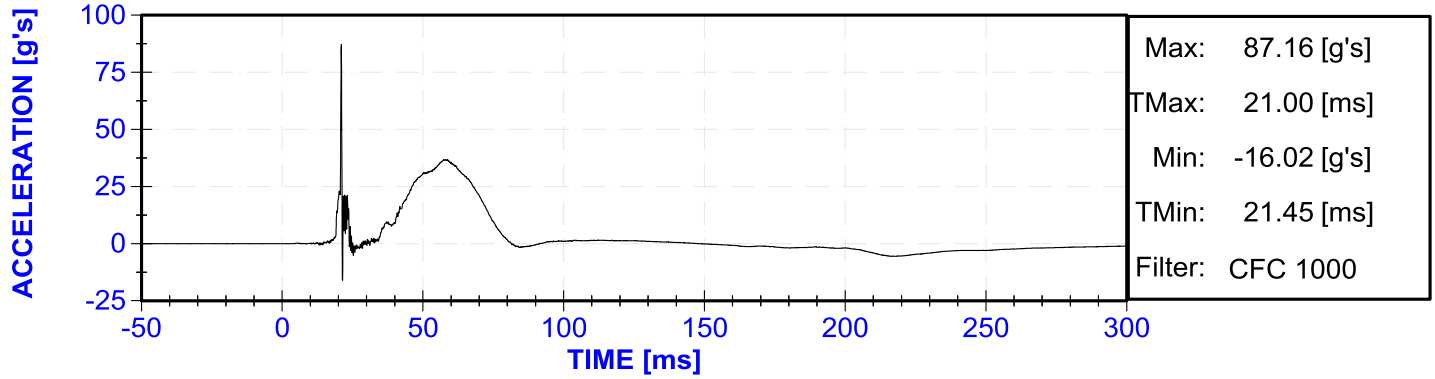
## Driver Pubic Symphysis Force (Y) vs. Time



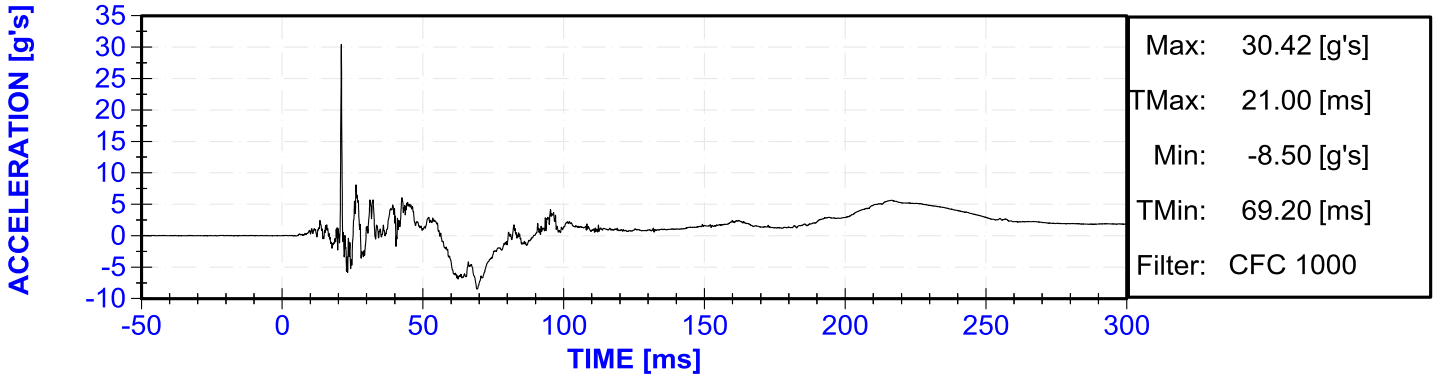

## Passenger Head Acceleration (X) vs. Time Primary



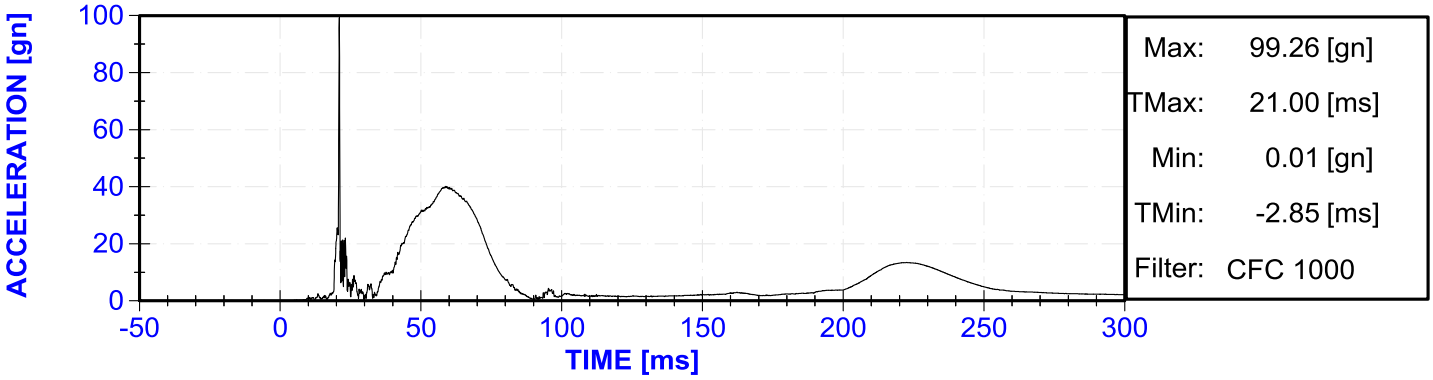

## Passenger Head Acceleration (Y) vs. Time Primary



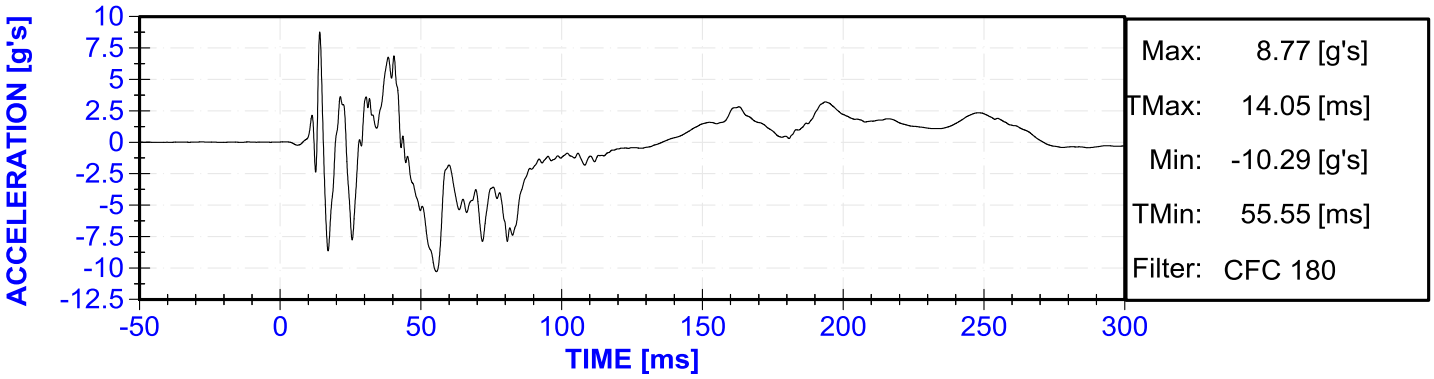

## Passenger Head Acceleration (Z) vs. Time Primary



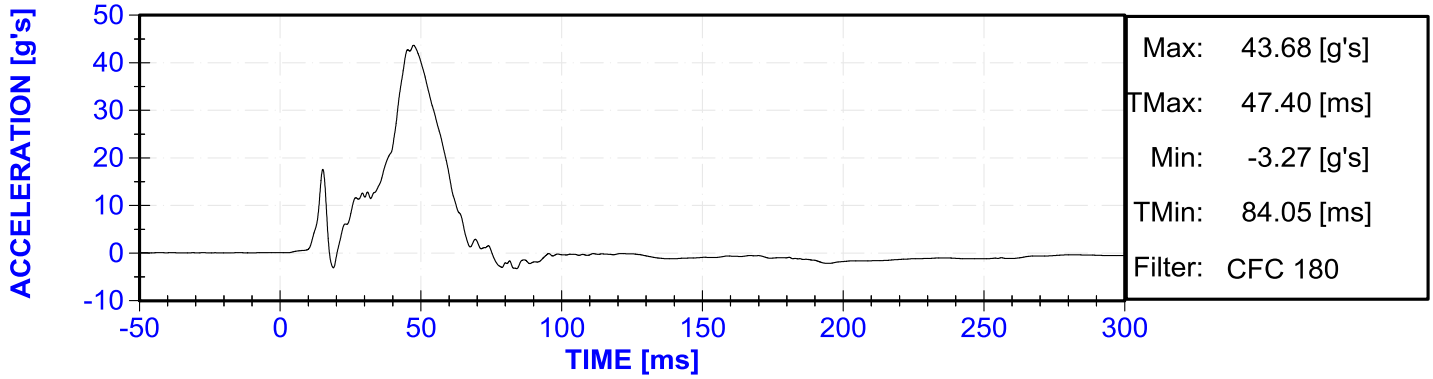
## Passenger Head Resultant Acceleration Primary vs. Time



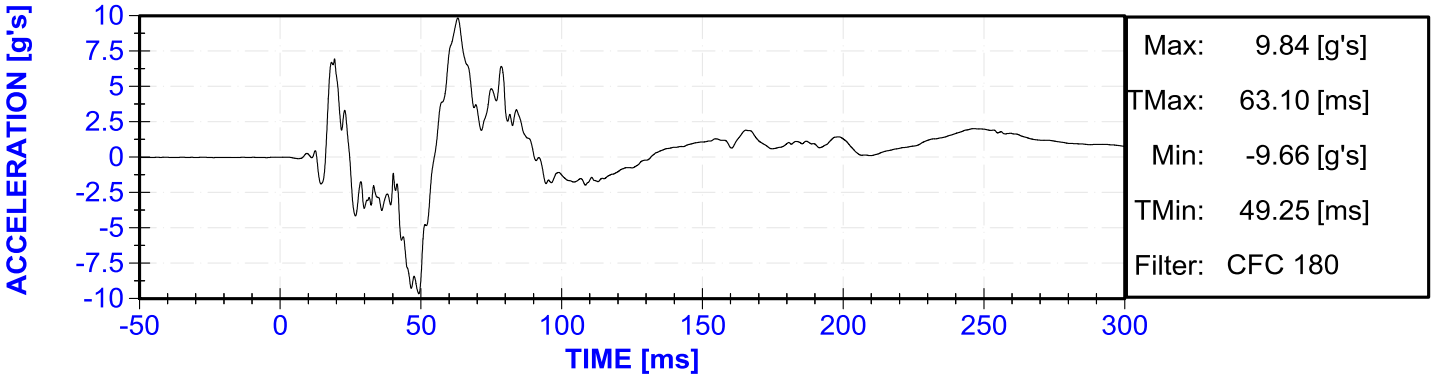

## Passenger Lower Spine T12 Acceleration (X) vs. Time



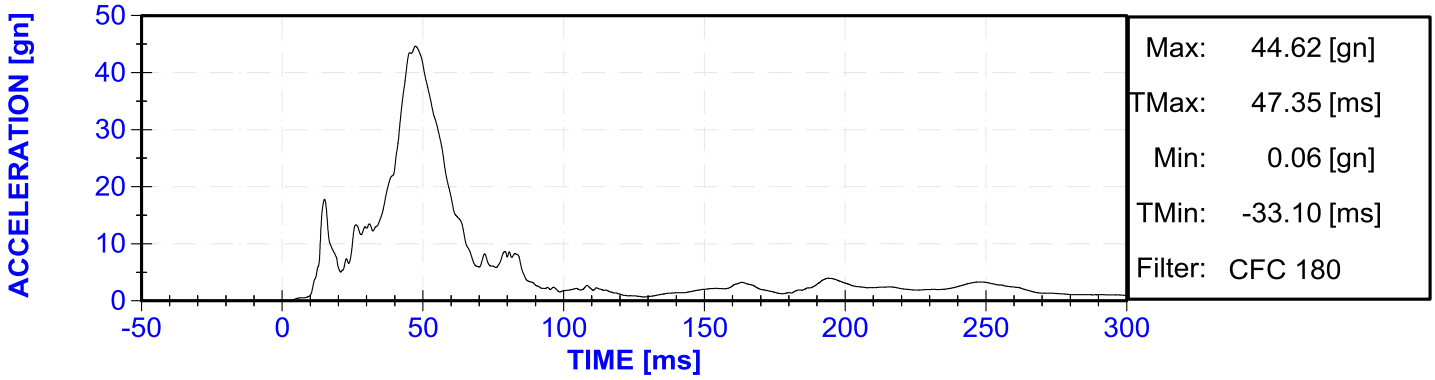

## Passenger Lower Spine T12 Acceleration (Y) vs. Time



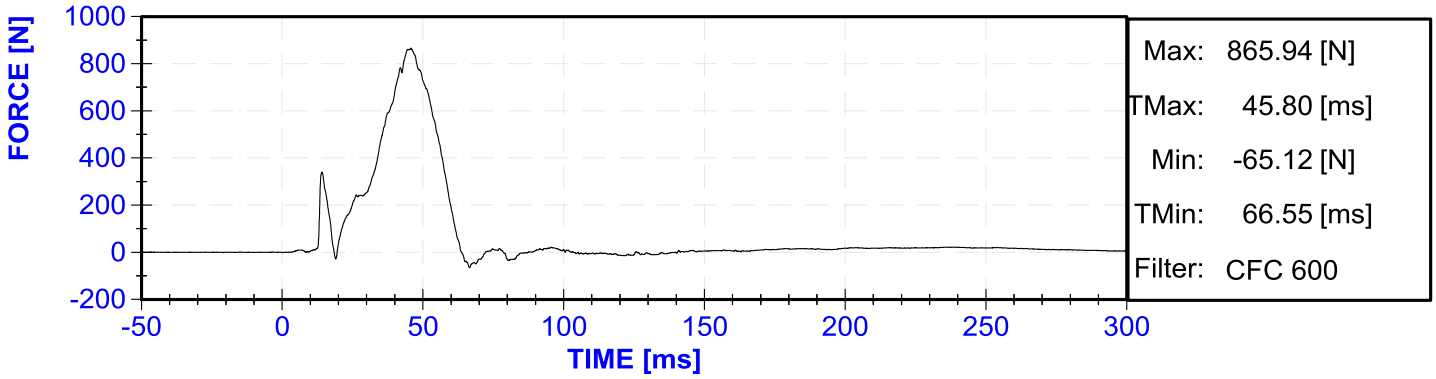

## Passenger Lower Spine T12 Acceleration (Z) vs. Time



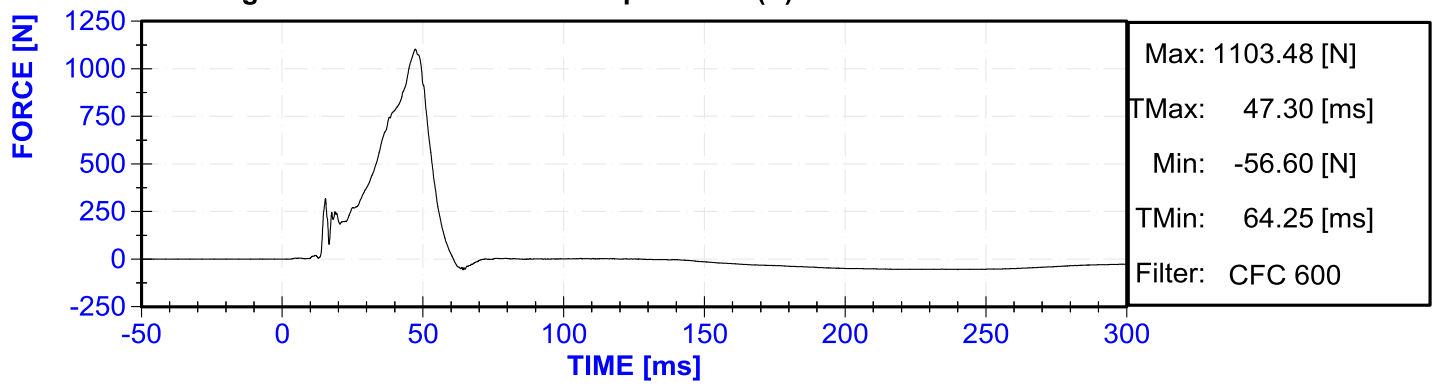
**Passenger Lower Spine T12 Resultant Acceleration vs. Time**



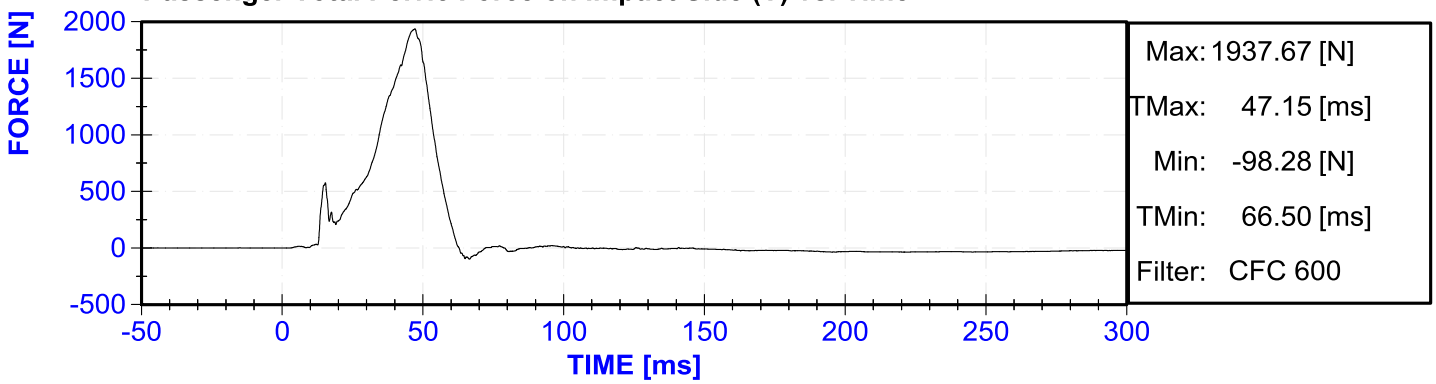

**Passenger Iliac Force on Impact Side (Y) vs. Time**




**Passenger Acetabulum Force on Impact Side (Y) vs. Time**




**Passenger Total Pelvic Force on Impact Side (Y) vs. Time**



# APPENDIX C

# DUMMY PERFORMANCE CALIBRATION TEST DATA

**CALIBRATION TEST RESULTS**

**PRE-TEST**

**EUROSID 2 (ES-2RE) MALE – DRIVER ATD**

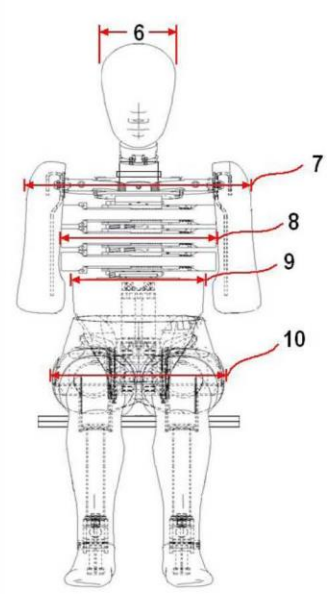
**SERIAL NO: F034**

**(CONFIGURED FOR LEFT SIDE IMPACT)**

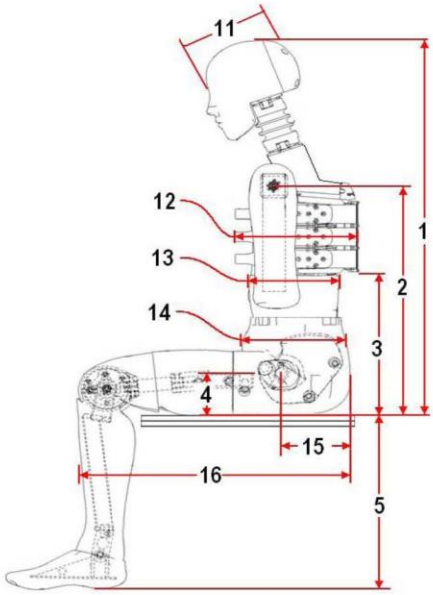
External Measurements - EuroSID-2re

Technician: M. Goehle  Date: 2/5/2016

Dummy Serial Number: F034




FRONT VIEW




SIDE VIEW

| Dim. No. | Description | Specification (mm) | | Result (mm) | Pass/Fail |
|---|---|---|---|---|---|
| 1 | Sitting Height | 900 | 918 | 912 | Pass |
| 2 | Seat to Shoulder Joint | 558 | 572 | 560 | Pass |
| 3 | Seat to Lower Face of Thoracic Spine Box | 346 | 356 | 350 | Pass |
| 4 | Seat to Hip Joint (center of bolt) | 97 | 103 | 100 | Pass |
| 5 | Sole to Seat, Sitting | 333 | 451 | 414 | Pass |
| 6 | Head Width | 152 | 158 | 154 | Pass |
| 7 | Shoulder/Arm Width | 461 | 479 | 473 | Pass |
| 8 | Thorax Width | 322 | 332 | 330 | Pass |
| 9 | Abdomen Width | 273 | 287 | 284 | Pass |
| 10 | Pelvis Lap Width | 359 | 373 | 367 | Pass |
| 11 | Head Depth | 196 | 206 | 200 | Pass |
| 12 | Thorax Depth | 262 | 272 | 266 | Pass |
| 13 | Abdomen Depth | 194 | 204 | 200 | Pass |
| 14 | Pelvis Depth | 235 | 245 | 238 | Pass |
| 15 | Back of Buttocks to Hip Joint (center of bolt) | 150 | 160 | 155 | Pass |
| 16 | Back of Buttocks to Front Knee | 597 | 615 | 604 | Pass |

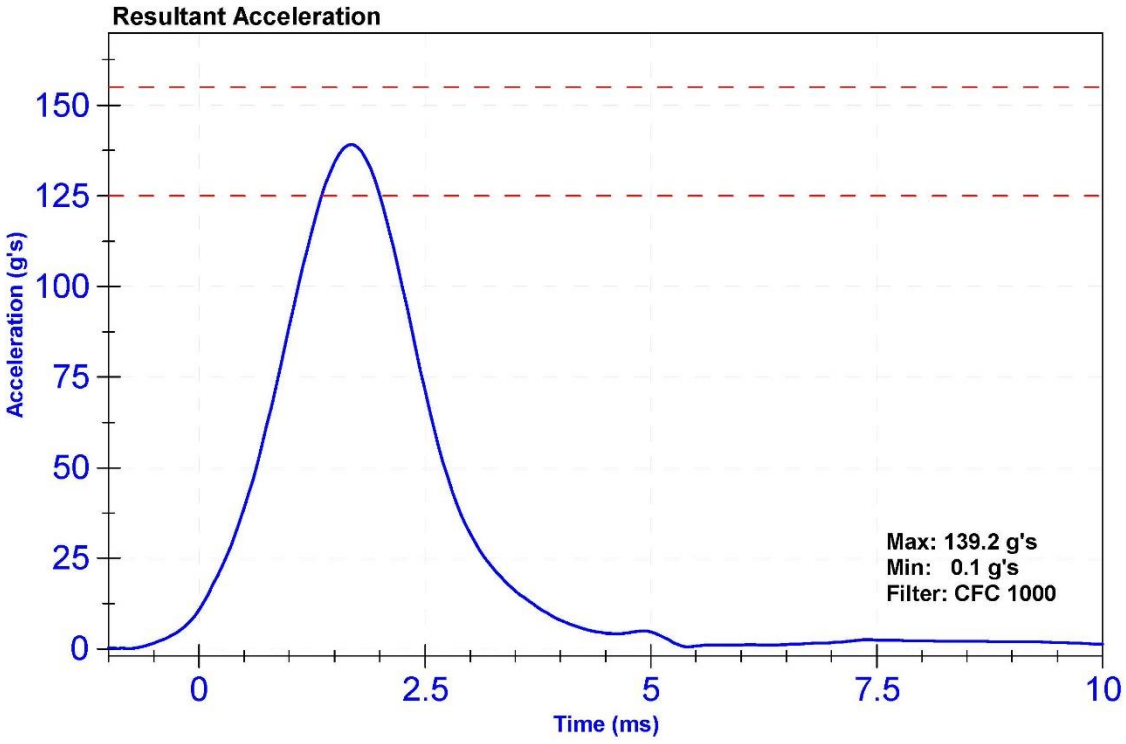
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M.Hartung |
| ATD Serial Number | F034 | Laboratory Supervisor | M.Goehle |

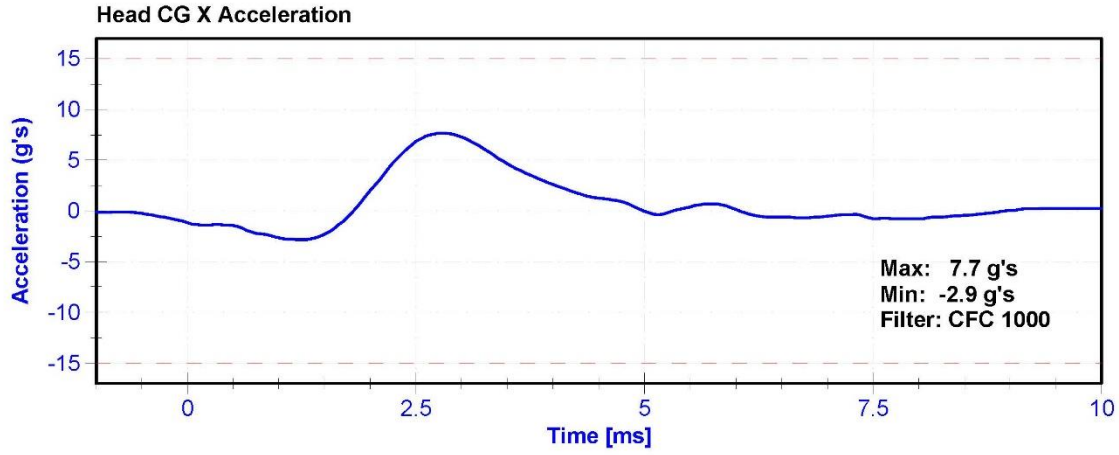
**Results**

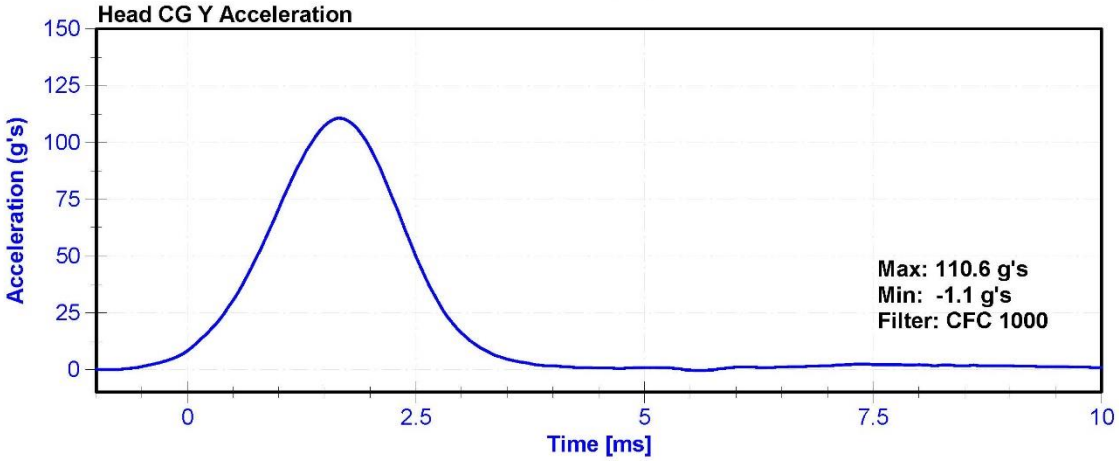
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 22.2 | Pass |
| Humidity | 10 | 70 | % | 30.9 | Pass |
| Resultant Acceleration | 125 | 155 | g's | 139.2 | Pass |
| Oscillation | 0 | 15 | % | 3.55 | Pass |
| Fore-Aft Acceleration | -15 | 15 | g's | 7.7 | Pass |

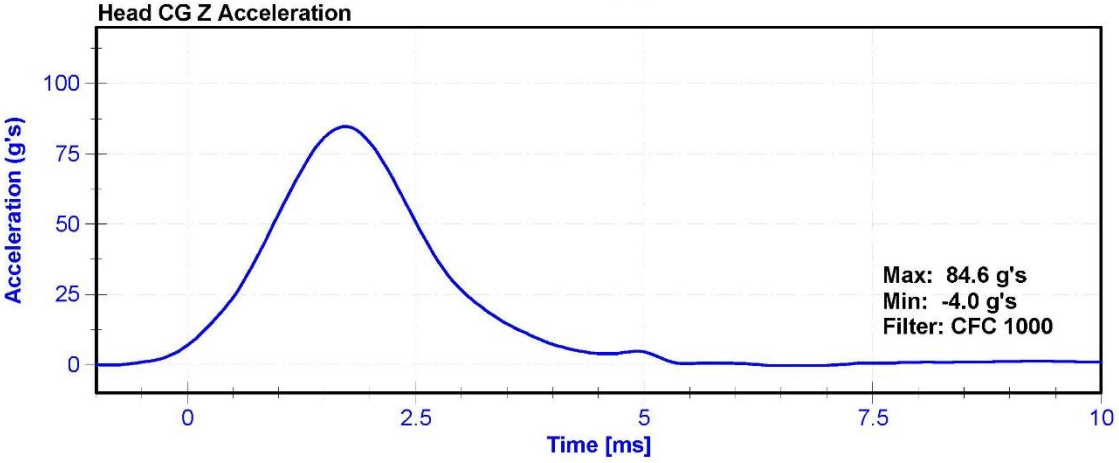
**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| X Accelerometer | ENDEVCO 7264CT | AC-P58904 | 10/19/2015 | 4/18/2016 |
| Y Accelerometer | ENDEVCO 7264CT | AC-P58911 | 10/19/2015 | 4/18/2016 |
| Z Accelerometer | ENDEVCO 7264CT | AC-P58776 | 10/19/2015 | 4/18/2016 |




Head CG X Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]
Max: 7.7 g's
Min: -2.9 g's
Filter: CFC 1000


Head CG Y Acceleration
Acceleration (g's)
150
125
100
75
50
25
0
0
2.5
5
7.5
10
Time [ms]
Max: 110.6 g's
Min: -1.1 g's
Filter: CFC 1000


Head CG Z Acceleration
Acceleration (g's)
100
75
50
25
0
0
2.5
5
7.5
10
Time [ms]
Max: 84.6 g's
Min: -4.0 g's
Filter: CFC 1000

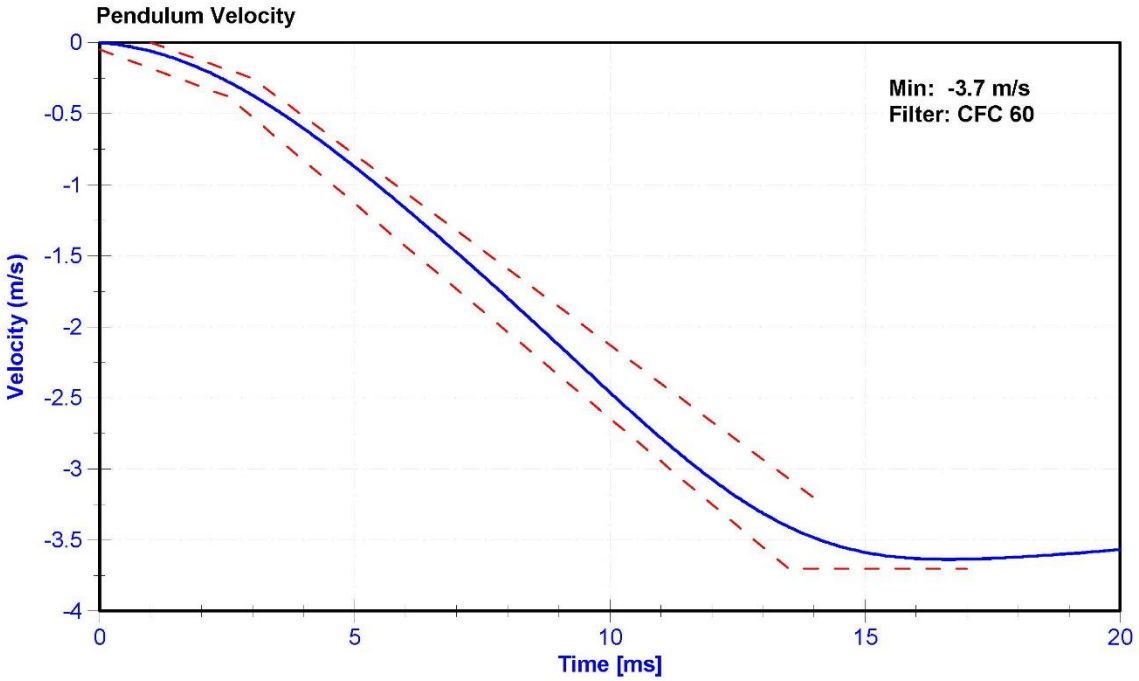
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M.Goehle |
| ATD Serial Number | F034 | Laboratory Supervisor | M.Hartung |

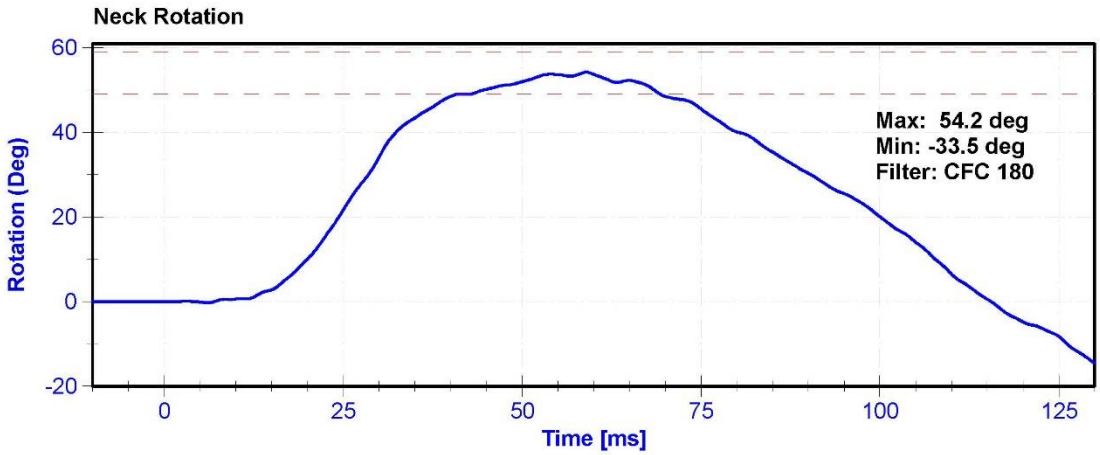
**Results**

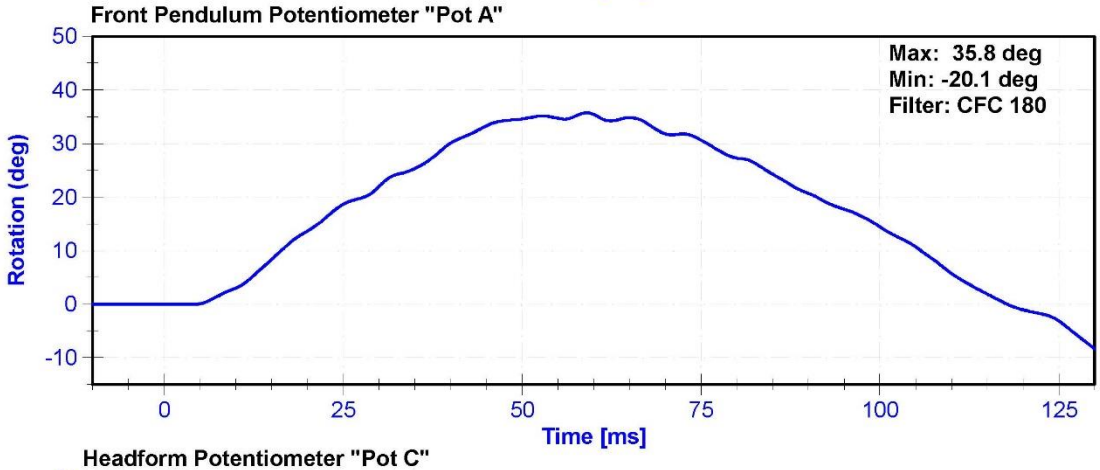
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 22.2 | Pass |
| Humidity | 10 | 70 | % | 27.2 | Pass |
| Velocity | 3.3 | 3.5 | m/s | 3.47 | Pass |
| Lateral Neck Rotation | 49 | 59 | deg | 54.2 | Pass |
| Time at Maximum Rotation | 54 | 66 | ms | 59.0 | Pass |
| Time of Rotation Decay from Maximum | 53 | 88 | ms | 56.5 | Pass |

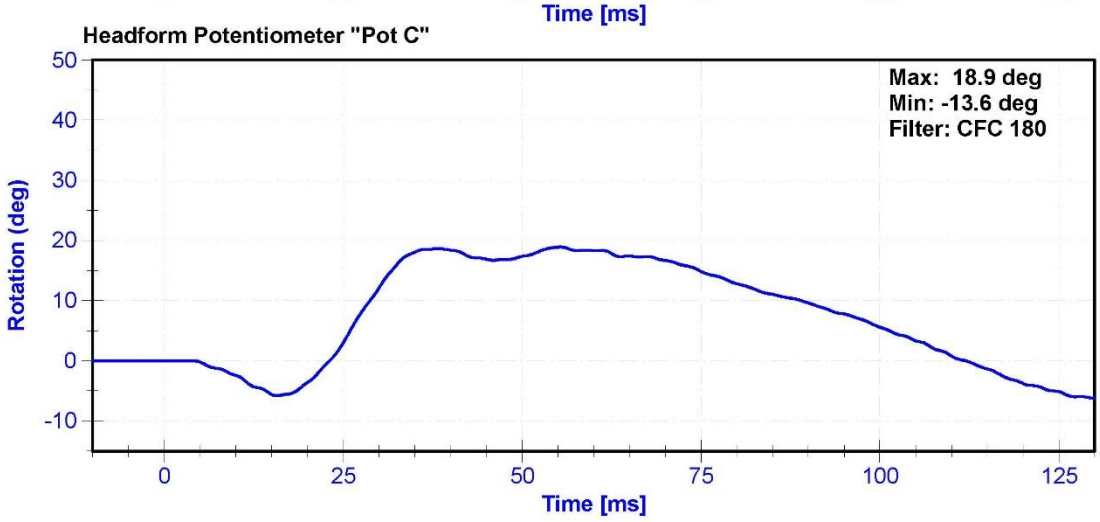
**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7231CT | AC-AH5F3 | 5/7/2015 | 5/6/2016 |
| Front Pendulum Potentiometer | SP22G | DS-094 | 9/24/2015 | 9/23/2016 |
| Headform Potentiometer | SP22G | DS-095 | 9/24/2015 | 9/23/2016 |




Neck Rotation
Rotation (Deg)
60
40
20
0
-20
0
25
50
75
100
125
Time [ms]
Max: 54.2 deg
Min: -33.5 deg
Filter: CFC 180


Front Pendulum Potentiometer "Pot A"
Rotation (deg)
50
40
30
20
10
0
-10
0
25
50
75
100
125
Time [ms]
Max: 35.8 deg
Min: -20.1 deg
Filter: CFC 180


Headform Potentiometer "Pot C"
Rotation (deg)
50
40
30
20
10
0
-10
0
25
50
75
100
125
Time [ms]
Max: 18.9 deg
Min: -13.6 deg
Filter: CFC 180

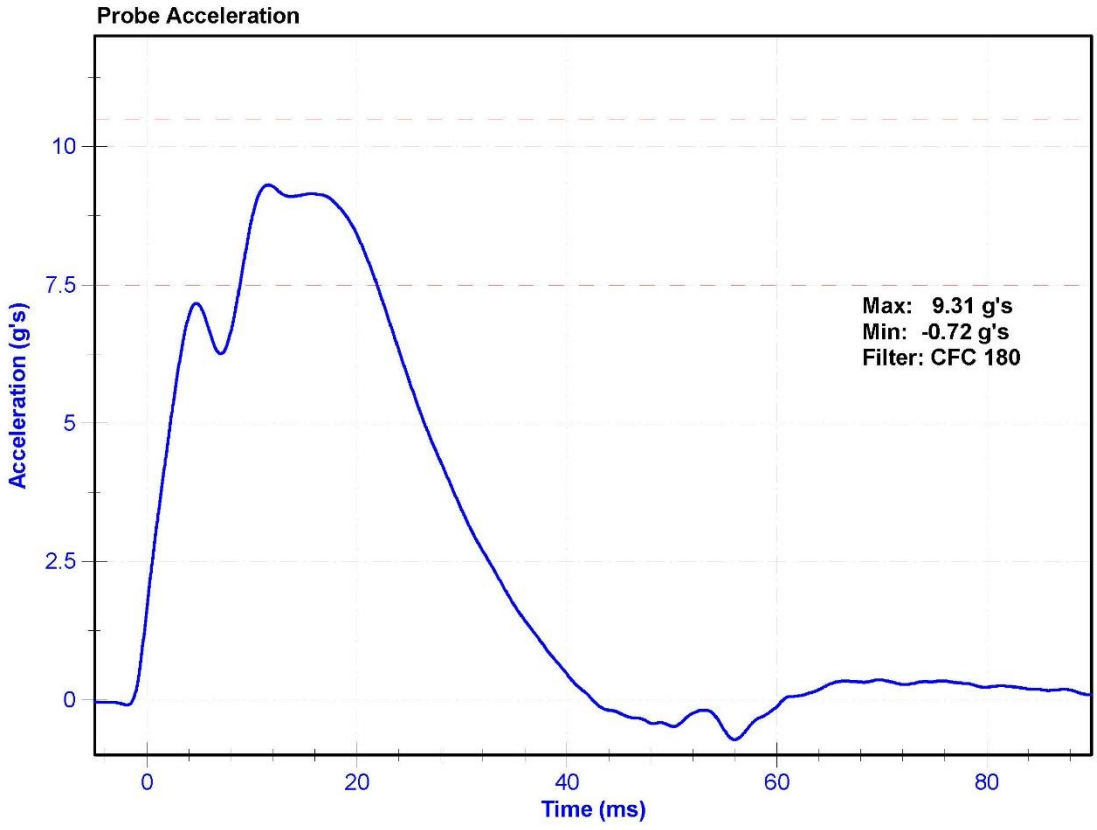
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M.Hartung |
| ATD Serial Number | F034 | Laboratory Supervisor | M.Goehle |

**Results**

| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.0 | Pass |
| Humidity | 10 | 70 | % | 24.3 | Pass |
| Velocity | 4.2 | 4.4 | m/s | 4.24 | Pass |
| Probe Acceleration | 7.5 | 10.5 | g's | 9.31 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Probe Accelerometer | ENDEVCO 7264CT | AC-P23155 | 1/13/2016 | 7/14/2016 |



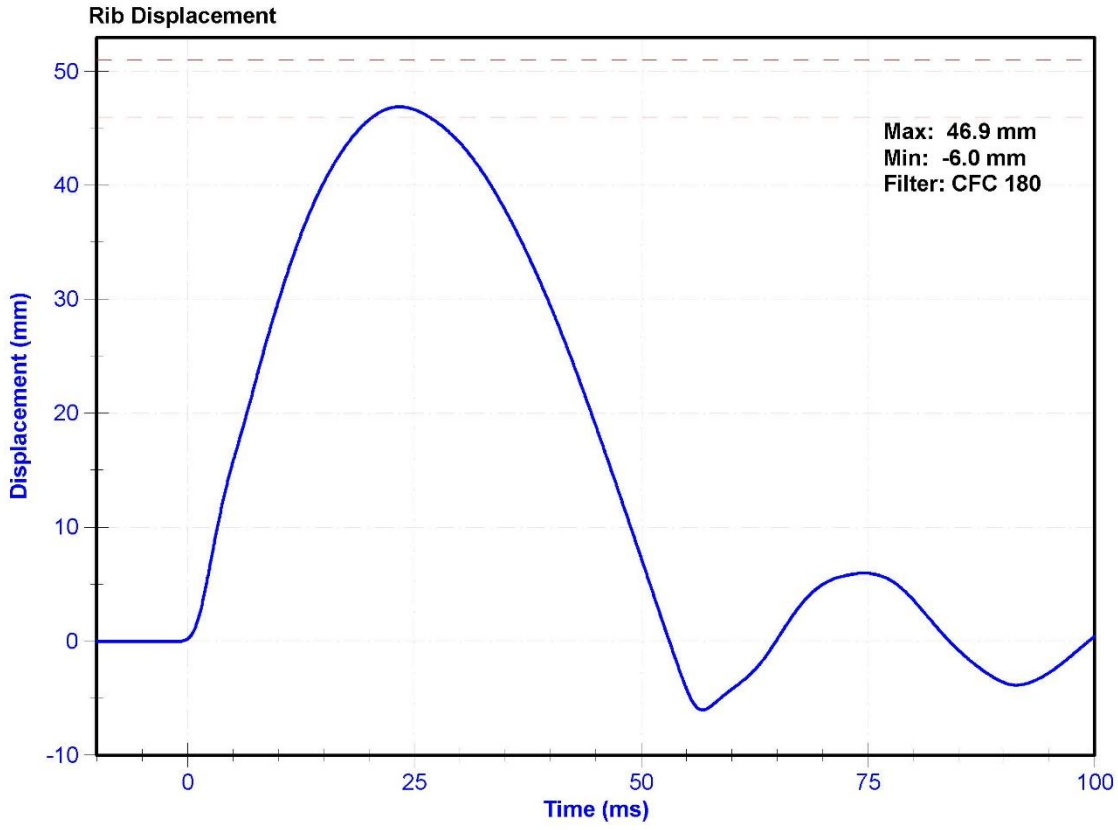
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M.Hartung |
| ATD Serial Number | F034 | Laboratory Supervisor | M.Goehle |

**Results**

| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.3 | Pass |
| Humidity | 10 | 70 | % | 30.3 | Pass |
| Rib Displacement | 46 | 51 | mm | 46.9 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Rib Potentiometer | Honeywell MLT-38000203 | DS-183GFE | 10/19/2015 | 10/18/2016 |



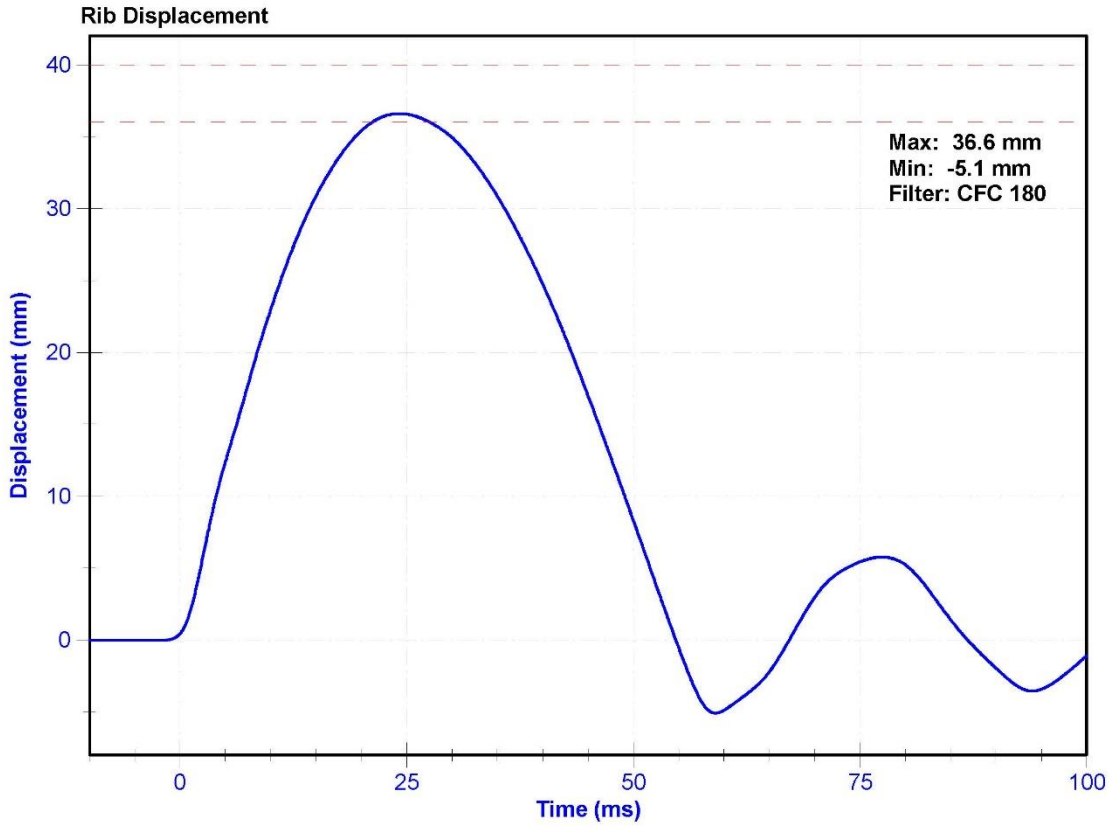
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M.Hartung |
| ATD Serial Number | F034 | Laboratory Supervisor | M.Goehle |

**Results**

| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.3 | Pass |
| Humidity | 10 | 70 | % | 30.3 | Pass |
| Rib Displacement | 36 | 40 | mm | 36.6 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Rib Potentiometer | Honeywell MLT-38000203 | DS-183GFE | 10/19/2015 | 10/18/2016 |



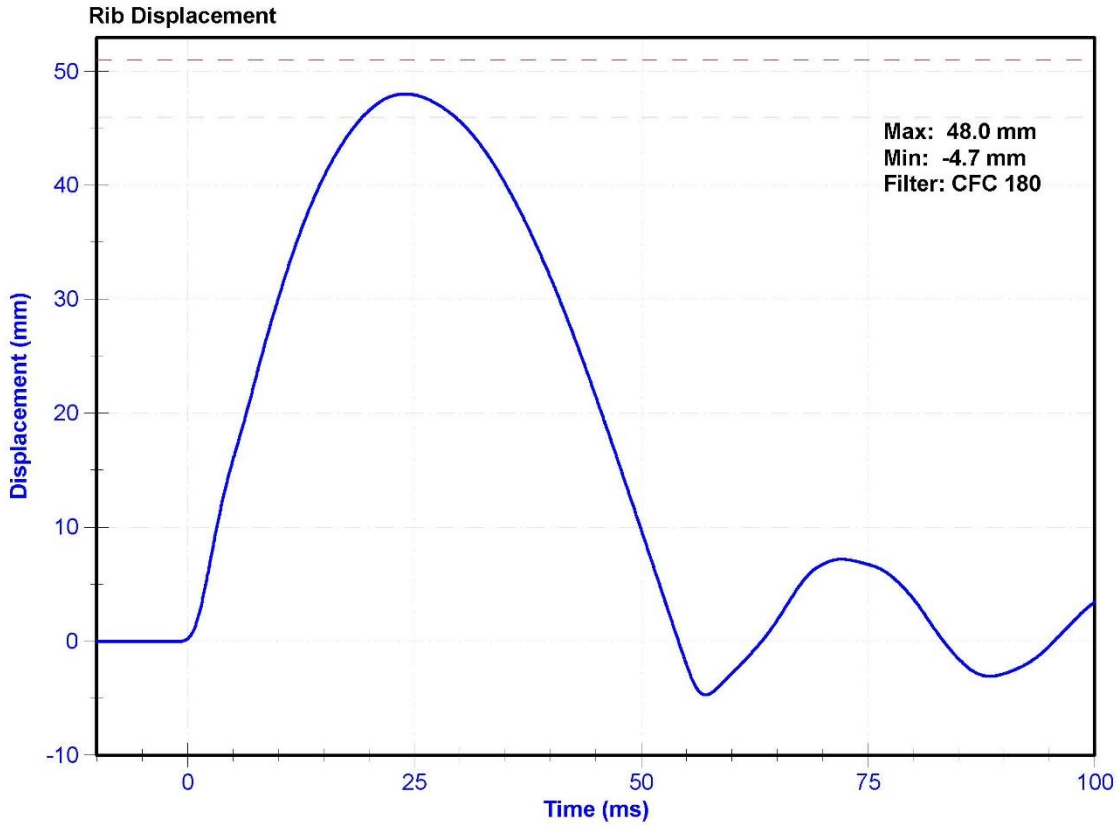
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M.Hartung |
| ATD Serial Number | F034 | Laboratory Supervisor | M.Goehle |

**Results**

| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.3 | Pass |
| Humidity | 10 | 70 | % | 30.3 | Pass |
| Rib Displacement | 46 | 51 | mm | 48.0 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Rib Potentiometer | Honeywell MLT-38000203 | DS-184GFE | 10/19/2015 | 10/18/2016 |



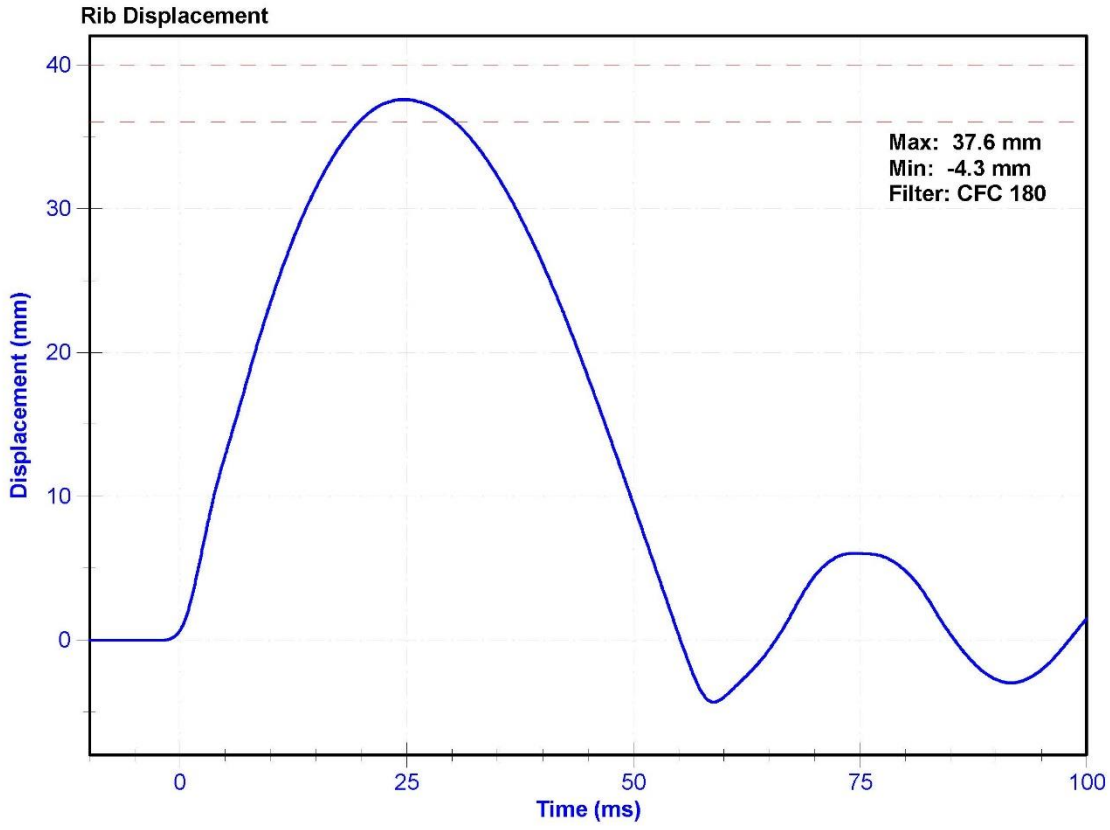
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M.Hartung |
| ATD Serial Number | F034 | Laboratory Supervisor | M.Goehle |

**Results**

| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.3 | Pass |
| Humidity | 10 | 70 | % | 30.3 | Pass |
| Rib Displacement | 36 | 40 | mm | 37.6 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Rib Potentiometer | Honeywell MLT-38000203 | DS-184GFE | 10/19/2015 | 10/18/2016 |



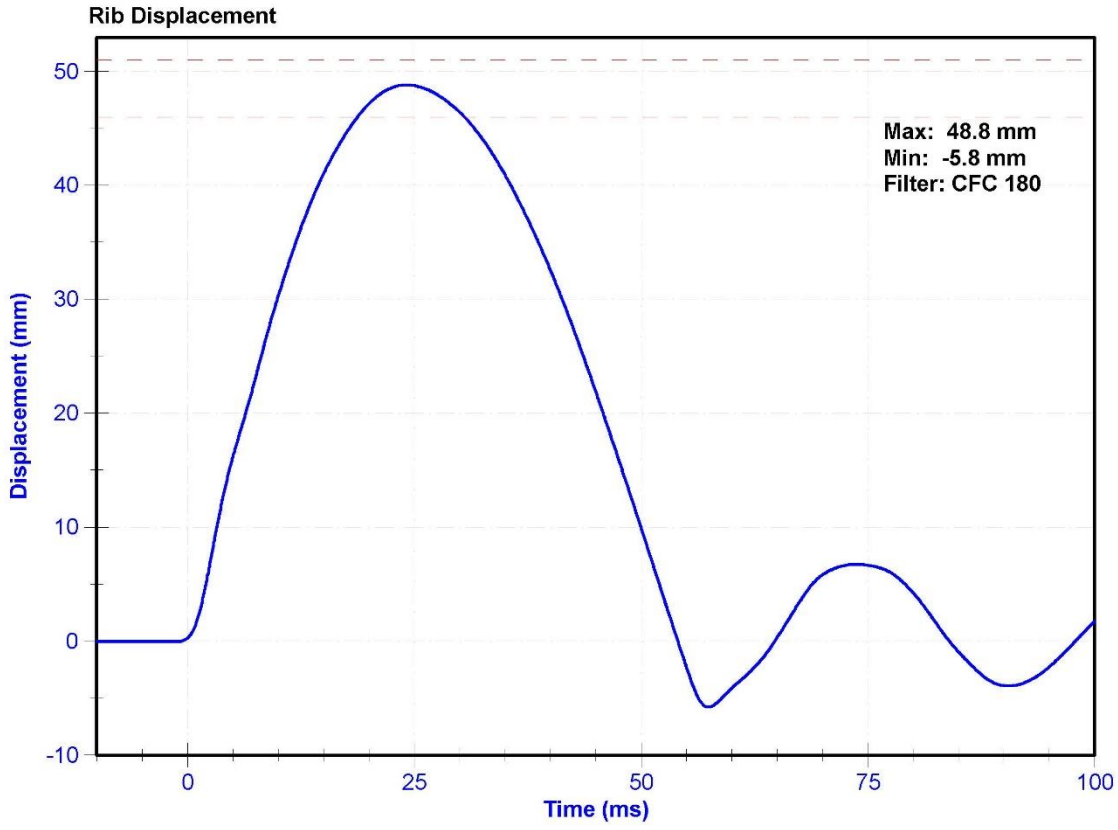
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M.Hartung |
| ATD Serial Number | F034 | Laboratory Supervisor | M.Goehle |

**Results**

| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.3 | Pass |
| Humidity | 10 | 70 | % | 30.3 | Pass |
| Rib Displacement | 46 | 51 | mm | 48.8 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Rib Potentiometer | Honeywell MLT-38000203 | DS-182GFE | 10/19/2015 | 10/18/2016 |



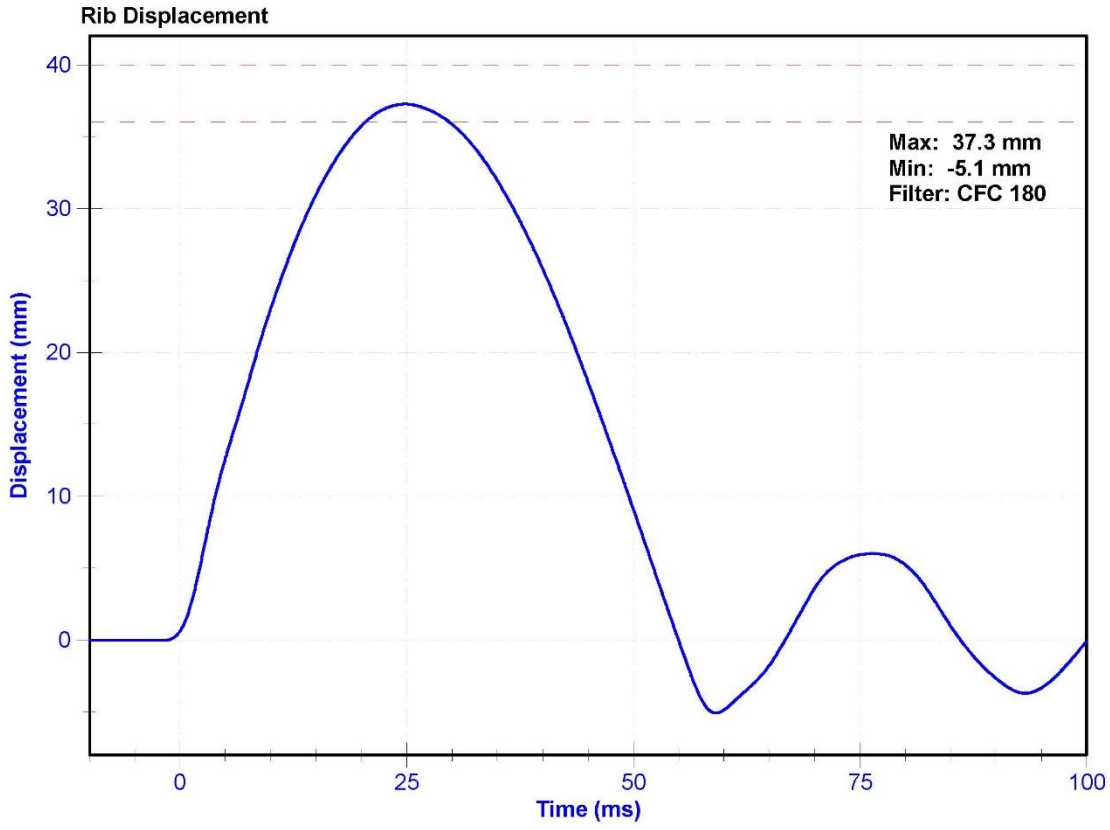
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M.Hartung |
| ATD Serial Number | F034 | Laboratory Supervisor | M.Goehle |

**Results**

| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.3 | Pass |
| Humidity | 10 | 70 | % | 30.3 | Pass |
| Rib Displacement | 36 | 40 | mm | 37.3 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Rib Potentiometer | Honeywell MLT-38000203 | DS-182GFE | 10/19/2015 | 10/18/2016 |



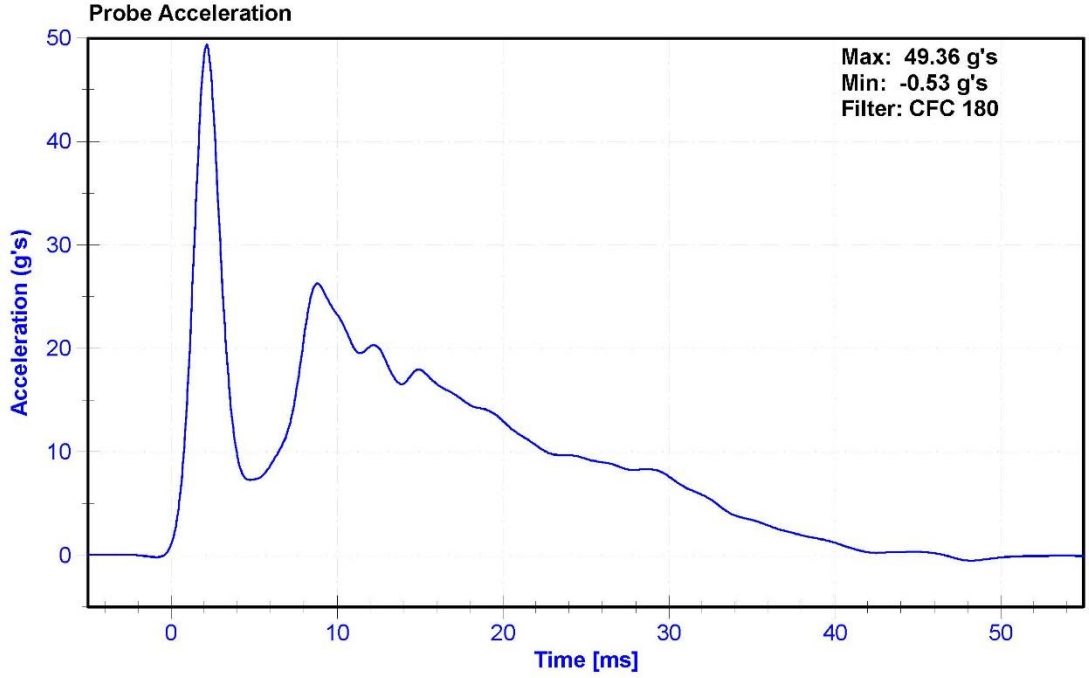
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M.Hartung |
| ATD Serial Number | F034 | Laboratory Supervisor | M.Goehle |

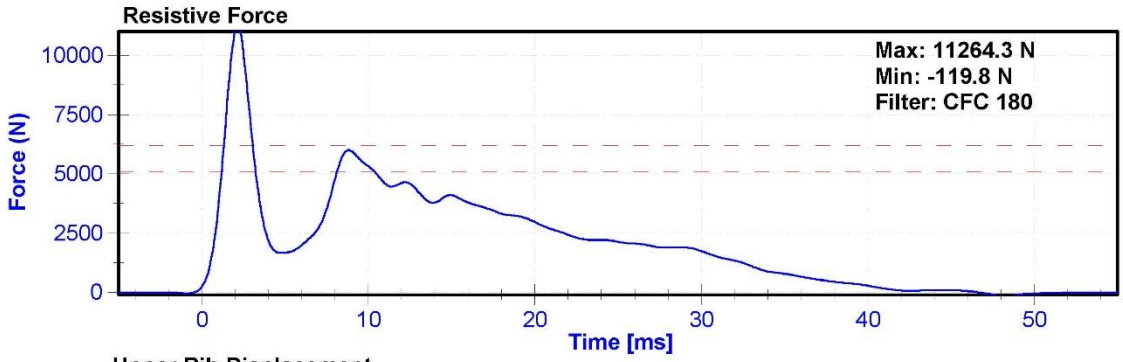
**Results**

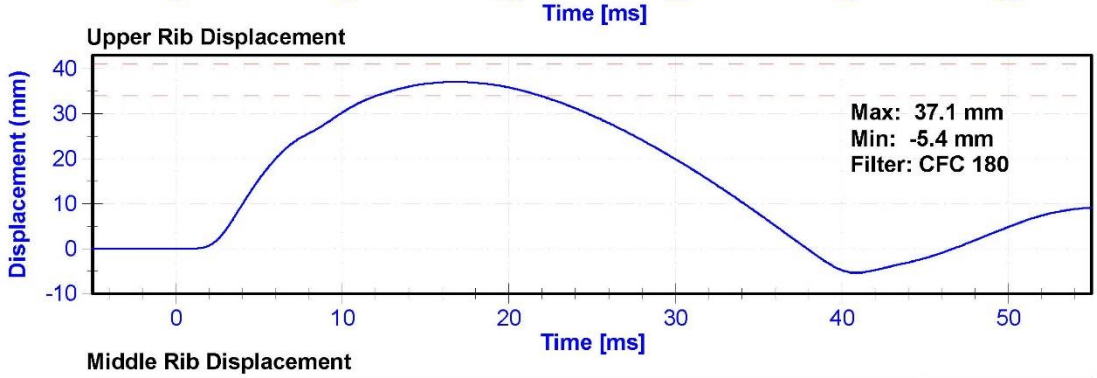
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 20.8 | Pass |
| Humidity | 10 | 70 | % | 34.7 | Pass |
| Velocity | 5.4 | 5.6 | m/s | 5.40 | Pass |
| Resistive Force after 6ms | 5100 | 6200 | N | 5999.3 | Pass |
| Upper Thorax Rib Deflection | 34 | 41 | mm | 37.1 | Pass |
| Mid Thorax Rib Deflection | 37 | 45 | mm | 40.8 | Pass |
| Lower Thorax Rib Deflection | 37 | 44 | mm | 39.7 | Pass |

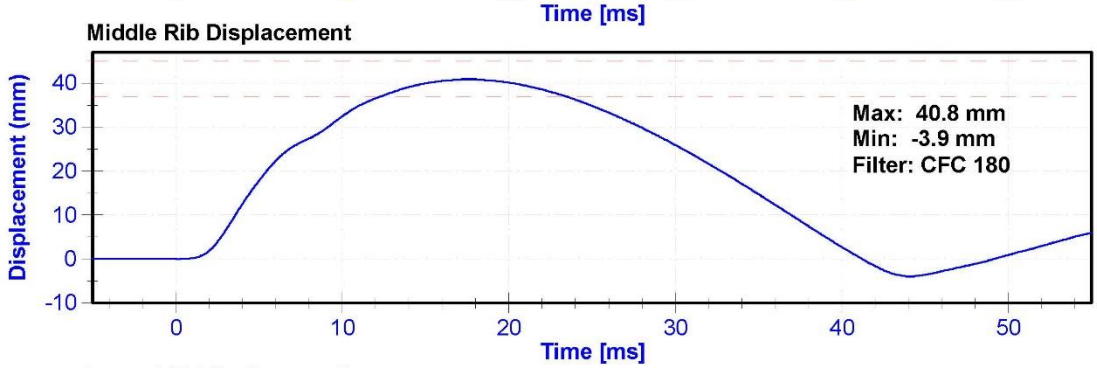
**Transducer Calibrations**

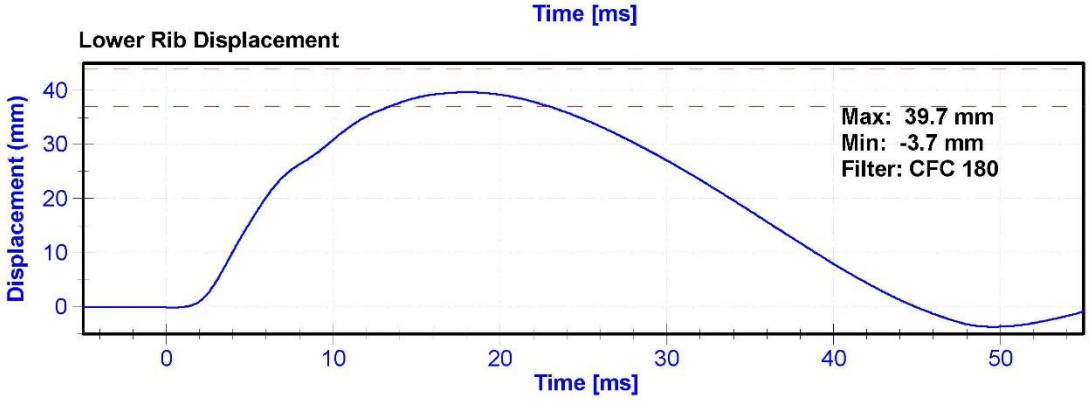
| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Probe Accelerometer | ENDEVCO 7264CT | AC-P23155 | 1/13/2016 | 7/14/2016 |
| Upper Thorax Rib Potentiometer | Honeywell MLT-38000203 | DS-183GFE | 10/19/2015 | 10/18/2016 |
| Middle Thorax Rib Potentiometer | Honeywell MLT-38000203 | DS-184GFE | 10/19/2015 | 10/18/2016 |
| Lower Thorax Rib Potentiometer | Honeywell MLT-38000203 | DS-182GFE | 10/19/2015 | 10/18/2016 |




Resistive Force
Force (N)
10000
7500
5000
2500
0
Max: 11264.3 N
Min: -119.8 N
Filter: CFC 180
0
10
20
30
40
50
Time [ms]


Upper Rib Displacement
Displacement (mm)
40
30
20
10
0
-10
Max: 37.1 mm
Min: -5.4 mm
Filter: CFC 180
0
10
20
30
40
50
Time [ms]


Middle Rib Displacement
Displacement (mm)
40
30
20
10
0
-10
Max: 40.8 mm
Min: -3.9 mm
Filter: CFC 180
0
10
20
30
40
50
Time [ms]


Lower Rib Displacement
Displacement (mm)
40
30
20
10
0
Max: 39.7 mm
Min: -3.7 mm
Filter: CFC 180
0
10
20
30
40
50
Time [ms]

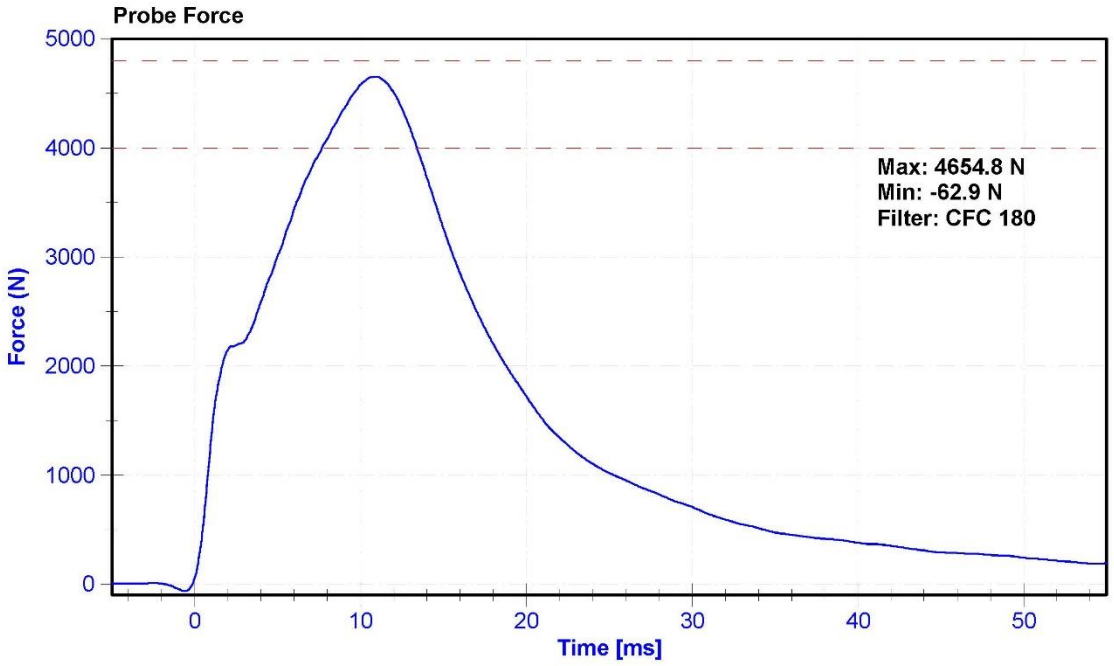
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M.Hartung |
| ATD Serial Number | F034 | Laboratory Supervisor | M.Goehle |

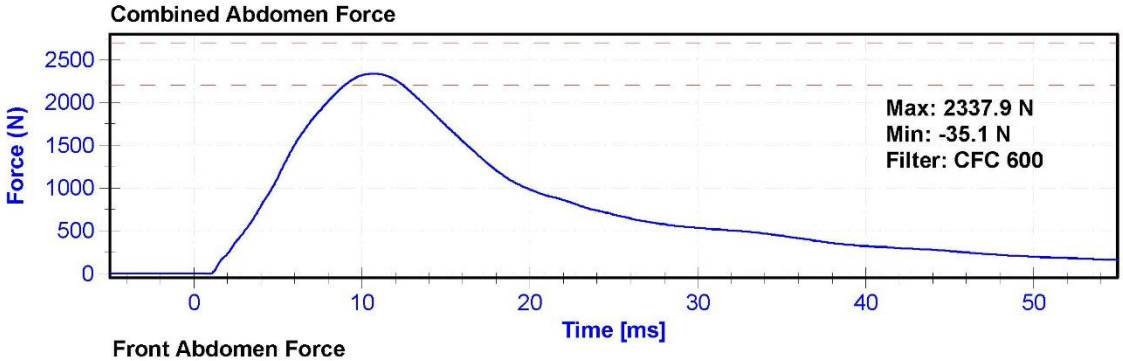
**Results**

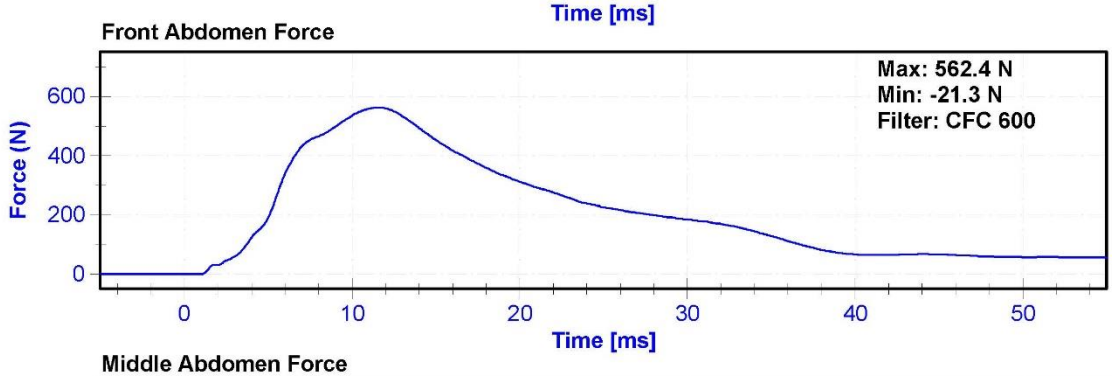
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.3 | Pass |
| Humidity | 10 | 70 | % | 33.9 | Pass |
| Velocity | 3.9 | 4.1 | m/s | 4.02 | Pass |
| Combined Abdomen Force | 2200 | 2700 | N | 2337.9 | Pass |
| Time at Peak Abdomen Force | 10.0 | 12.3 | ms | 10.70 | Pass |
| Resistive Probe Force | 4000 | 4800 | N | 4654.8 | Pass |
| Time at Peak Resistive Force | 10.6 | 13.0 | ms | 10.95 | Pass |

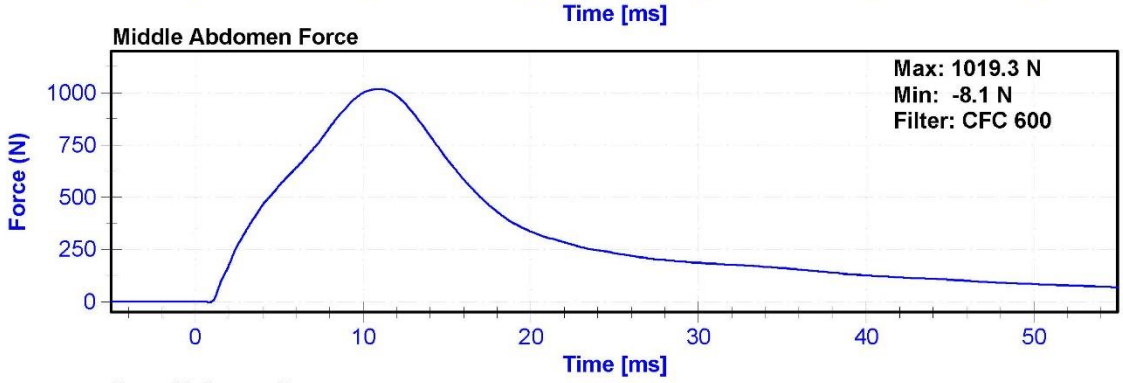
**Transducer Calibrations**

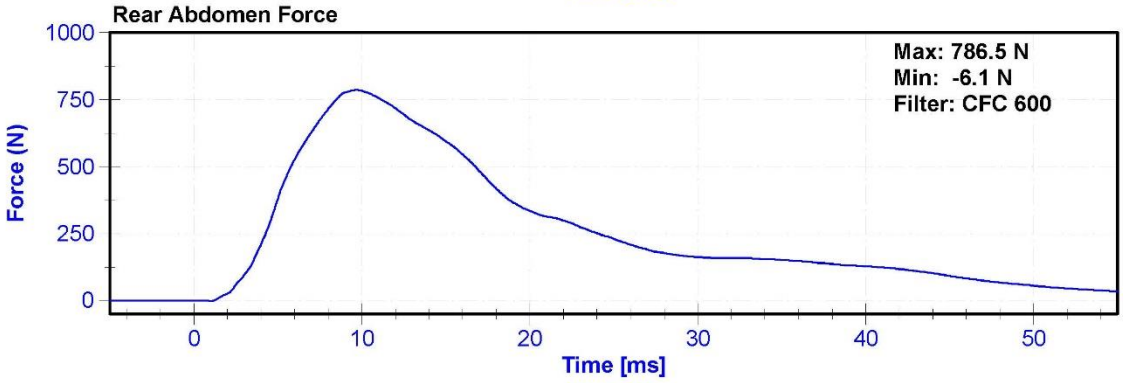
| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7264CT | AC-P23155 | 1/13/2016 | 7/14/2016 |
| Front Abdomen Load Cell | DENTON 2631 | LC-1512 | 6/25/2015 | 6/24/2016 |
| Middle Abdomen Load Cell | DENTON 2631 | LC-1526 | 6/25/2015 | 6/24/2016 |
| Rear Abdomen Load Cell | DENTON 2631 | LC-1516 | 6/25/2015 | 6/24/2016 |




Combined Abdomen Force
Force (N)
2500
2000
1500
1000
500
0
Max: 2337.9 N
Min: -35.1 N
Filter: CFC 600
0
10
20
30
40
50
Time [ms]


Front Abdomen Force
Force (N)
600
400
200
0
Max: 562.4 N
Min: -21.3 N
Filter: CFC 600
0
10
20
30
40
50
Time [ms]


Middle Abdomen Force
Force (N)
1000
750
500
250
0
Max: 1019.3 N
Min: -8.1 N
Filter: CFC 600
0
10
20
30
40
50
Time [ms]


Rear Abdomen Force
Force (N)
1000
750
500
250
0
Max: 786.5 N
Min: -6.1 N
Filter: CFC 600
0
10
20
30
40
50
Time [ms]

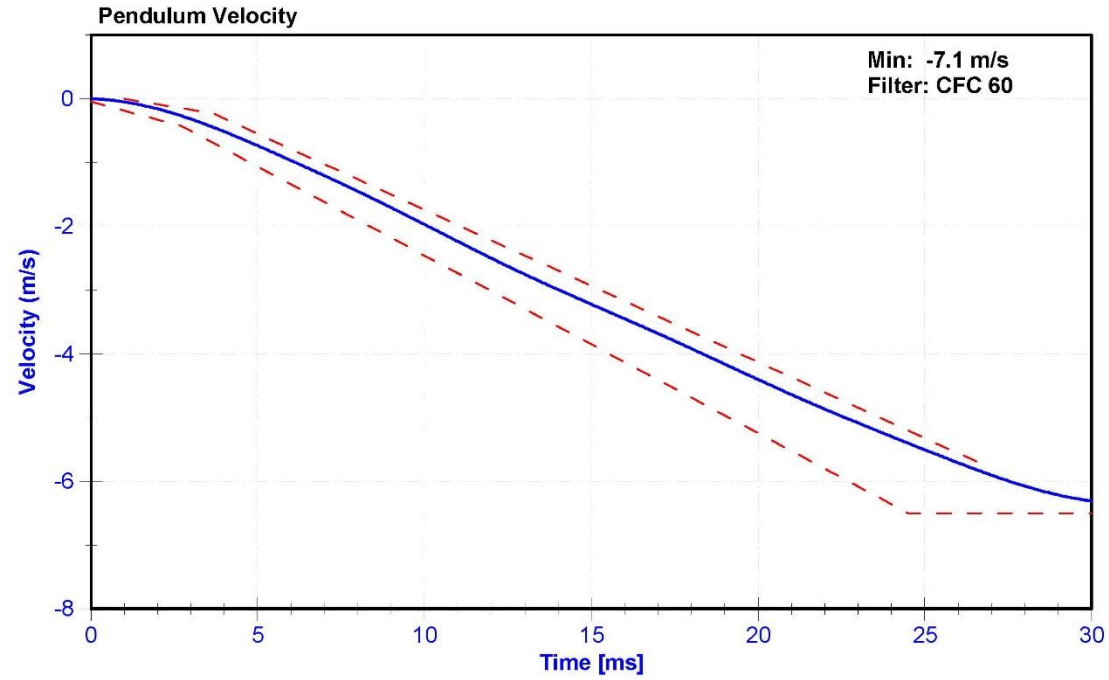
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M.Hartung |
| ATD Serial Number | F034 | Laboratory Supervisor | M.Goehle |

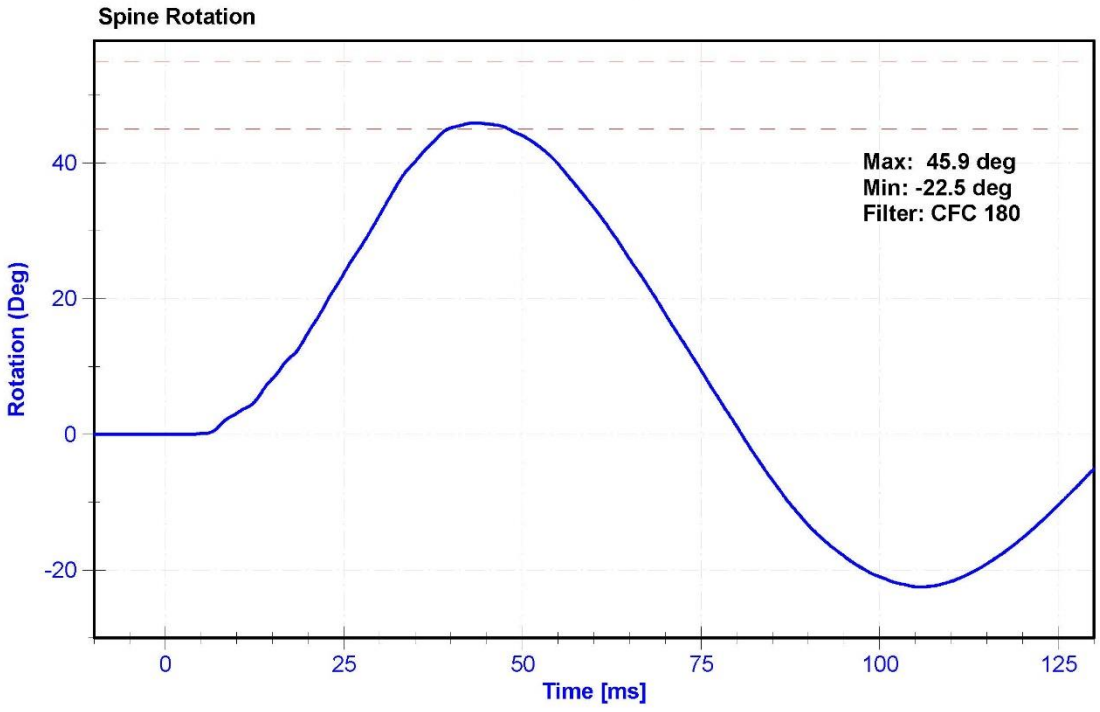
**Results**

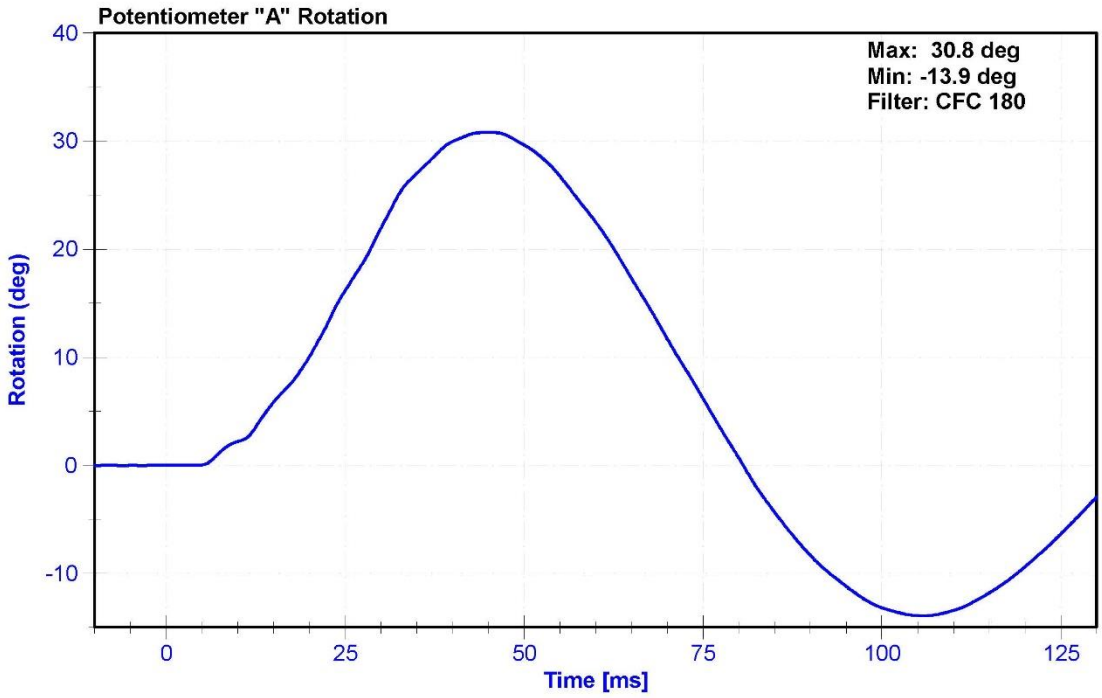
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 22.0 | Pass |
| Humidity | 10 | 70 | % | 23.9 | Pass |
| Velocity | 5.95 | 6.15 | m/s | 6.068 | Pass |
| Lateral Spine Rotation | 45 | 55 | deg | 45.9 | Pass |
| Time at Maximum Rotation | 39 | 53 | ms | 43.4 | Pass |
| Time of Decay to Zero Degrees | 37 | 57 | ms | 37.3 | Pass |
| Pulse within Corridor? | - | - | - | | |

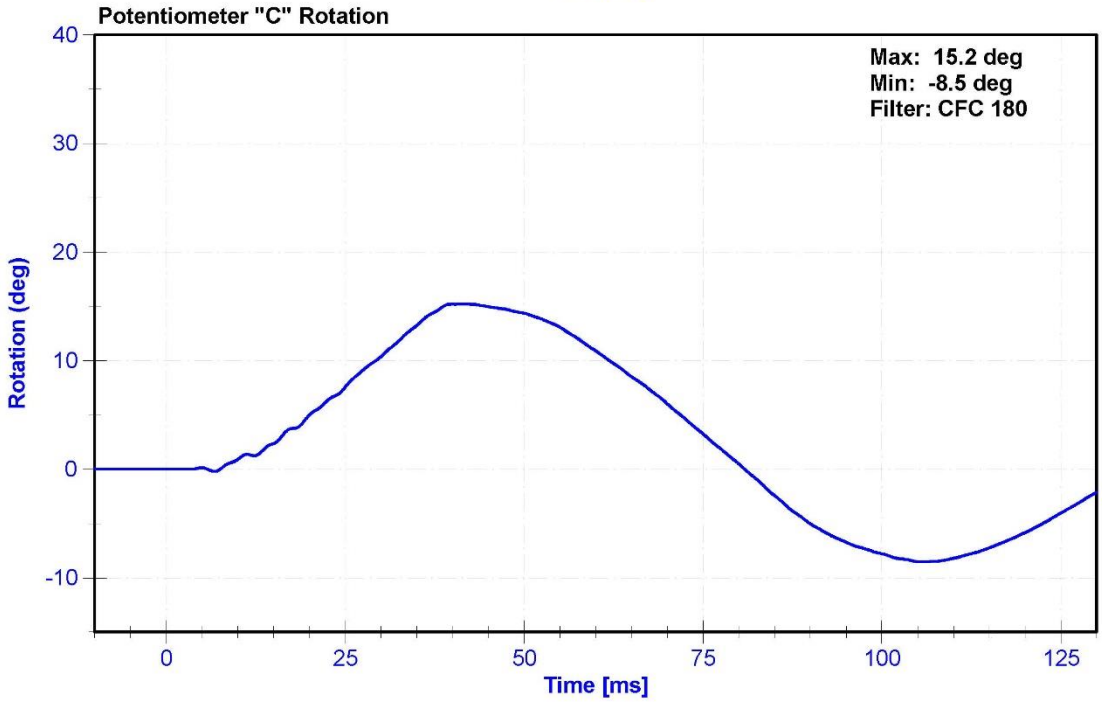
**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7231CT | AC-AH5F3 | 5/7/2015 | 5/6/2016 |
| Pendulum "A" Potentiometer | SP22G | DS-094 | 9/24/2015 | 9/23/2016 |
| Condyle "B" Potentiometer | SP22G | DS-095 | 9/24/2015 | 9/23/2016 |


Pendulum Velocity
Min: -7.1 m/s
Filter: CFC 60
Velocity (m/s)
0
-2
-4
-6
-8
0
5
10
15
20
25
30
Time [ms]


Spine Rotation
Max: 45.9 deg
Min: -22.5 deg
Filter: CFC 180
Rotation (Deg)
40
20
0
-20
0
25
50
75
100
125
Time [ms]


Potentiometer "A" Rotation
Max: 30.8 deg
Min: -13.9 deg
Filter: CFC 180
Rotation (deg)
40
30
20
10
0
-10
0
25
50
75
100
125
Time [ms]


Potentiometer "C" Rotation
Max: 15.2 deg
Min: -8.5 deg
Filter: CFC 180
Rotation (deg)
40
30
20
10
0
-10
0
25
50
75
100
125
Time [ms]

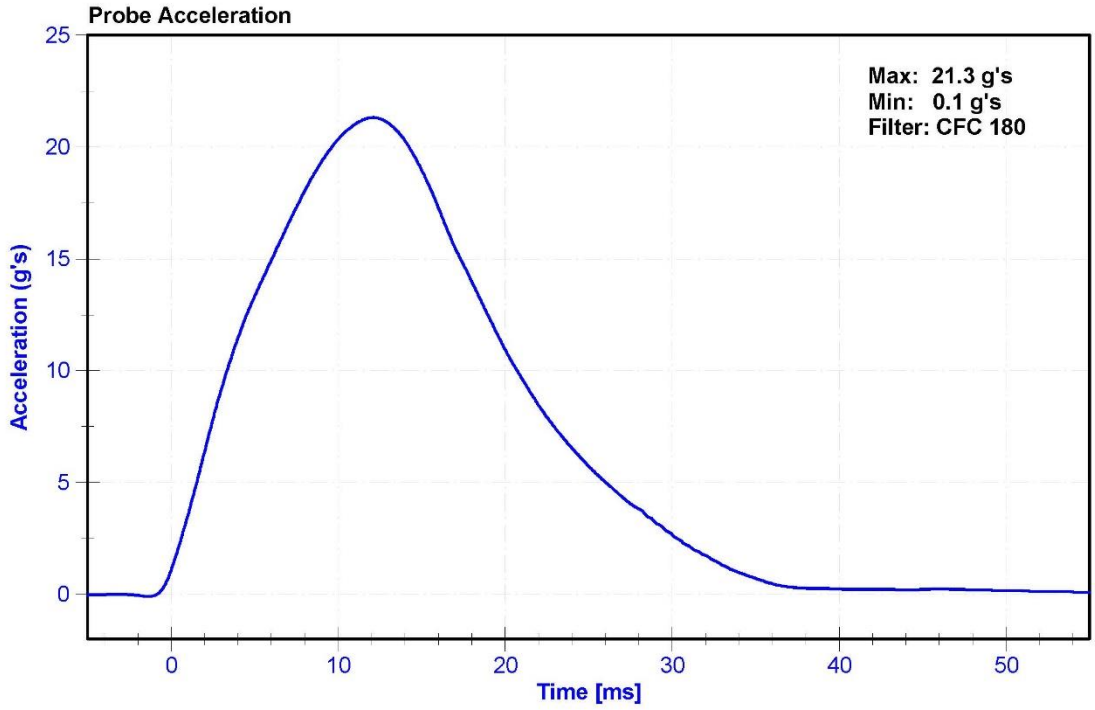
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M.Hartung |
| ATD Serial Number | F034 | Laboratory Supervisor | M.Goehle |

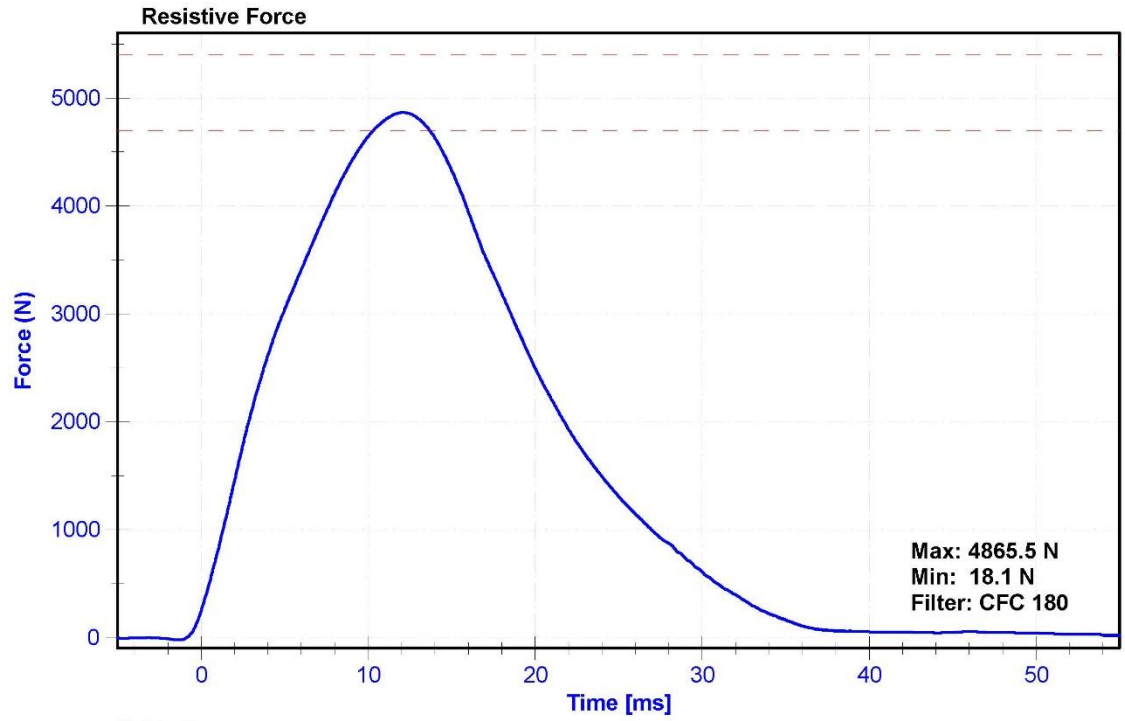
**Results**

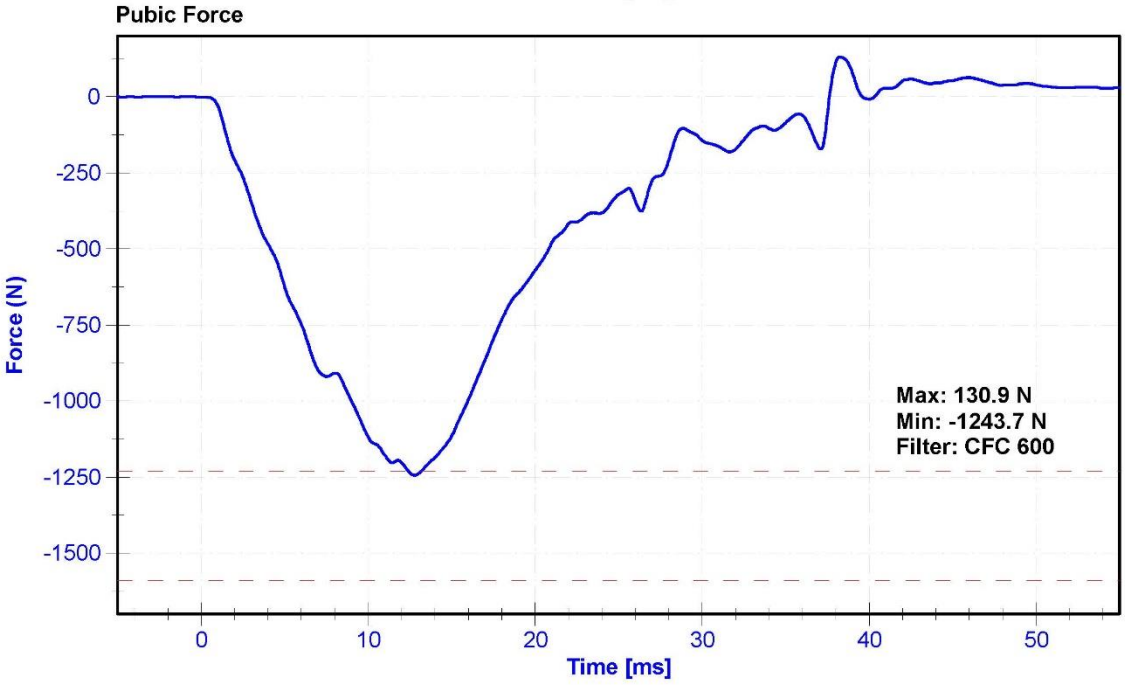
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.6 | Pass |
| Humidity | 10 | 70 | % | 30.7 | Pass |
| Velocity | 4.2 | 4.4 | m/s | 4.32 | Pass |
| Resistive Force | 4700 | 5400 | N | 4865.5 | Pass |
| Time at Peak Resistive Force | 11.8 | 16.1 | ms | 12.10 | Pass |
| Pubic Force | -1590 | -1230 | N | -1243.7 | Pass |
| Time at Peak Pubic Force | 12.2 | 17.0 | ms | 12.75 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7264CT | AC-P23155 | 1/13/2016 | 7/14/2016 |
| Pubic Load Cell | Denton 3096JFL | LC-465Fy | 6/25/2015 | 6/24/2016 |




Resistive Force
Force (N)
5000
4000
3000
2000
1000
0
0
10
20
30
40
50
Time [ms]
Max: 4865.5 N
Min: 18.1 N
Filter: CFC 180


Pubic Force
Force (N)
0
-250
-500
-750
-1000
-1250
-1500
0
10
20
30
40
50
Time [ms]
Max: 130.9 N
Min: -1243.7 N
Filter: CFC 600

## CALIBRATION TEST RESULTS

## PRE-TEST

## SID-IIS 5TH PERCENTILE FEMALE - PASSENGER ATD

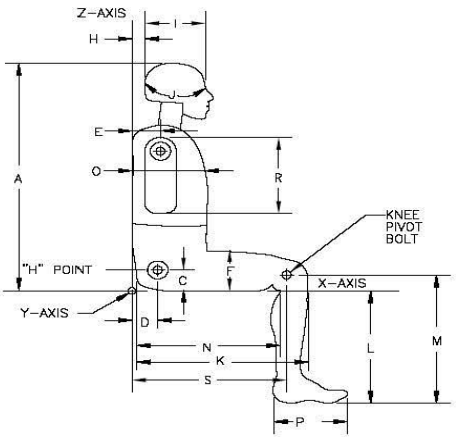
## SERIAL No: 303

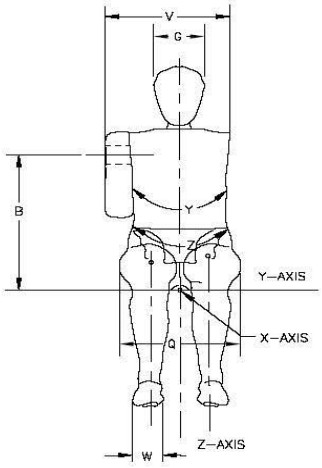
## (CONFIGURED FOR LEFT SIDE IMPACT)

External Measurements - SID-IIs

Technician: M.Hartung  Date: 2/8/2016

Dummy Serial Number: 303




| Symbol | Description | Specification (mm) | | Result (mm) | Pass/Fail |
|---|---|---|---|---|---|
| A | Sitting Height | 772 | 788 | 781 | Pass |
| B | Shoulder Pivot Height | 437 | 453 | 445 | Pass |
| C | H-point Height | 79 | 89 | 86 | Pass |
| D | H-point from seatback | 141 | 151 | 147 | Pass |
| E | Shoulder Pivot from Backline | 97 | 107 | 103 | Pass |
| F | Thigh Clearance | 119 | 135 | 125 | Pass |
| G | Head Breadth | 140 | 148 | 143 | Pass |
| H | Head Back from Backline | 40 | 46 | 44 | Pass |
| I | Head Depth | 178 | 188 | 181 | Pass |
| J | Head Circumference | 541 | 551 | 546 | Pass |
| K | Buttock to Knee Length | 514 | 540 | 530 | Pass |
| L | Popliteal Height | 343 | 369 | 355 | Pass |
| M | Knee Pivot to floor height | 392 | 409 | 400 | Pass |
| N | Buttock Popliteal Length | 416 | 442 | 438 | Pass |
| O | Chest Depth w/o jacket | 195 | 211 | 206 | Pass |
| P | Foot Length | 216 | 232 | 219 | Pass |
| Q | Hip Breadth (w/pelvic plugs) | 313 | 323 | 320 | Pass |
| R | Arm Length | 249 | 259 | 253 | Pass |
| S | Knee Joint to seatback | 477 | 493 | 488 | Pass |
| V | Shoulder Width | 341 | 357 | 350 | Pass |
| W | Foot Width | 78 | 94 | 85 | Pass |
| Y | Chest Circumference w/jacket | 851 | 881 | 869 | Pass |
| Z | Waist Circumference | 761 | 791 | 770 | Pass |

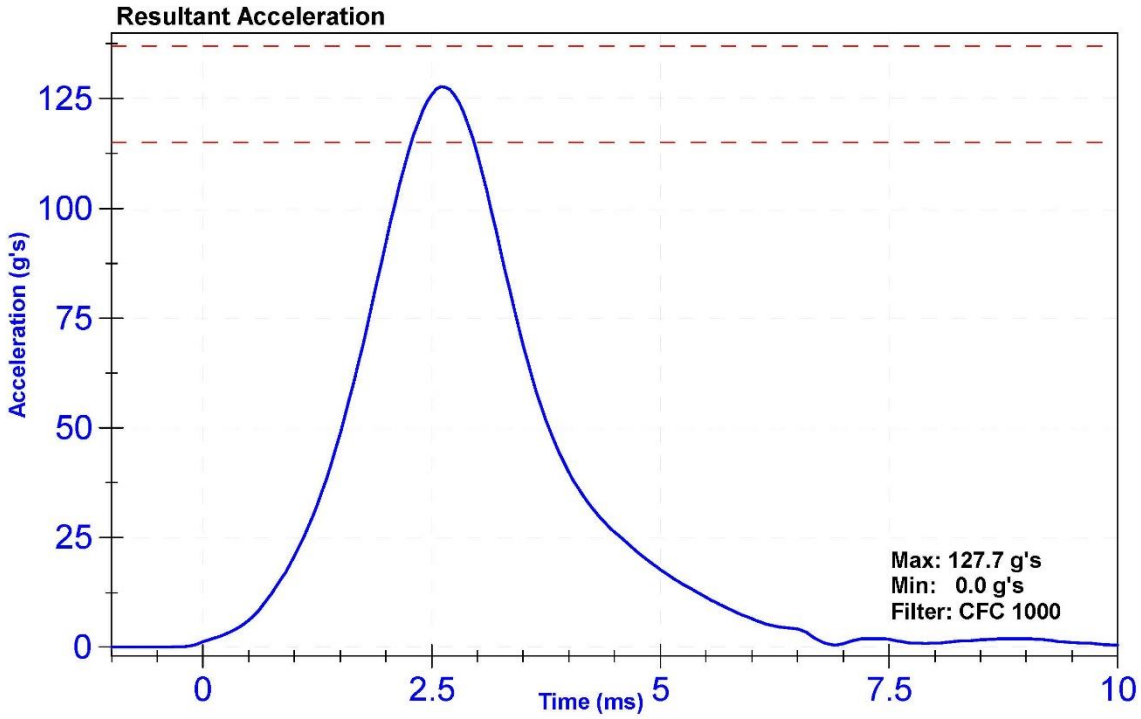
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M.Hartung |
| ATD Serial Number | 303 | Laboratory Supervisor | M.Goehle |

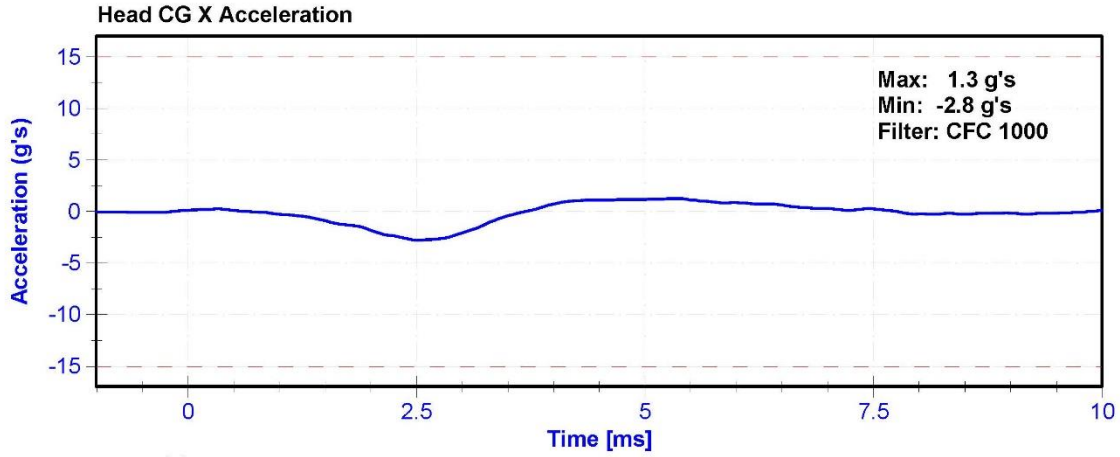
**Results**

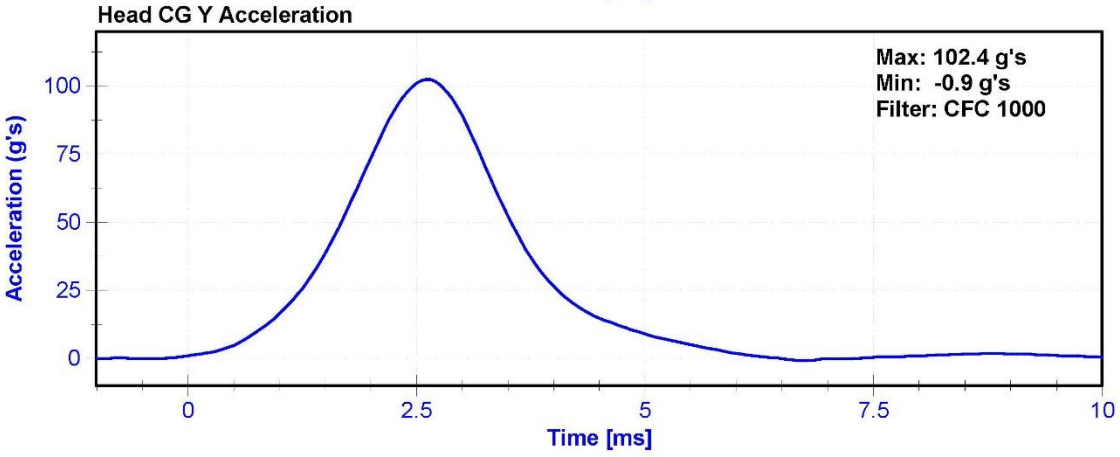
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.9 | Pass |
| Humidity | 10 | 70 | % | 22.2 | Pass |
| Resultant Acceleration | 115 | 137 | g's | 127.7 | Pass |
| Oscillation | 0 | 15 | % | 1.5 | Pass |
| Fore-Aft Acceleration | -15 | 15 | g's | -2.8 | Pass |

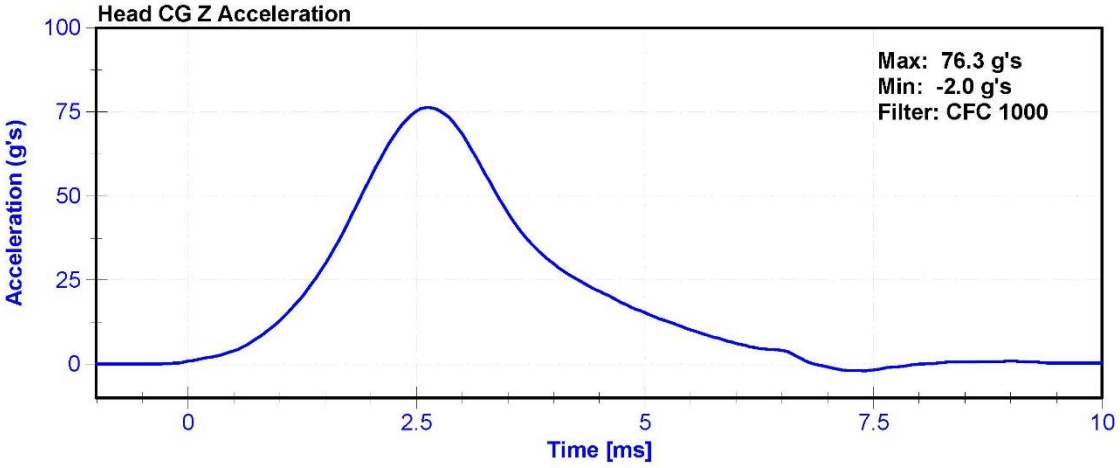
**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| X Accelerometer | ENDEVCO 7264 | AC-P83420 | 10/16/2015 | 4/15/2016 |
| Y Accelerometer | ENDEVCO 7264 | AC-P52040 | 10/14/2015 | 4/13/2016 |
| Z Accelerometer | ENDEVCO 7264CT | AC-P58737 | 10/14/2015 | 4/13/2016 |




Head CG X Acceleration
Max: 1.3 g's
Min: -2.8 g's
Filter: CFC 1000
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]


Head CG Y Acceleration
Max: 102.4 g's
Min: -0.9 g's
Filter: CFC 1000
Acceleration (g's)
100
75
50
25
0
0
2.5
5
7.5
10
Time [ms]


Head CG Z Acceleration
Max: 76.3 g's
Min: -2.0 g's
Filter: CFC 1000
Acceleration (g's)
100
75
50
25
0
0
2.5
5
7.5
10
Time [ms]

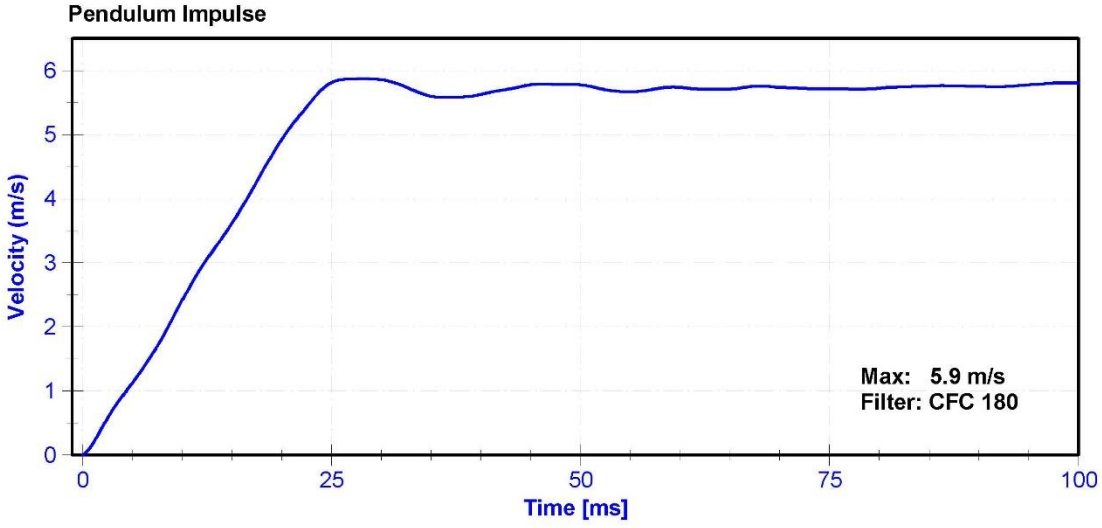
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M.Hartung |
| ATD Serial Number | 303 | Laboratory Supervisor | M.Goehle |

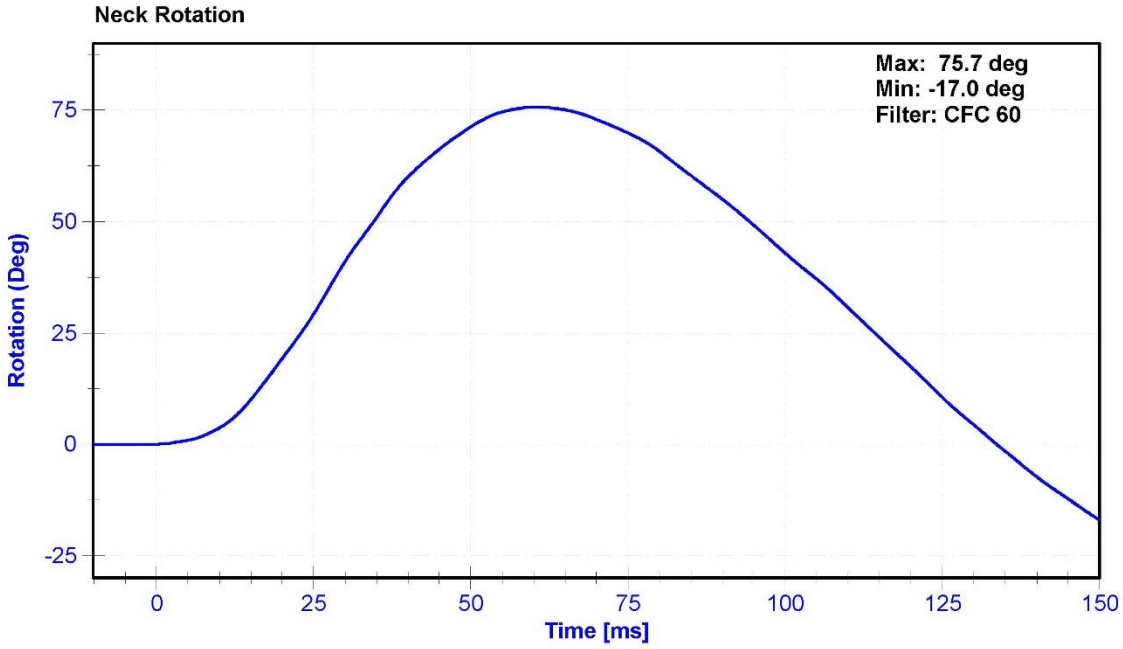
**Results**

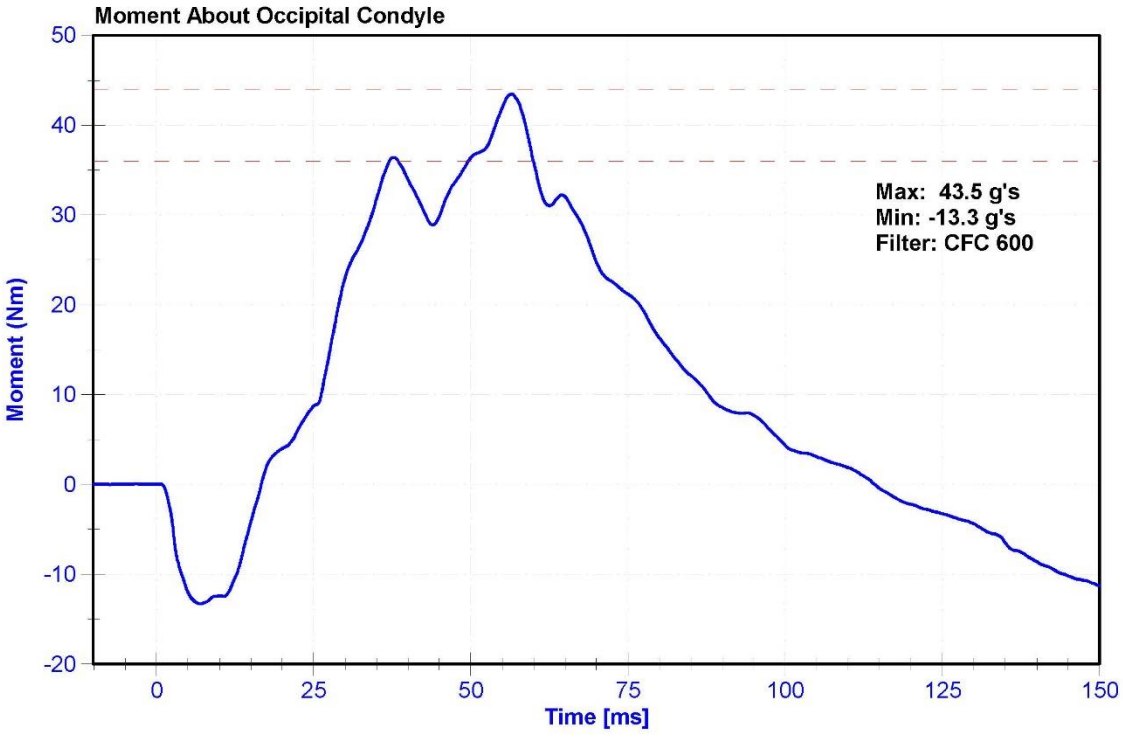
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.8 | Pass |
| Humidity | 10 | 70 | % | 25.7 | Pass |
| Velocity | 5.51 | 5.63 | m/s | 5.583 | Pass |
| Pendulum Impulse at 10ms | 2.2 | 2.8 | m/s | 2.41 | Pass |
| Pendulum Impulse at 15ms | 3.3 | 4.1 | m/s | 3.62 | Pass |
| Pendulum Impulse at 20ms | 4.4 | 5.4 | m/s | 4.93 | Pass |
| Pendulum Impulse at 25ms | 5.4 | 6.1 | m/s | 5.81 | Pass |
| Pendulum Impulse from 25 to 100ms | 5.5 | 6.2 | m/s | 5.87 | Pass |
| Neck Rotation | 71 | 81 | deg | 75.7 | Pass |
| Time at Maximum Rotation | 50 | 70 | ms | 60.5 | Pass |
| Moment about the OC | 36 | 44 | Nm | 43.5 | Pass |
| Moment Decay to 0 Nm | 102 | 126 | ms | 114.3 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7231CT | AC-AH5F3 | 5/7/2015 | 5/6/2016 |
| Pendulum Potentiometer | Denton 78051-342 | DS-184Pend | 9/24/2015 | 9/23/2016 |
| Condyle Potentiometer | Denton 78051-342 | DS-185Pend | 9/25/2015 | 9/24/2016 |
| Upper Neck Load Cell | Denton 1716A | LC-2019Fy | 6/29/2015 | 6/28/2016 |




Neck Rotation
Max: 75.7 deg
Min: -17.0 deg
Filter: CFC 60
Rotation (Deg)
75
50
25
0
-25
0
25
50
75
100
125
150
Time [ms]


Moment About Occipital Condyle
Max: 43.5 g's
Min: -13.3 g's
Filter: CFC 600
Moment (Nm)
50
40
30
20
10
0
-10
-20
0
25
50
75
100
125
150
Time [ms]

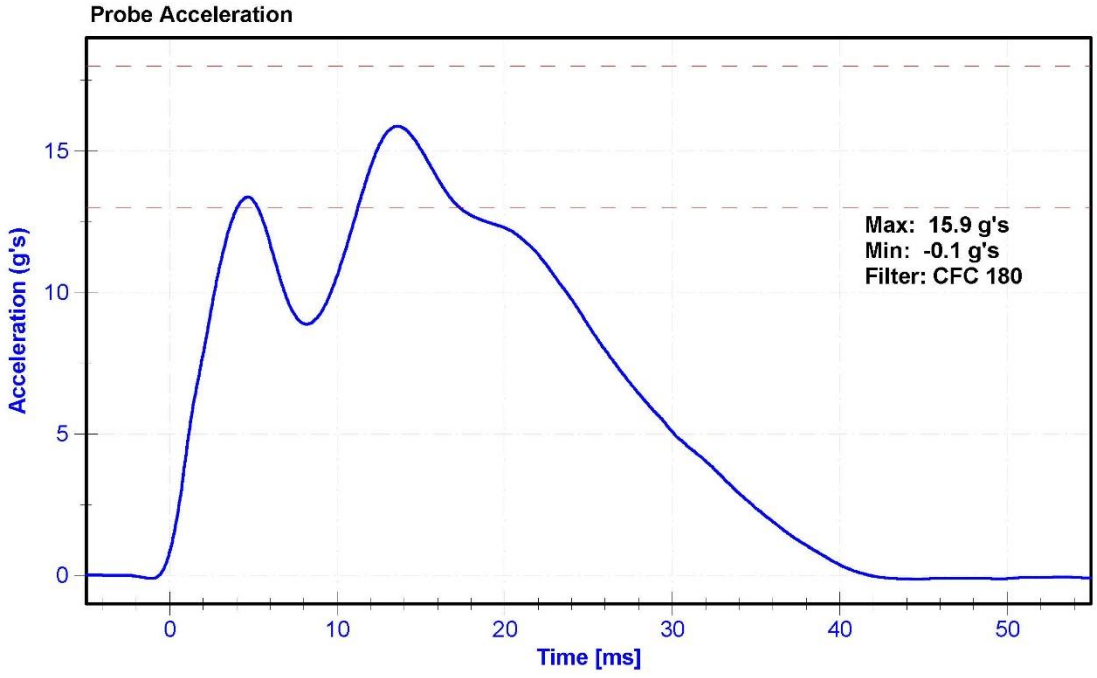
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M.Hartung |
| ATD Serial Number | 303 | Laboratory Supervisor | M.Goehle |

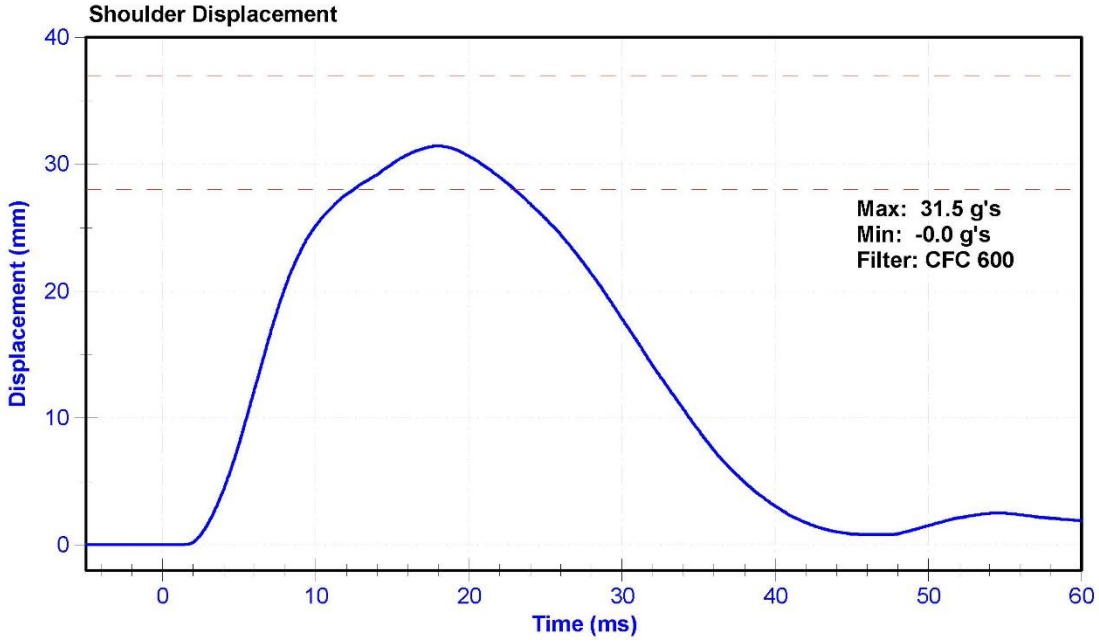
**Results**

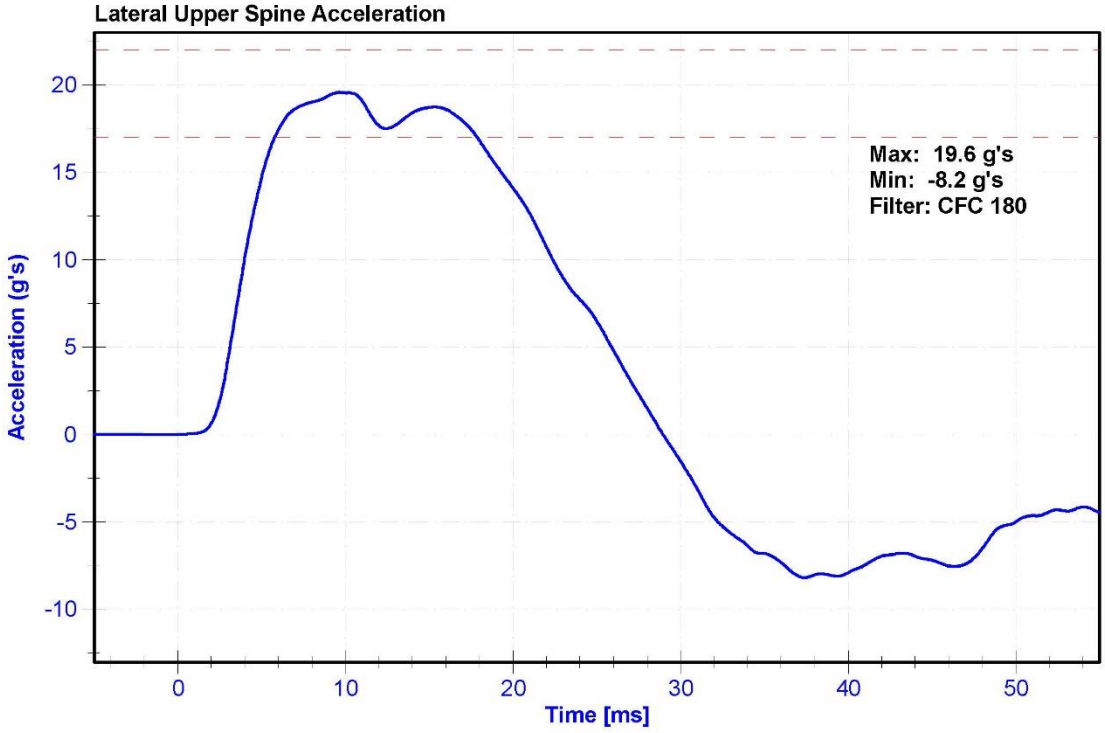
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 20.7 | Pass |
| Humidity | 10 | 70 | % | 24.1 | Pass |
| Velocity | 4.2 | 4.4 | m/s | 4.35 | Pass |
| Probe Acceleration | 13 | 18 | g's | 15.9 | Pass |
| Shoulder Deflection | 28 | 37 | mm | 31.5 | Pass |
| Lateral Upper Spine Acceleration | 17 | 22 | g's | 19.6 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7264CT | AC-P23155 | 1/13/2016 | 7/14/2016 |
| Shoulder Potentiometer | Servo 08TC1-3725 | DS-008GFE | 10/19/2015 | 10/18/2016 |
| Upper Spine Y Accelerometer | ENDEVCO 7264CT | AC-P63315 | 10/19/2015 | 4/18/2016 |




Shoulder Displacement
Displacement (mm)
Time (ms)
Max: 31.5 g's
Min: -0.0 g's
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 19.6 g's
Min: -8.2 g's
Filter: CFC 180

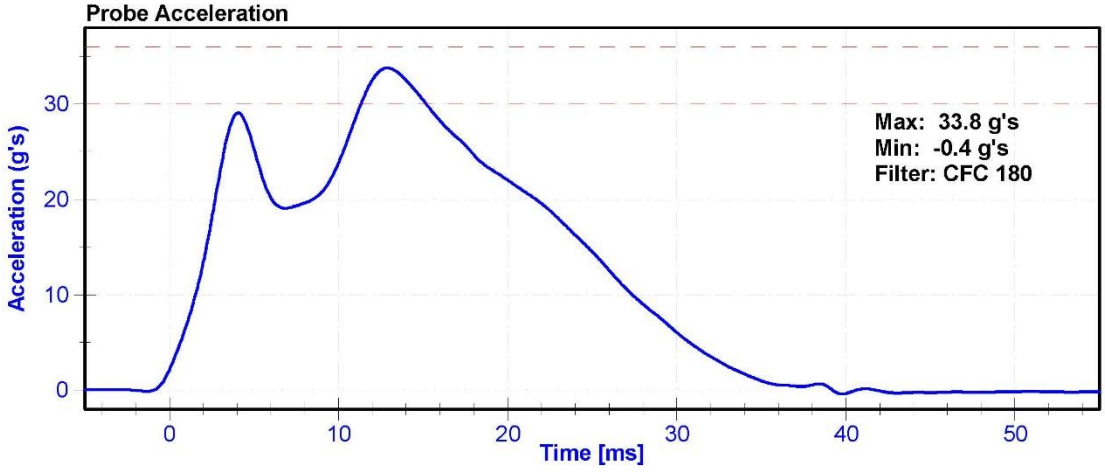
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M.Hartung |
| ATD Serial Number | 303 | Laboratory Supervisor | M.Goehle |

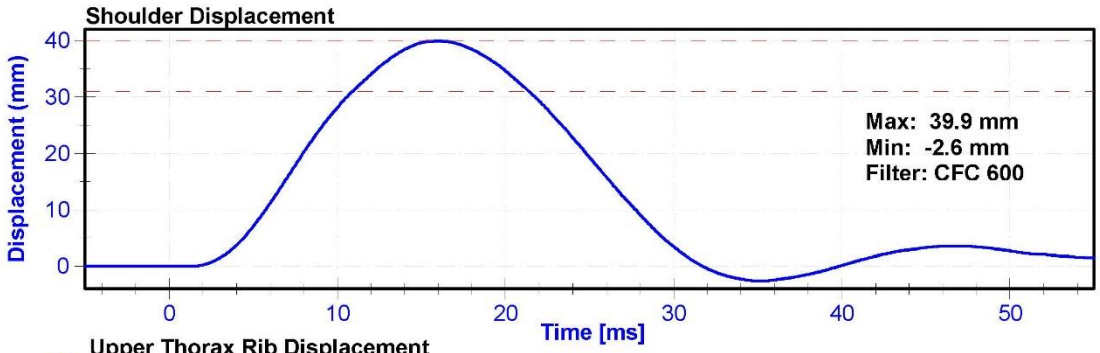
**Results**

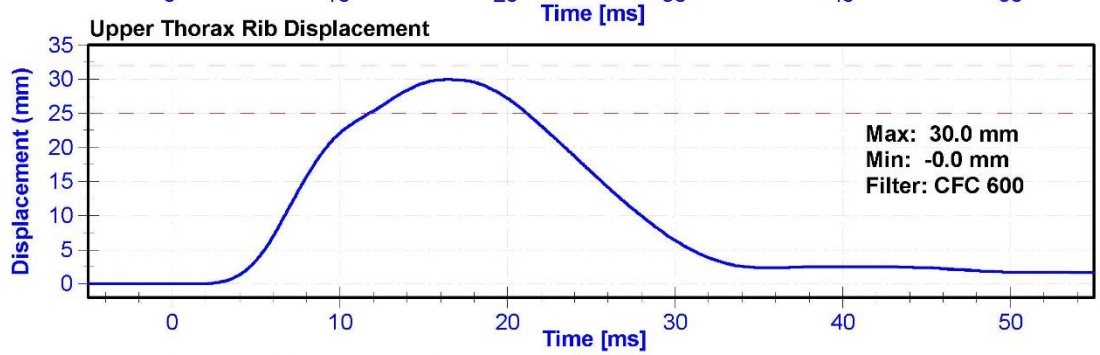
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 20.6 | Pass |
| Humidity | 10 | 70 | % | 24.4 | Pass |
| Velocity | 6.6 | 6.8 | m/s | 6.67 | Pass |
| Probe Acceleration after 5 ms | 30 | 36 | g's | 33.8 | Pass |
| Lateral Upper Spine Acceleration | 34 | 43 | g's | 38.7 | Pass |
| Lateral Lower Spine Acceleration | 29 | 37 | g's | 32.7 | Pass |
| Shoulder Deflection | 31 | 40 | mm | 39.9 | Pass |
| Upper Thorax Rib Deflection | 25 | 32 | mm | 30.0 | Pass |
| Mid Thorax Rib Deflection | 30 | 36 | mm | 32.9 | Pass |
| Lower Thorax Rib Deflection | 32 | 38 | mm | 34.1 | Pass |

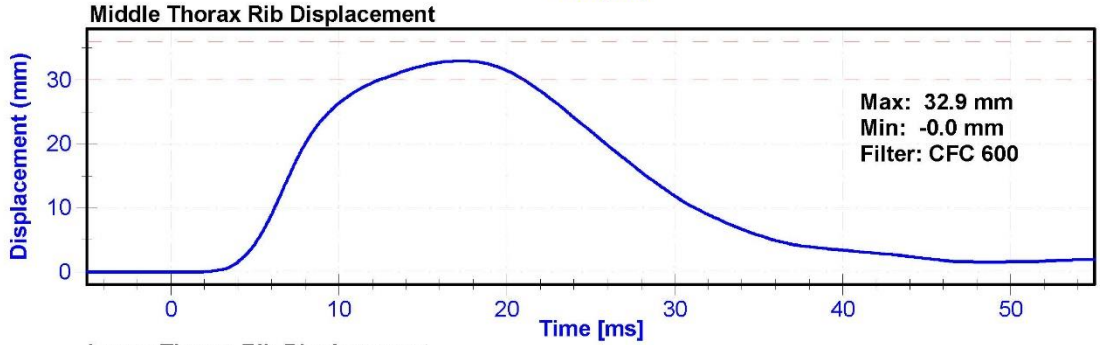
**Transducer Calibrations**

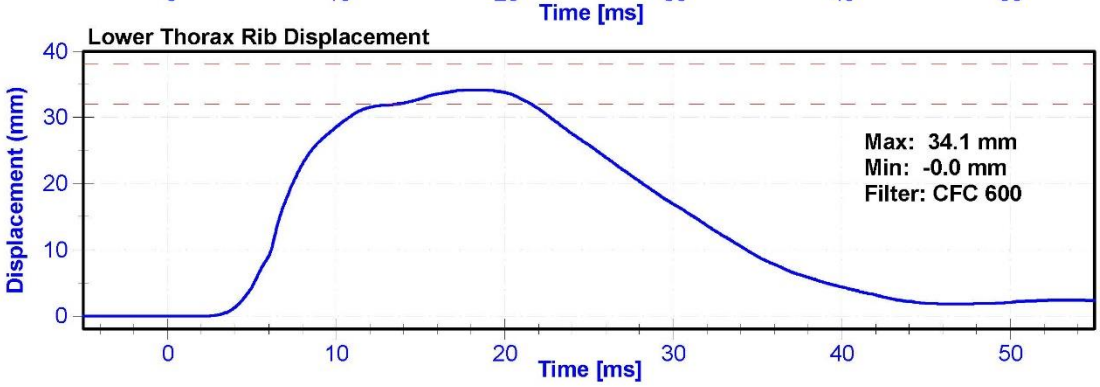
| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7264CT | AC-P23155 | 1/13/2016 | 7/14/2016 |
| Upper Spine T1 Y Accelerometer | ENDEVCO 7264CT | AC-P63315 | 10/19/2015 | 4/18/2016 |
| Upper Spine T12 Y Accelerometer | ENDEVCO 7264CT | AC-P51974 | 10/19/2015 | 4/18/2016 |
| Shoulder Potentiometer | Servo 08TC1-3725 | DS-008GFE | 10/19/2015 | 10/18/2016 |
| Upper Thorax Rib Potentiometer | Servo 08CT1-3725 | DS-1199GFE | 10/19/2015 | 10/18/2016 |
| Middle Thorax Rib Potentiometer | Servo 08CT1-3725 | DS-1246GFE | 10/19/2015 | 10/18/2016 |
| Lower Thorax Rib Potentiometer | Servo 08CT1-3725 | DS-1256GFE | 10/19/2015 | 10/18/2016 |



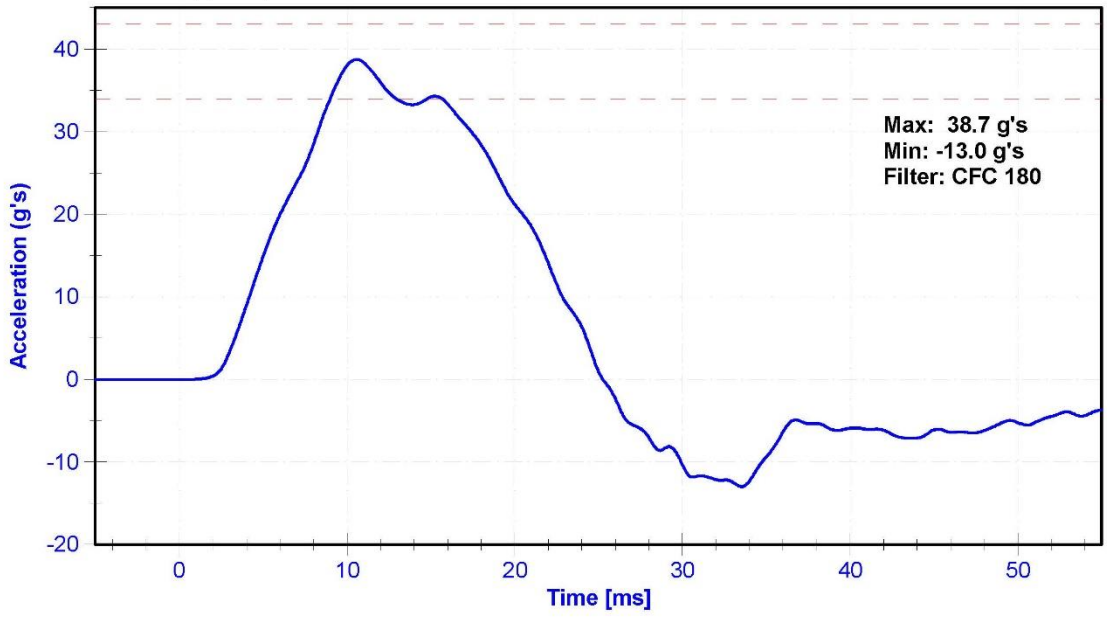

Shoulder Displacement
Displacement (mm)
Time [ms]
Max: 39.9 mm
Min: -2.6 mm
Filter: CFC 600


Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 30.0 mm
Min: -0.0 mm
Filter: CFC 600

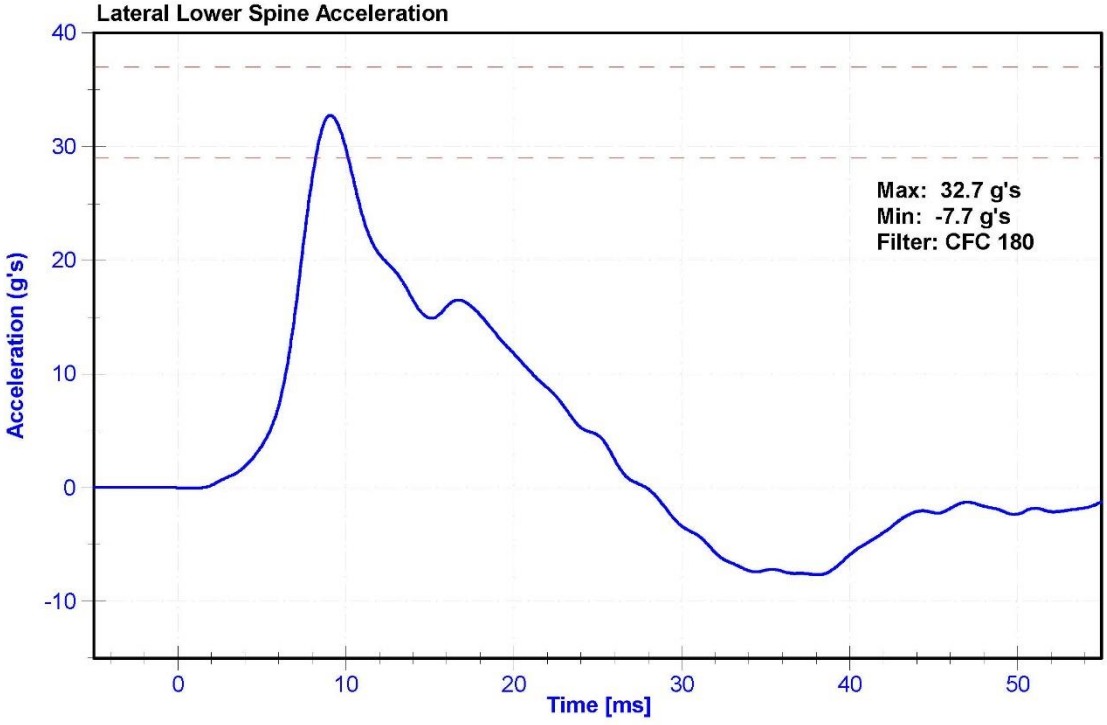

Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 32.9 mm
Min: -0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 34.1 mm
Min: -0.0 mm
Filter: CFC 600

Lateral Upper Spine Acceleration




Lateral Lower Spine Acceleration



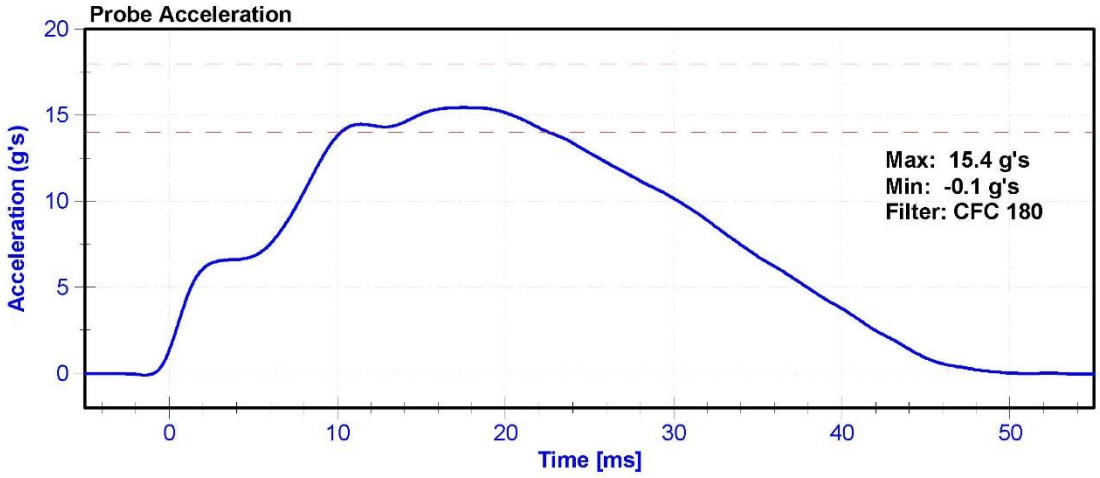
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M.Hartung |
| ATD Serial Number | 303 | Laboratory Supervisor | M.Goehle |

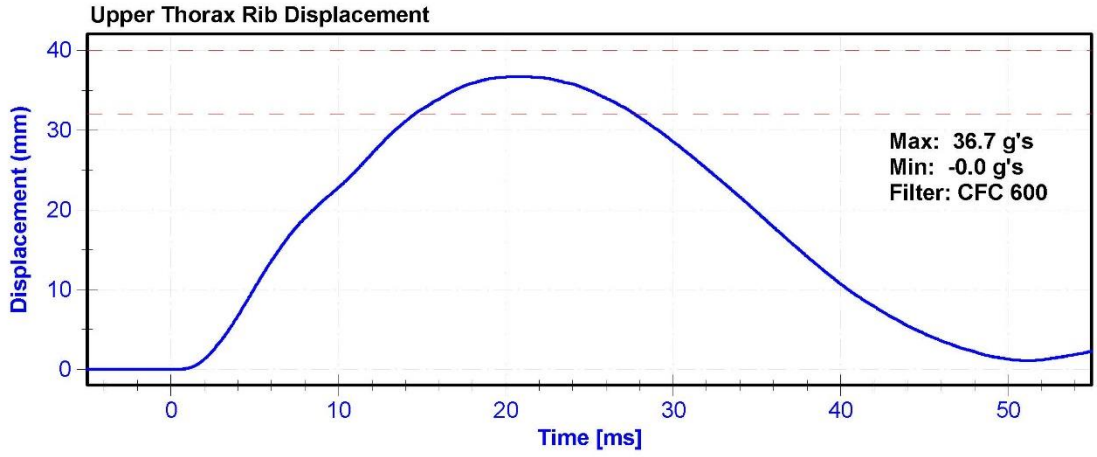
**Results**

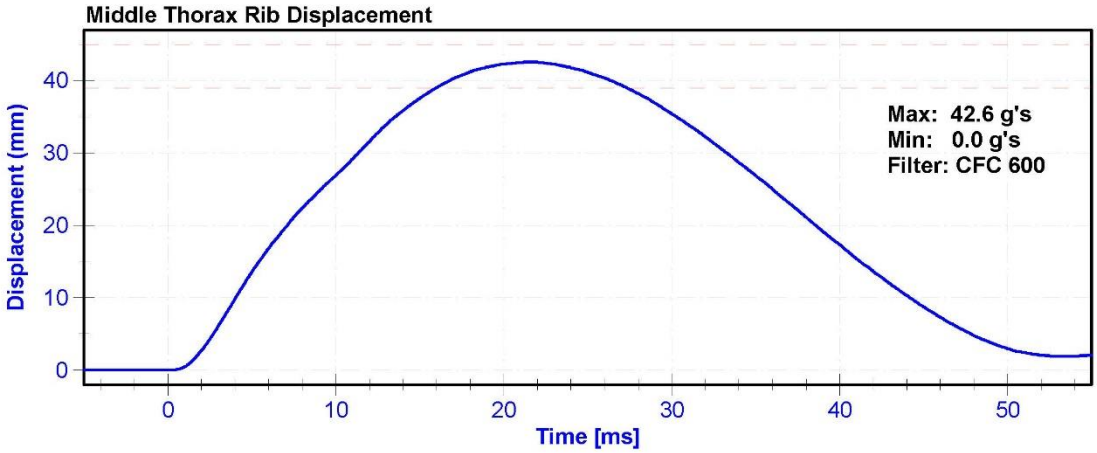
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 20.8 | Pass |
| Humidity | 10 | 70 | % | 24.3 | Pass |
| Velocity | 4.2 | 4.4 | m/s | 4.32 | Pass |
| Probe Acceleration | 14 | 18 | g's | 15.4 | Pass |
| Lateral Upper Spine Acceleration | 13 | 17 | g's | 15.4 | Pass |
| Lateral Lower Spine Acceleration | 7 | 11 | g's | 9.2 | Pass |
| Upper Thorax Rib Deflection | 32 | 40 | mm | 36.7 | Pass |
| Middle Thorax Rib Deflection | 39 | 45 | mm | 42.6 | Pass |
| Lower Thorax Rib Deflection | 35 | 43 | mm | 40.7 | Pass |

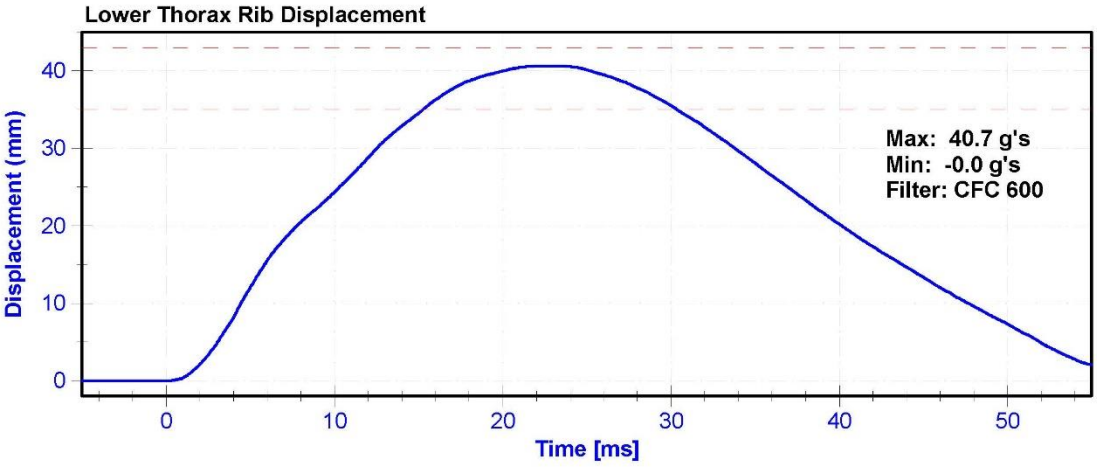
**Transducer Calibrations**

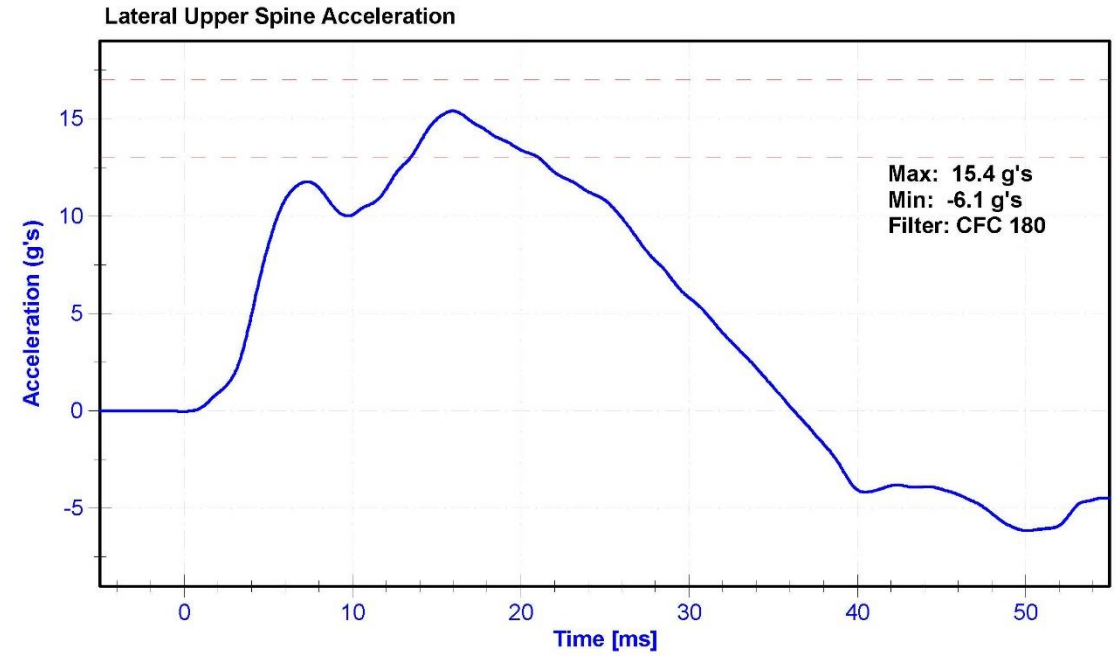
| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7264CT | AC-P23155 | 1/13/2016 | 7/14/2016 |
| Upper Spine Y Accelerometer | ENDEVCO 7264CT | AC-P63315 | 10/19/2015 | 4/18/2016 |
| Lower Spine Y Accelerometer | ENDEVCO 7264CT | AC-P51974 | 10/19/2015 | 4/18/2016 |
| Upper Thorax Rib Potentiometer | Servo 08CT1-3725 | DS-1199GFE | 10/19/2015 | 10/18/2016 |
| Middle Thorax Rib Potentiometer | Servo 08CT1-3725 | DS-1246GFE | 10/19/2015 | 10/18/2016 |
| Lower Thorax Rib Potentiometer | Servo 08CT1-3725 | DS-1256GFE | 10/19/2015 | 10/18/2016 |

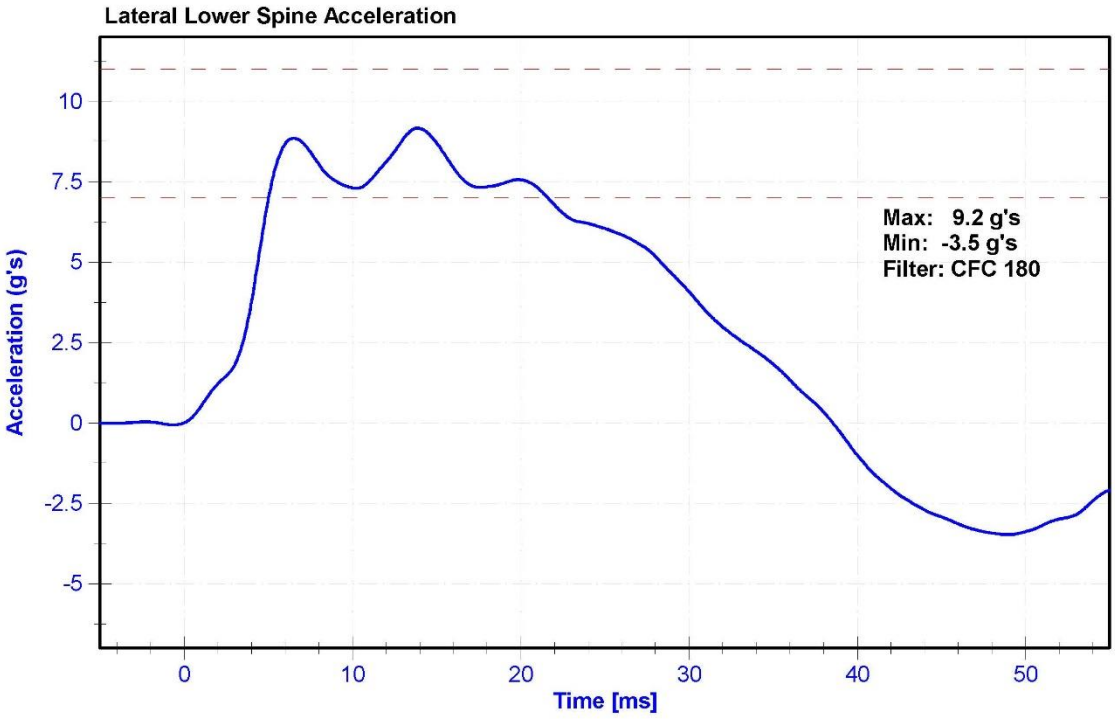



Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 36.7 g's
Min: -0.0 g's
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 42.6 g's
Min: 0.0 g's
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 40.7 g's
Min: -0.0 g's
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 15.4 g's
Min: -6.1 g's
Filter: CFC 180
Acceleration (g's)
15
10
5
0
-5
0
10
20
30
40
50
Time [ms]


Lateral Lower Spine Acceleration
Max: 9.2 g's
Min: -3.5 g's
Filter: CFC 180
Acceleration (g's)
10
7.5
5
2.5
0
-2.5
-5
0
10
20
30
40
50
Time [ms]

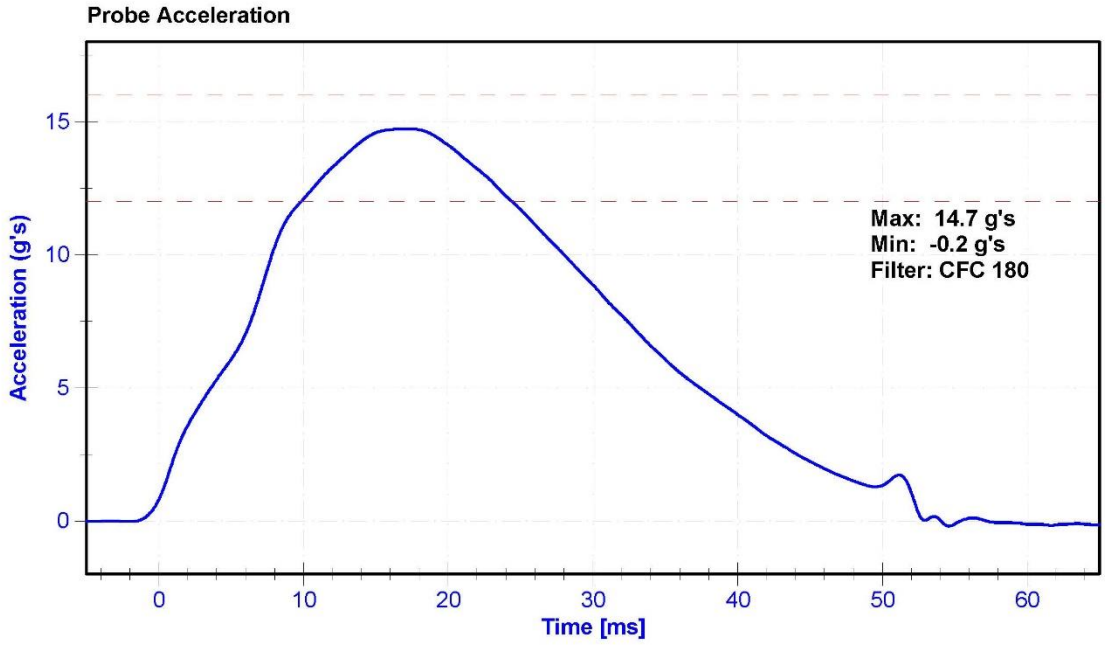
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M.Hartung |
| ATD Serial Number | 303 | Laboratory Supervisor | M.Goehle |

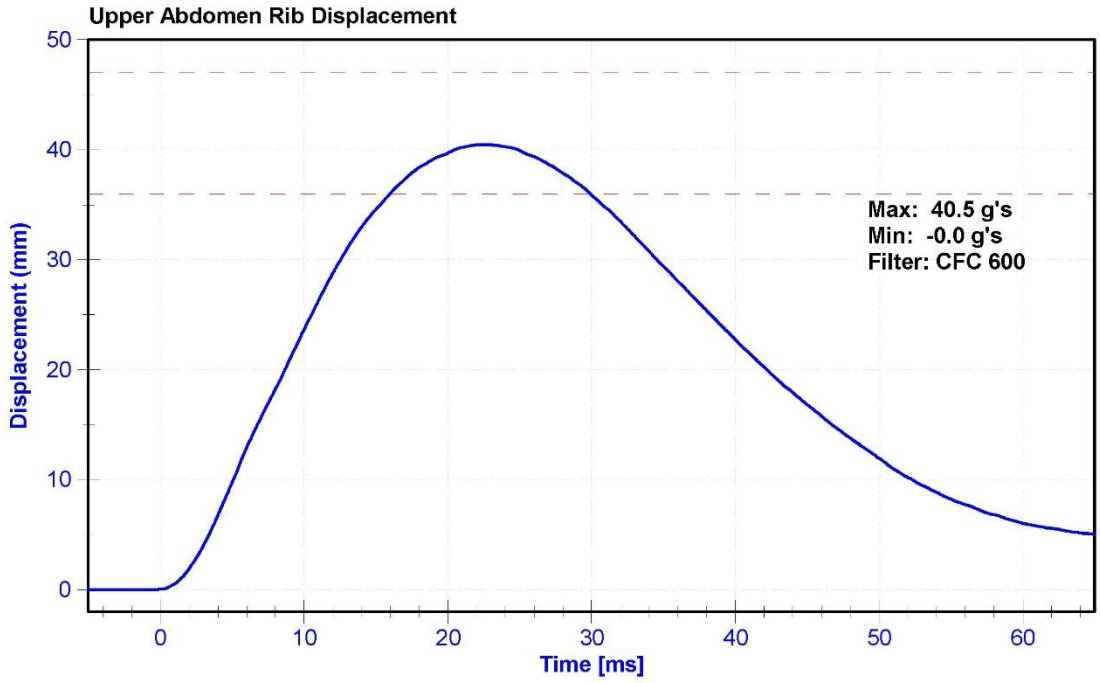
**Results**

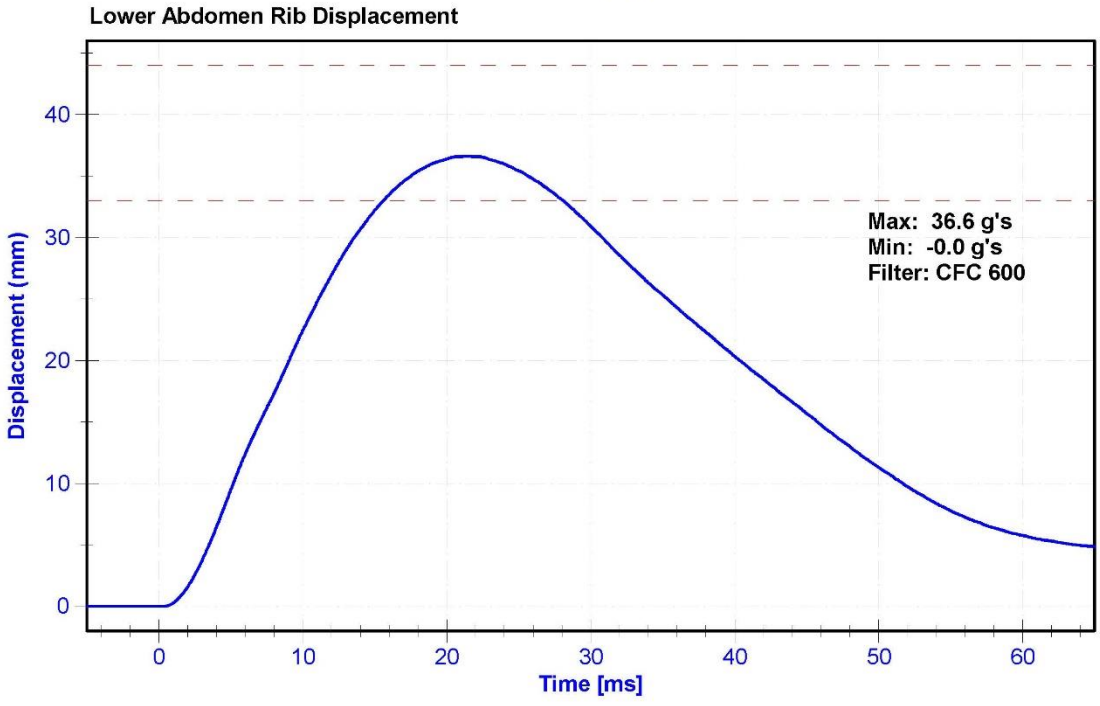
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 20.7 | Pass |
| Humidity | 10 | 70 | % | 24.4 | Pass |
| Velocity | 4.2 | 4.4 | m/s | 4.33 | Pass |
| Probe Acceleration | 12 | 16 | g's | 14.7 | Pass |
| Lateral Lower Spine Acceleration | 9 | 14 | g's | 11.1 | Pass |
| Upper Abdomen Rib Deflection | 36 | 47 | mm | 40.5 | Pass |
| Lower Abdomen Rib Deflection | 33 | 44 | mm | 36.6 | Pass |

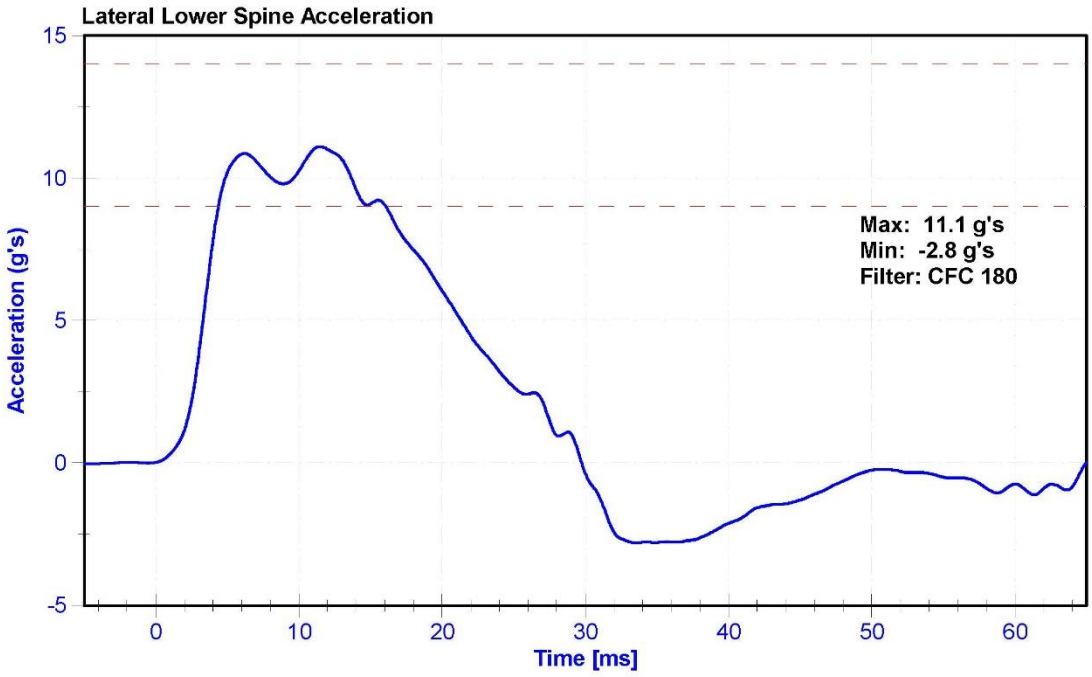
**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibratio Date | Calibration Due Date |
|---|---|---|---|---|
| Probe Accelerometer | ENDEVCO 7264CT | AC-P23155 | 1/13/2016 | 7/14/2016 |
| Lower Spine Y Accelerometer | ENDEVCO 7264CT | AC-P51974 | 10/19/2015 | 4/18/2016 |
| Upper Abdomen Rib Potentiometer | Servo 08CT1-3725 | DS-1274GFE | 10/19/2015 | 10/18/2016 |
| Lower Abdomen Rib Potentiometer | Servo 08CT1-3745 | DS-2316GFE | 10/28/2015 | 10/27/2016 |




Upper Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 40.5 g's
Min: -0.0 g's
Filter: CFC 600


Lower Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 36.6 g's
Min: -0.0 g's
Filter: CFC 600


Lateral Lower Spine Acceleration
Acceleration (g's)
15
10
5
0
-5
0
10
20
30
40
50
60
Time [ms]
Max: 11.1 g's
Min: -2.8 g's
Filter: CFC 180

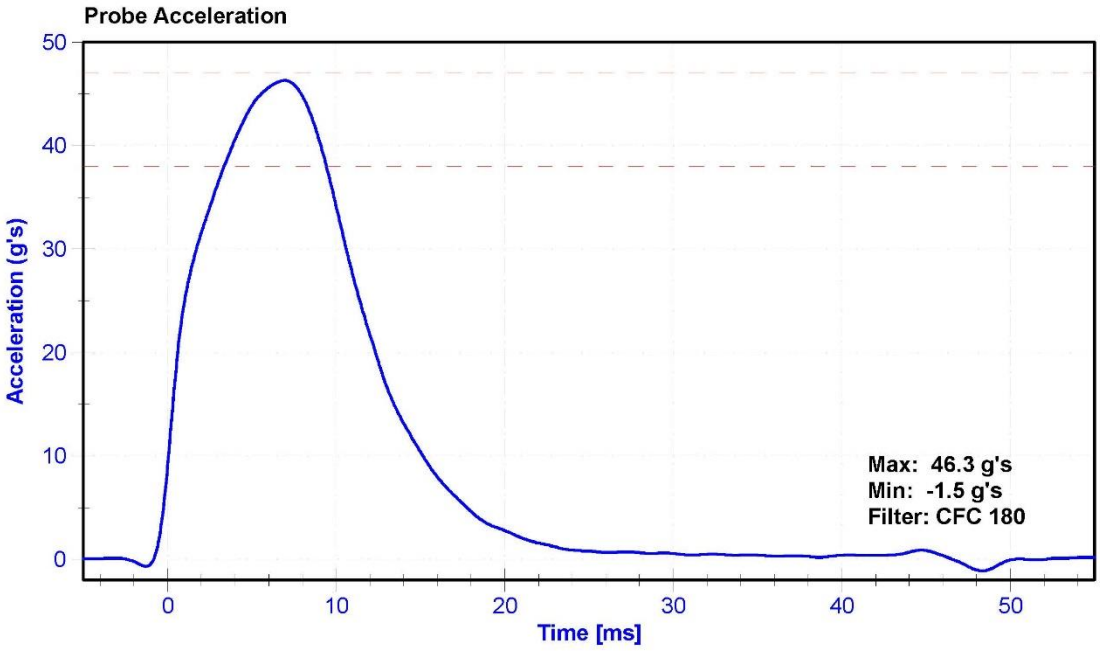
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M.Hartung |
| ATD Serial Number | 303 | Laboratory Supervisor | M. Goehle |

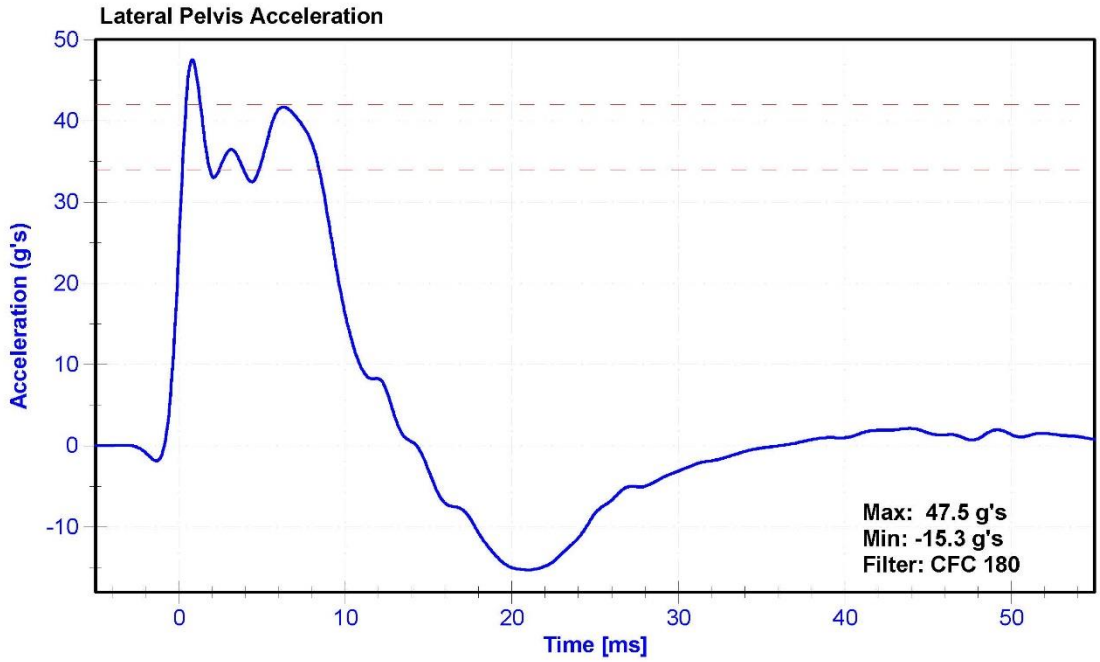
**Results**

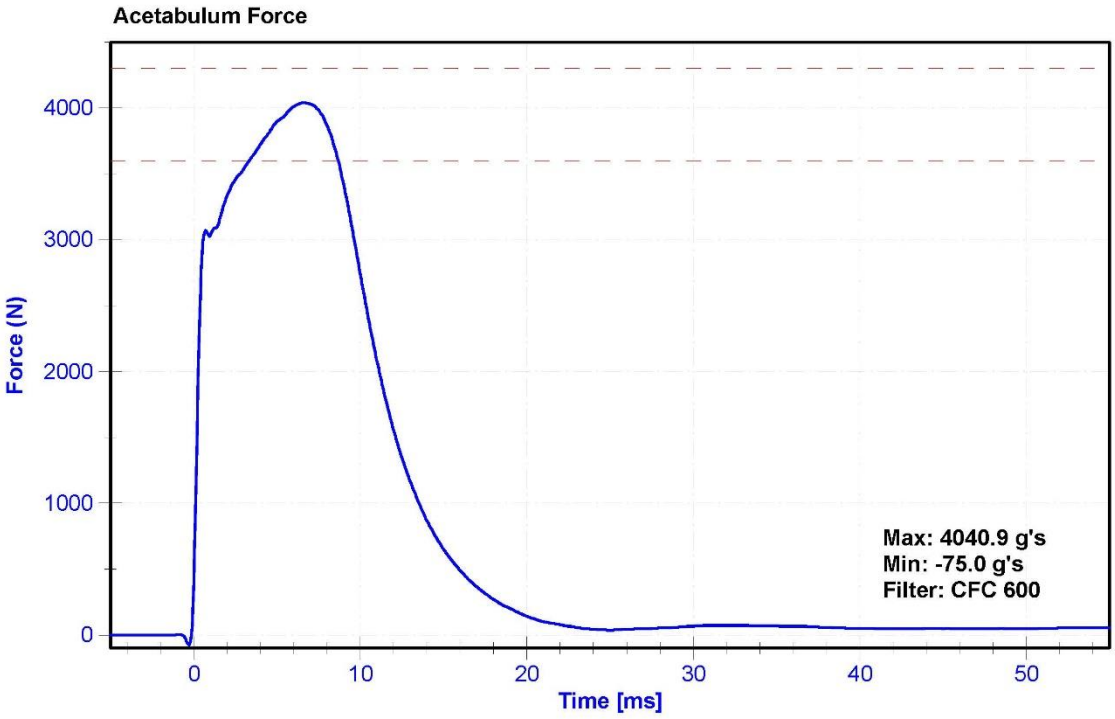
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 20.8 | Pass |
| Humidity | 10 | 70 | % | 24.3 | Pass |
| Velocity | 6.6 | 6.8 | m/s | 6.61 | Pass |
| Probe Acceleration | 38 | 47 | g's | 46.3 | Pass |
| Lateral Pelvis Acceleration after 6ms | 34 | 42 | g's | 41.7 | Pass |
| Acetabulum Force | 3600 | 4300 | N | 4040.9 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7264CT | AC-P23155 | 1/13/2016 | 7/14/2016 |
| Pelvis Y Accelerometer | ENDEVCO 7264 | AC-P51259 | 10/19/2015 | 4/18/2016 |
| Acetabulum Load Cell | Denton IF-520 | LC-236Fy | 6/29/2015 | 6/28/2016 |
| Certification Plug | Humanetics | 3179 | 7/20/2009 | N/A |
| Crash Test Plug | Humanetics | 3180 | 7/20/2009 | N/A |




Lateral Pelvis Acceleration
Acceleration (g's)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]
Max: 47.5 g's
Min: -15.3 g's
Filter: CFC 180


Acetabulum Force
Force (N)
4000
3000
2000
1000
0
0
10
20
30
40
50
Time [ms]
Max: 4040.9 g's
Min: -75.0 g's
Filter: CFC 600

DENTON ATD, INC.
10317 U.S. Highway 250 North • Milan, OH 44846-9570
DENTON Tel (419) 625 -5200 • Fax (419) 625 -5335 • email: info@dentonatd.com • www.dentonatd.com

H

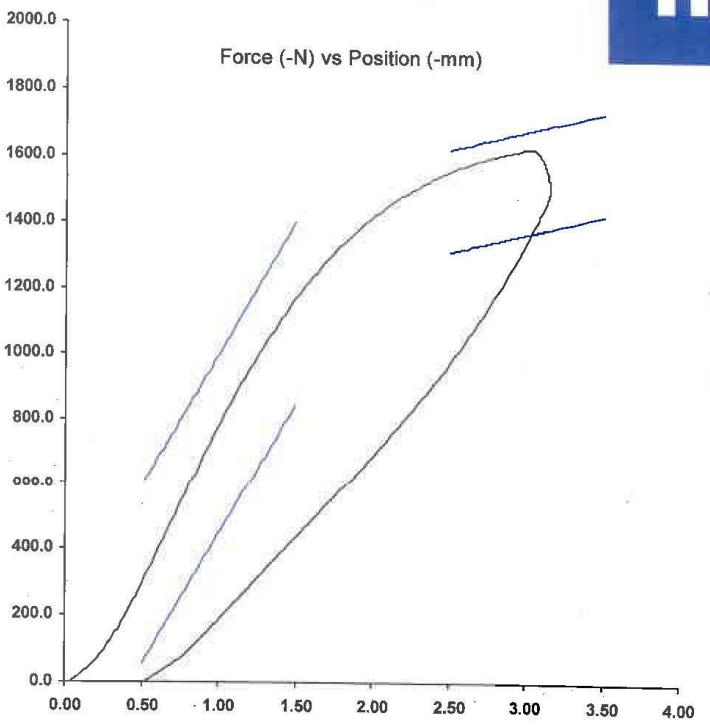
## SID-IIs Pelvis Plug Quasi-static Certification

Specimen ID (Serial No.) 3179
Test Number 6501
Report Number 2404
Test Date and Time 7/20/2009 6:49:19 AM

| | Test Results | Spec Min | Spec Max |
|---|---|---|---|
| Force @ 0.5 mm (N) | 297.4 | 50.0 | 600.0 |
| Force @ 1.5 mm (N) | 1,178.9 | 850.0 | 1,400.0 |
| Force @ 2.5 mm (N) | 1,553.8 | 1,306.0 | 1,618.0 |
| Force @ 3.0 mm (N) | 1,621.8 | 1,361.0 | 1,673.0 |

Testing Machine SFM-20K
Load Cell S/N (318607A), Units (N ) 5000

Crosshead Speed ( -mm / min ) or Rate 25
Extension or Position Measured by SFM-20K ( 02022512 )




By : 4. Ball Date : 8-3-09

Operator D. Resor D.R. Part Number 180-4450

Template No 107 20-Jul-09 Target Density (pcf) 4.66
Denton ATD, Inc.

DENTON ATD, INC.
10317 U.S. Highway 250 North • Milan, OH 44846-9570
DENTON Tel (419) 625 -5200 • Fax (419) 625 -5335 • email: info@dentonatd.com • www.dentonatd.com

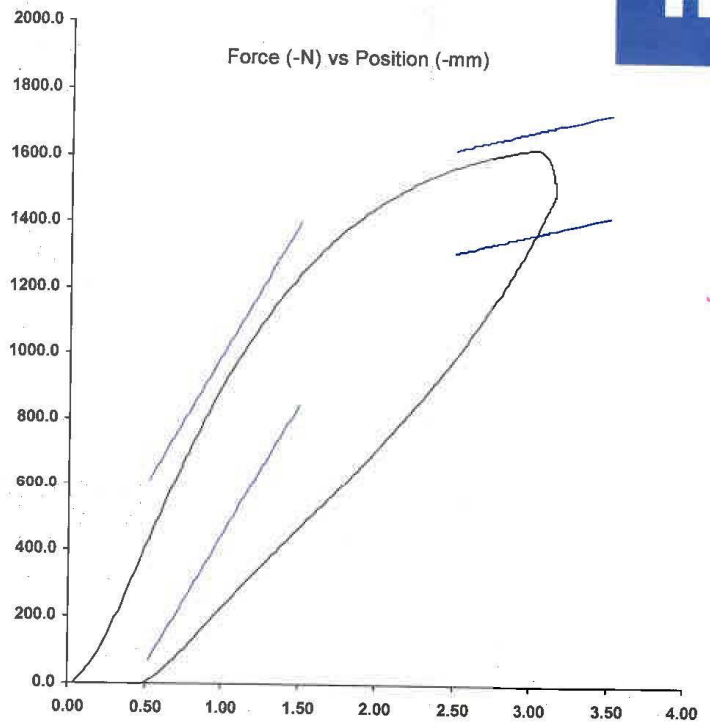
H

## SID-IIs Pelvis Plug Quasi-static Certification

Specimen ID (Serial No.) 3180
Test Number 6502
Report Number 2404
Test Date and Time 7/20/2009 6:50:15 AM

| | Test Results | Spec Min | Spec Max |
|---|---|---|---|
| Force @ 0.5 mm (N) | 433.2 | 50.0 | 600.0 |
| Force @ 1.5 mm (N) | 1,247.0 | 850.0 | 1,400.0 |
| Force @ 2.5 mm (N) | 1,565.2 | 1,306.0 | 1,618.0 |
| Force @ 3.0 mm (N) | 1,622.9 | 1,361.0 | 1,673.0 |

Force (-N) vs Position (-mm)




Testing Machine SFM-20K
Load Cell S/N (318607A), Units (N ) 5000

Crosshead Speed ( -mm / min ) or Rate 25
Extension or Position Measured by SFM-20K ( 02022512 )

By : H. Ball Date : 8-3-09

Operator D. Resor D.R. Part Number 180-4450

Template No 107 20-Jul-09 Target Density (pcf) 4.66
Denton ATD, Inc.

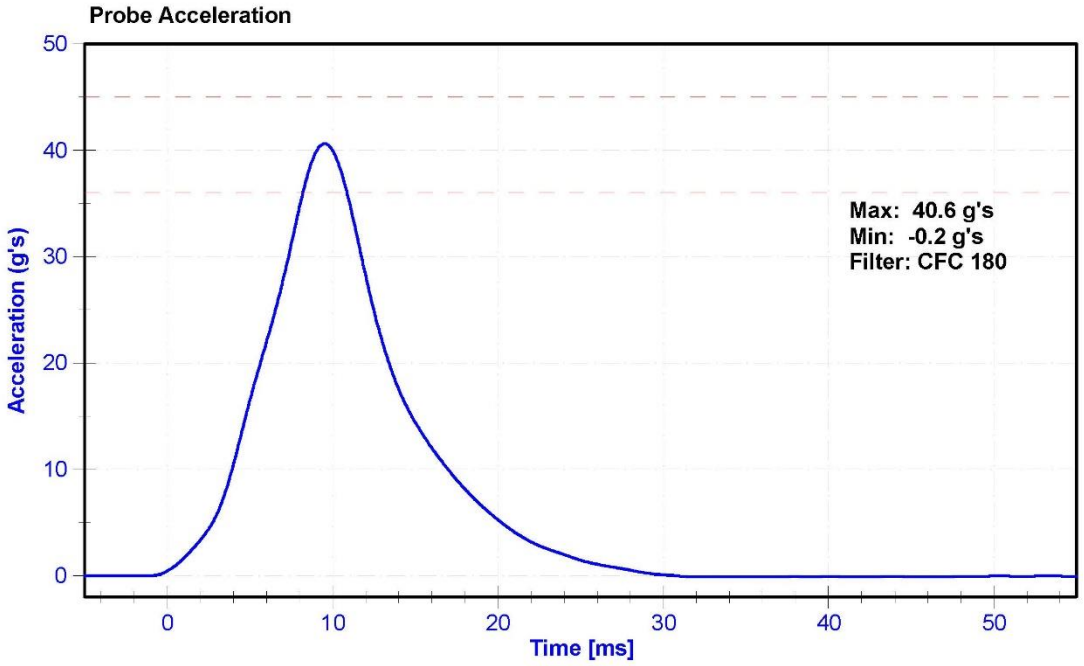
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M.Hartung |
| ATD Serial Number | 303 | Laboratory Supervisor | M.Goehle |

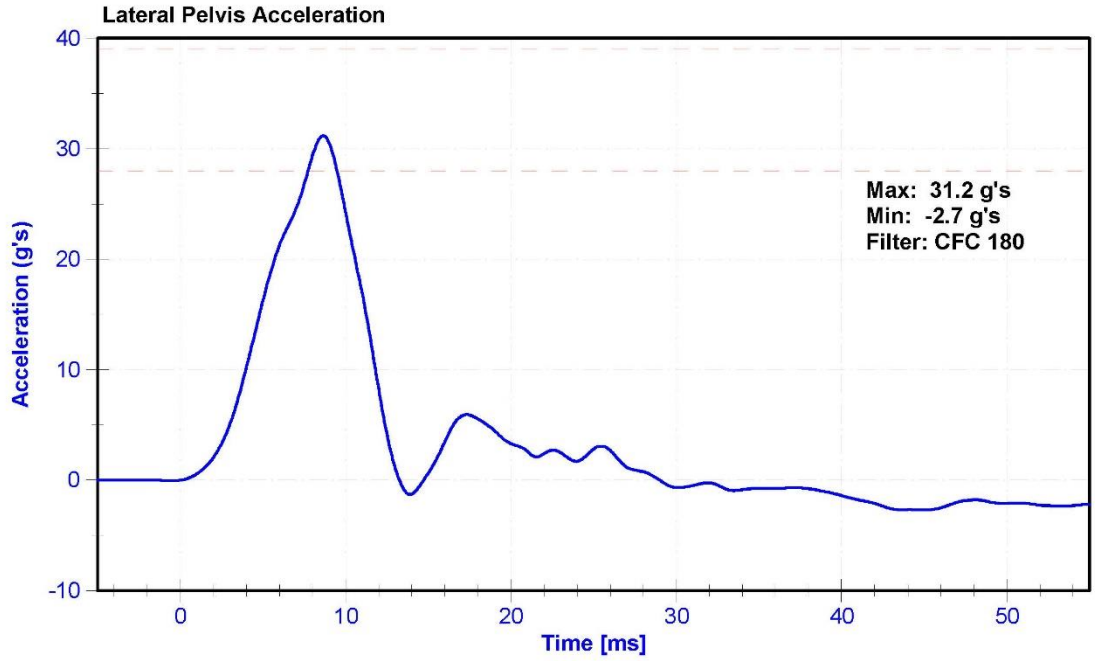
**Results**

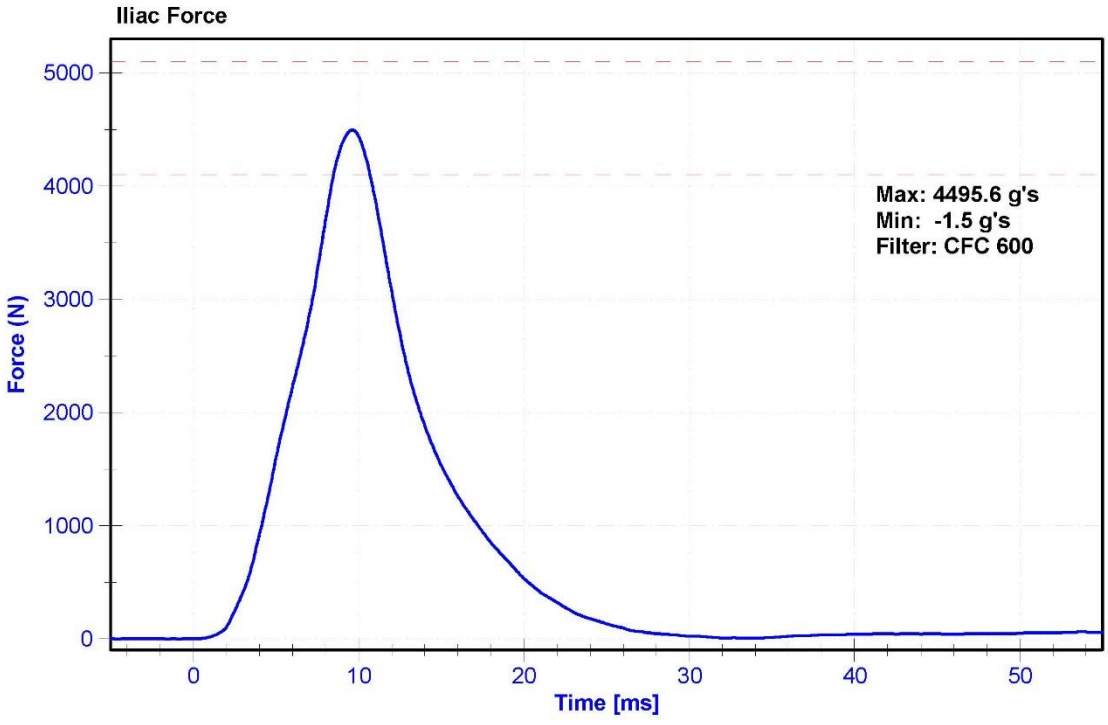
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.3 | Pass |
| Humidity | 10 | 70 | % | 23.8 | Pass |
| Velocity | 4.2 | 4.4 | m/s | 4.30 | Pass |
| Probe Acceleration | 36 | 45 | g's | 40.6 | Pass |
| Lateral Pelvis Acceleration | 28 | 39 | g's | 31.2 | Pass |
| Iliac Force | 4100 | 5100 | N | 4495.6 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7264CT | AC-P23155 | 1/13/2016 | 7/14/2016 |
| Pelvis Y Accelerometer | ENDEVCO 7264 | AC-P51259 | 10/19/2015 | 4/18/2016 |
| Iliac Load Cell | DENTON 3228J | LC-285Fy | 7/21/2015 | 7/20/2016 |




Lateral Pelvis Acceleration
Acceleration (g's)
Time [ms]
Max: 31.2 g's
Min: -2.7 g's
Filter: CFC 180


Iliac Force
Force (N)
Time [ms]
Max: 4495.6 g's
Min: -1.5 g's
Filter: CFC 600

**CALIBRATION TEST RESULTS**

**POST-TEST**

**EUROSID 2 (ES-2RE) MALE – DRIVER ATD**

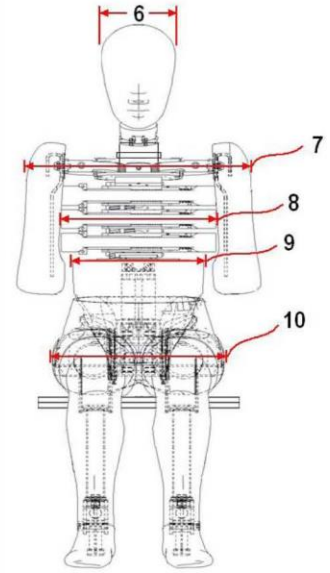
**SERIAL NO: F034**

**(CONFIGURED FOR LEFT SIDE IMPACT)**

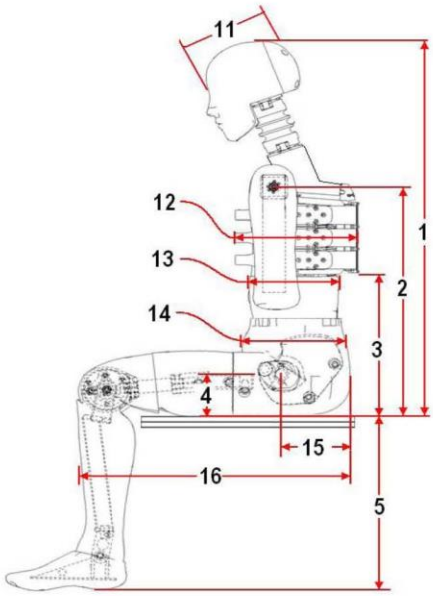
External Measurements - EuroSID-2re

Technician: M. Goehle  Date: 3/22/2016

Dummy Serial Number: F034




FRONT VIEW




SIDE VIEW

| Dim. No. | Description | Specification (mm) | | Result (mm) | Pass/Fail |
|---|---|---|---|---|---|
| 1 | Sitting Height | 900 | 918 | 910 | Pass |
| 2 | Seat to Shoulder Joint | 558 | 572 | 560 | Pass |
| 3 | Seat to Lower Face of Thoracic Spine Box | 346 | 356 | 350 | Pass |
| 4 | Seat to Hip Joint (center of bolt) | 97 | 103 | 100 | Pass |
| 5 | Sole to Seat, Sitting | 333 | 451 | 414 | Pass |
| 6 | Head Width | 152 | 158 | 154 | Pass |
| 7 | Shoulder/Arm Width | 461 | 479 | 473 | Pass |
| 8 | Thorax Width | 322 | 332 | 330 | Pass |
| 9 | Abdomen Width | 273 | 287 | 284 | Pass |
| 10 | Pelvis Lap Width | 359 | 373 | 368 | Pass |
| 11 | Head Depth | 196 | 206 | 200 | Pass |
| 12 | Thorax Depth | 262 | 272 | 266 | Pass |
| 13 | Abdomen Depth | 194 | 204 | 200 | Pass |
| 14 | Pelvis Depth | 235 | 245 | 238 | Pass |
| 15 | Back of Buttocks to Hip Joint (center of bolt) | 150 | 160 | 155 | Pass |
| 16 | Back of Buttocks to Front Knee | 597 | 615 | 607 | Pass |

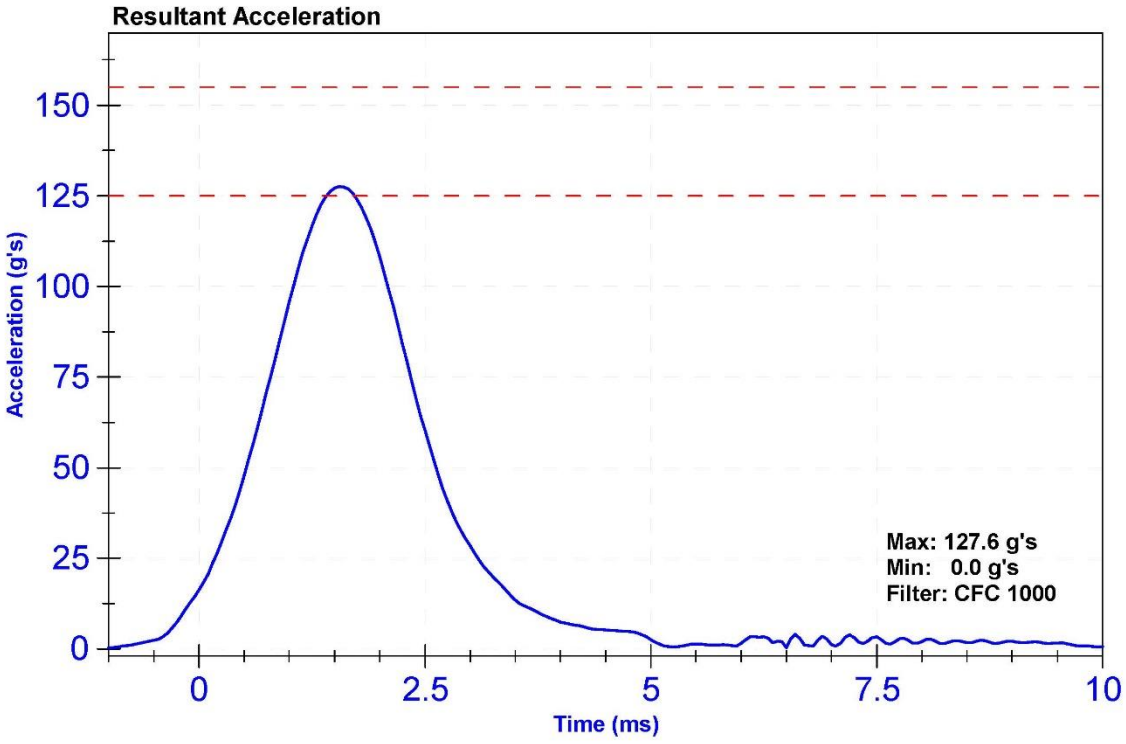
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M. Goehle |
| ATD Serial Number | F034 | Laboratory Supervisor | M. Goehle |

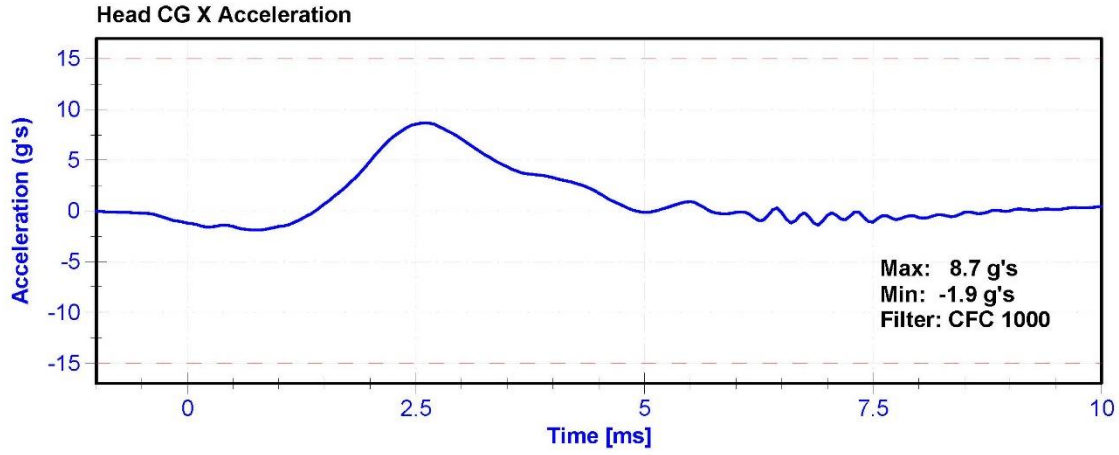
**Results**

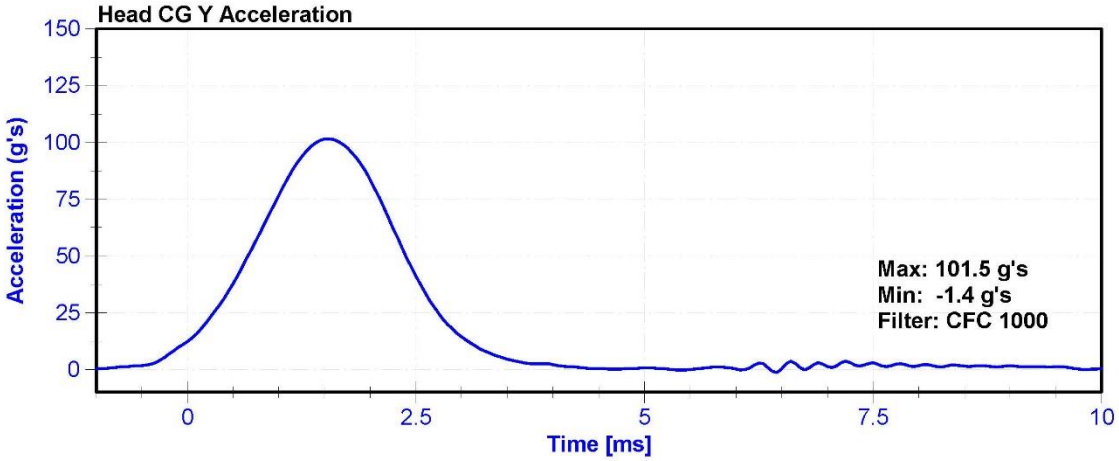
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.7 | Pass |
| Humidity | 10 | 70 | % | 27.5 | Pass |
| Resultant Acceleration | 125 | 155 | g's | 127.6 | Pass |
| Oscillation | 0 | 15 | % | 3.07 | Pass |
| Fore-Aft Acceleration | -15 | 15 | g's | 8.7 | Pass |

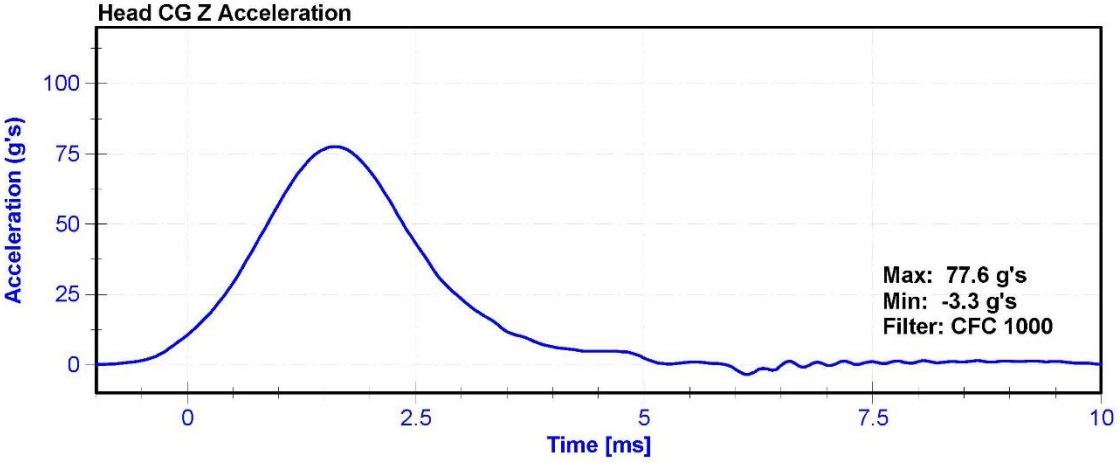
**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| X Accelerometer | ENDEVCO 7264CT | AC-P58904 | 10/19/2015 | 4/18/2016 |
| Y Accelerometer | ENDEVCO 7264CT | AC-P58911 | 10/19/2015 | 4/18/2016 |
| Z Accelerometer | ENDEVCO 7264CT | AC-P58776 | 10/19/2015 | 4/18/2016 |




Head CG X Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]
Max: 8.7 g's
Min: -1.9 g's
Filter: CFC 1000


Head CG Y Acceleration
Acceleration (g's)
150
125
100
75
50
25
0
0
2.5
5
7.5
10
Time [ms]
Max: 101.5 g's
Min: -1.4 g's
Filter: CFC 1000


Head CG Z Acceleration
Acceleration (g's)
100
75
50
25
0
0
2.5
5
7.5
10
Time [ms]
Max: 77.6 g's
Min: -3.3 g's
Filter: CFC 1000

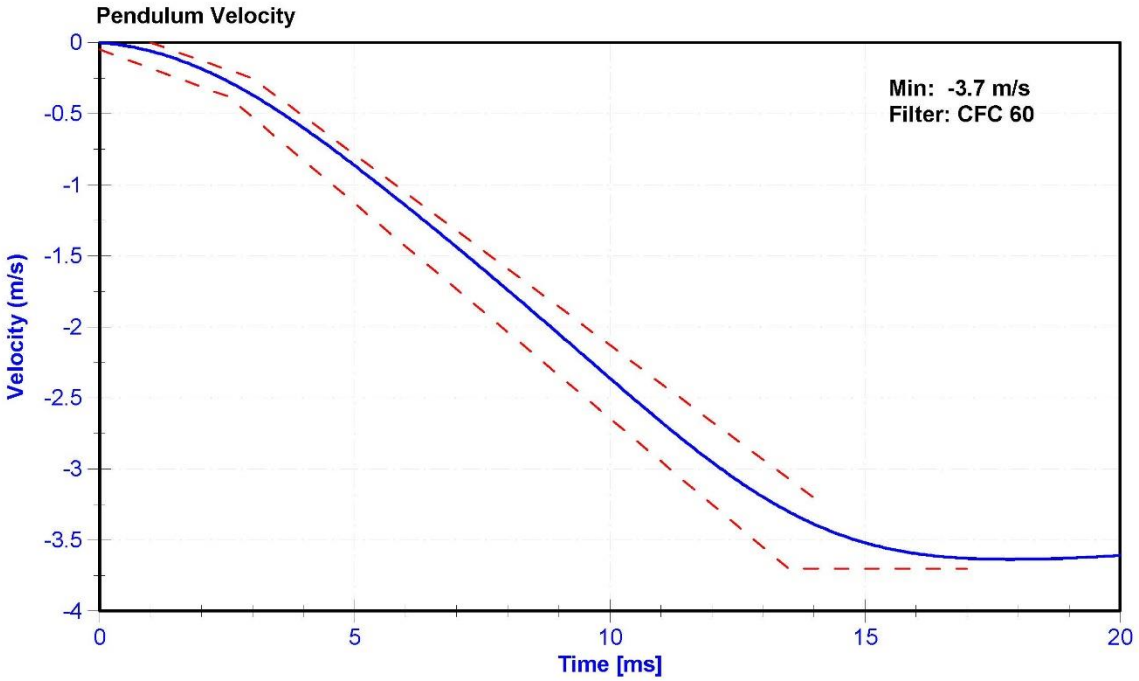
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M. Goehle |
| ATD Serial Number | F034 | Laboratory Supervisor | M. Goehle |

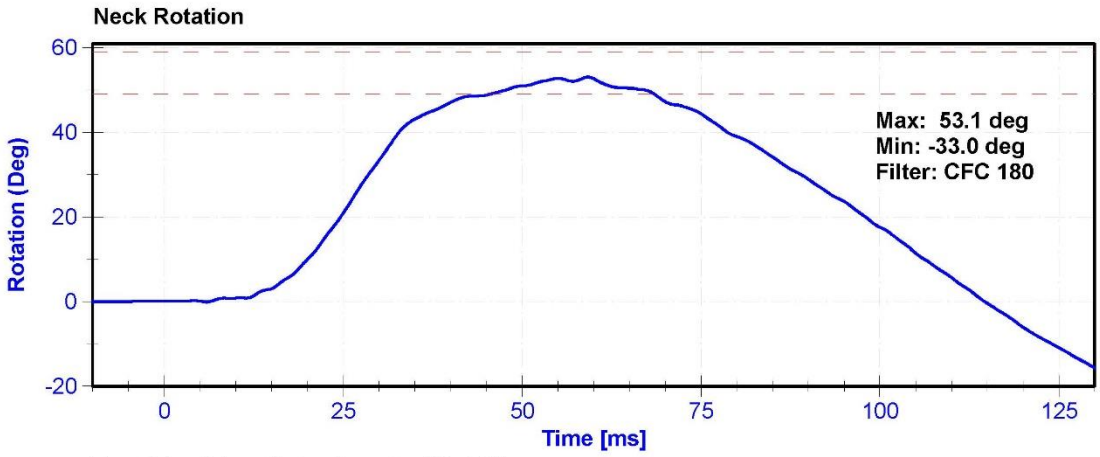
**Results**

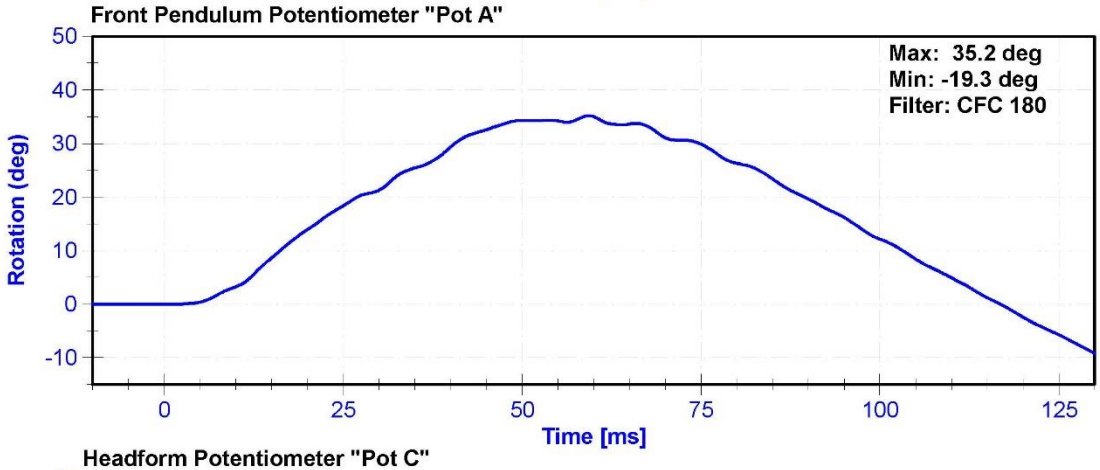
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.8 | Pass |
| Humidity | 10 | 70 | % | 18.4 | Pass |
| Velocity | 3.3 | 3.5 | m/s | 3.46 | Pass |
| Lateral Neck Rotation | 49 | 59 | deg | 53.1 | Pass |
| Time at Maximum Rotation | 54 | 66 | ms | 59.2 | Pass |
| Time of Rotation Decay from Maximum | 53 | 88 | ms | 55.4 | Pass |

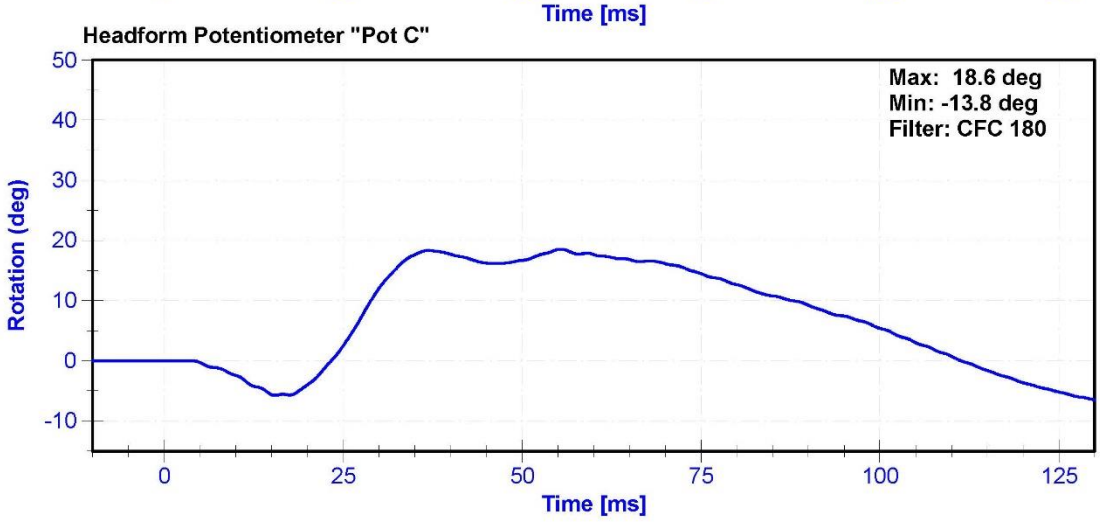
**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7231CT | AC-AH5F3 | 5/7/2015 | 5/6/2016 |
| Front Pendulum Potentiometer | SP22G | DS-094 | 9/24/2015 | 9/23/2016 |
| Headform Potentiometer | SP22G | DS-095 | 9/24/2015 | 9/23/2016 |




Neck Rotation
Rotation (Deg)
60
40
20
0
-20
0
25
50
75
100
125
Time [ms]
Max: 53.1 deg
Min: -33.0 deg
Filter: CFC 180


Front Pendulum Potentiometer "Pot A"
Rotation (deg)
50
40
30
20
10
0
-10
0
25
50
75
100
125
Time [ms]
Max: 35.2 deg
Min: -19.3 deg
Filter: CFC 180


Headform Potentiometer "Pot C"
Rotation (deg)
50
40
30
20
10
0
-10
0
25
50
75
100
125
Time [ms]
Max: 18.6 deg
Min: -13.8 deg
Filter: CFC 180

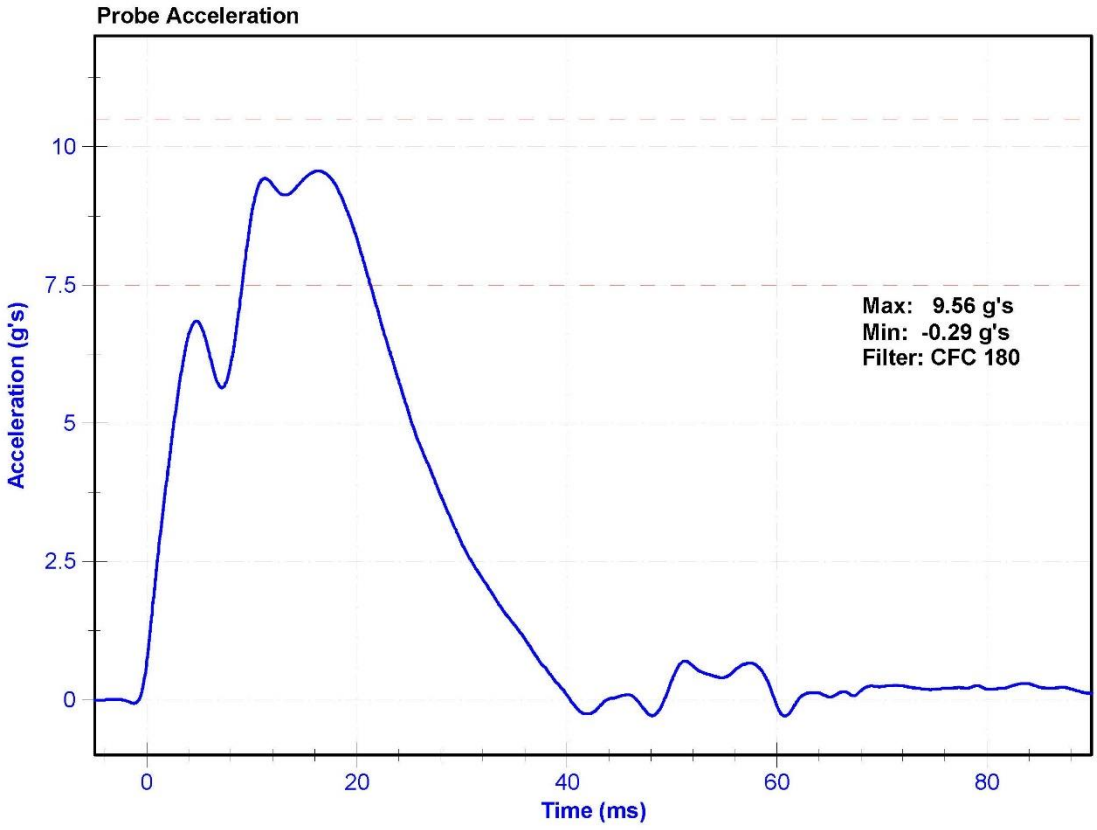
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M. Goehle |
| ATD Serial Number | F034 | Laboratory Supervisor | M. Goehle |

**Results**

| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 20.8 | Pass |
| Humidity | 10 | 70 | % | 25.3 | Pass |
| Velocity | 4.2 | 4.4 | m/s | 4.23 | Pass |
| Probe Acceleration | 7.5 | 10.5 | g's | 9.56 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Probe Accelerometer | ENDEVCO 7264CT | AC-P23155 | 1/13/2016 | 7/14/2016 |



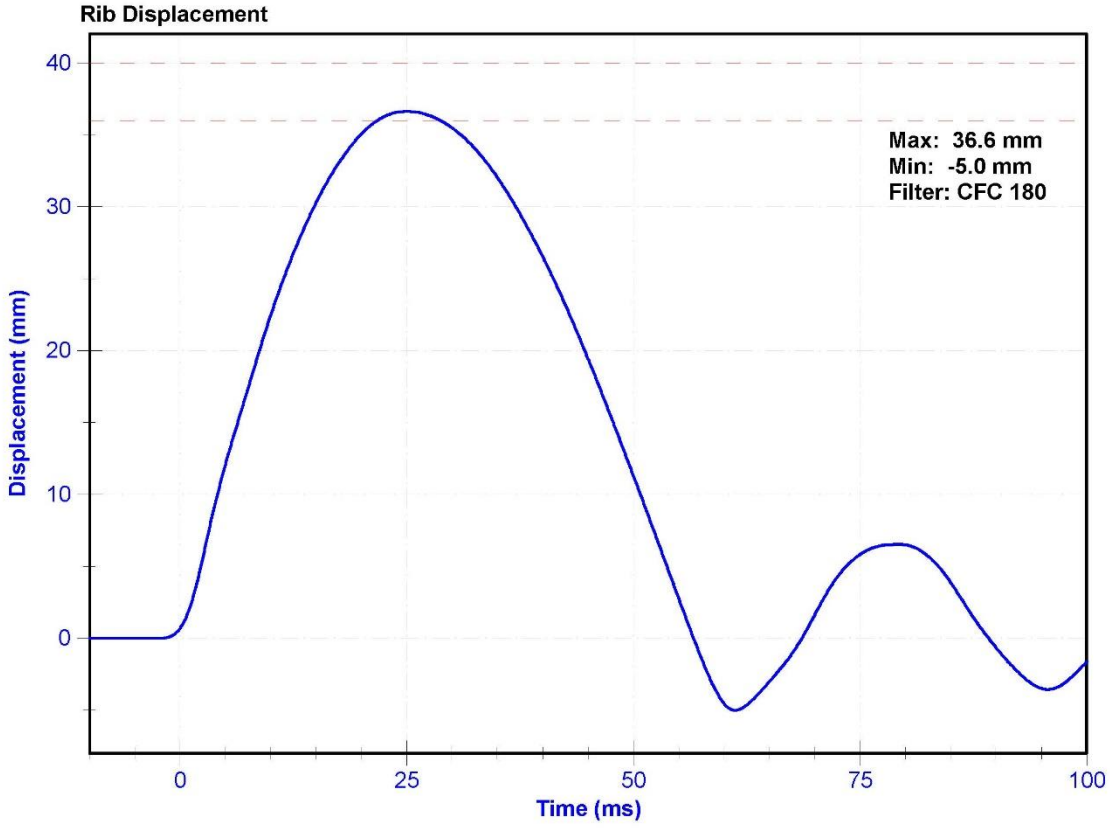
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M. Goehle |
| ATD Serial Number | F034 | Laboratory Supervisor | M. Goehle |

**Results**

| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.1 | Pass |
| Humidity | 10 | 70 | % | 29.8 | Pass |
| Rib Displacement | 36 | 40 | mm | 36.6 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Rib Potentiometer | Honeywell MLT-38000203 | DS-183GFE | 10/19/2015 | 10/18/2016 |



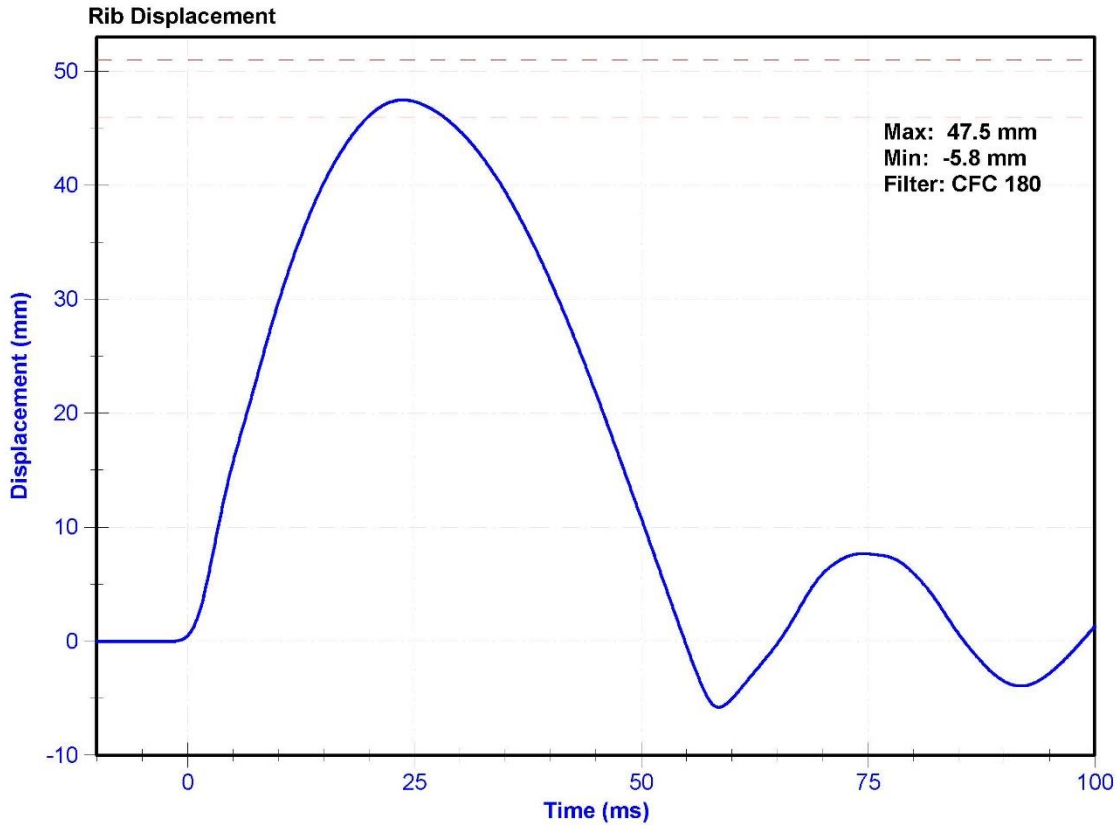
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M. Goehle |
| ATD Serial Number | F034 | Laboratory Supervisor | M. Goehle |

**Results**

| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.1 | Pass |
| Humidity | 10 | 70 | % | 29.8 | Pass |
| Rib Displacement | 46 | 51 | mm | 47.5 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Rib Potentiometer | Honeywell MLT-38000203 | DS-183GFE | 10/19/2015 | 10/18/2016 |



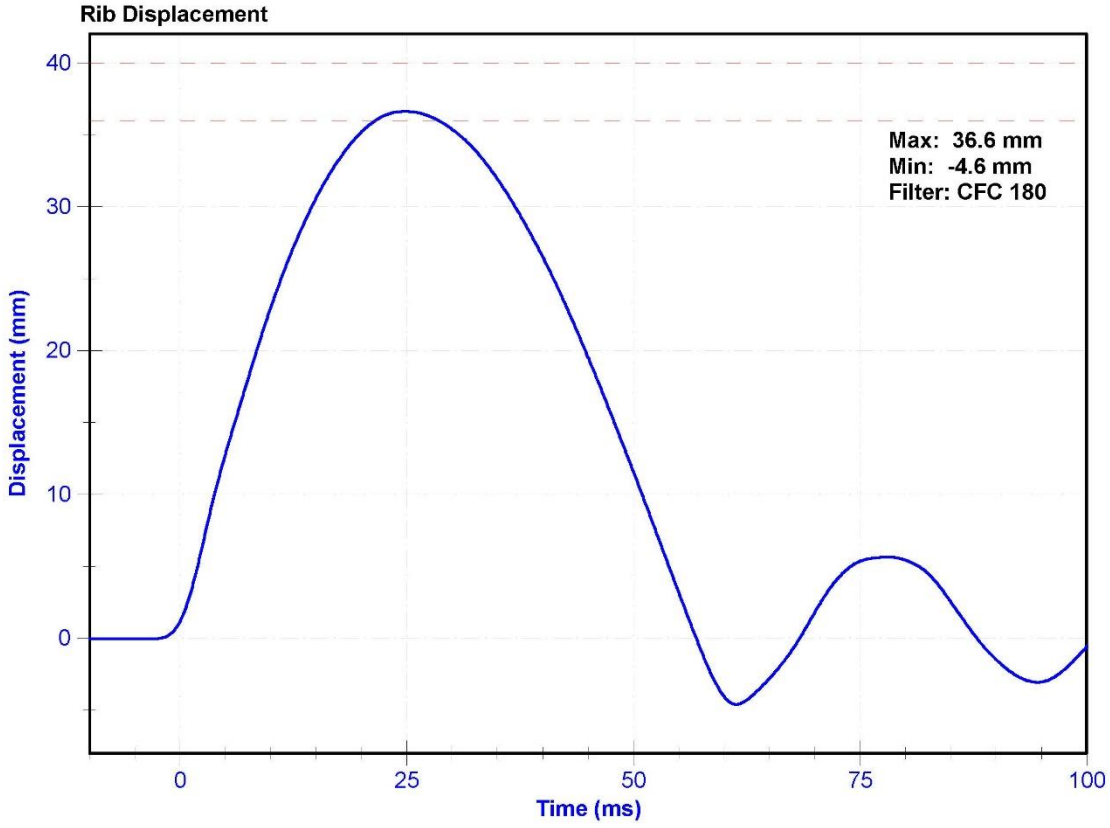
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M. Goehle |
| ATD Serial Number | F034 | Laboratory Supervisor | M. Goehle |

**Results**

| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 20.8 | Pass |
| Humidity | 10 | 70 | % | 28.4 | Pass |
| Rib Displacement | 36 | 40 | mm | 36.6 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Rib Potentiometer | Honeywell MLT-38000203 | DS-184GFE | 10/19/2015 | 10/18/2016 |



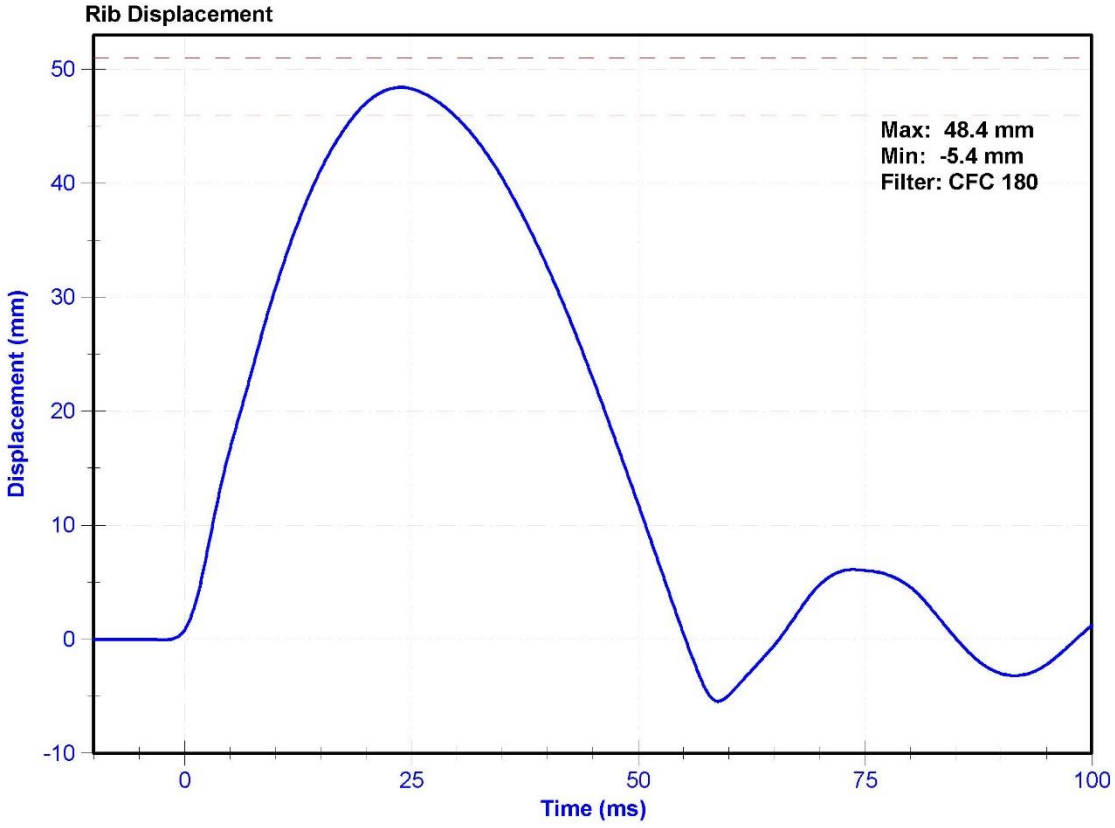
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M. Goehle |
| ATD Serial Number | F034 | Laboratory Supervisor | M. Goehle |

**Results**

| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 20.8 | Pass |
| Humidity | 10 | 70 | % | 28.4 | Pass |
| Rib Displacement | 46 | 51 | mm | 48.4 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Rib Potentiometer | Honeywell MLT-38000203 | DS-184GFE | 10/19/2015 | 10/18/2016 |



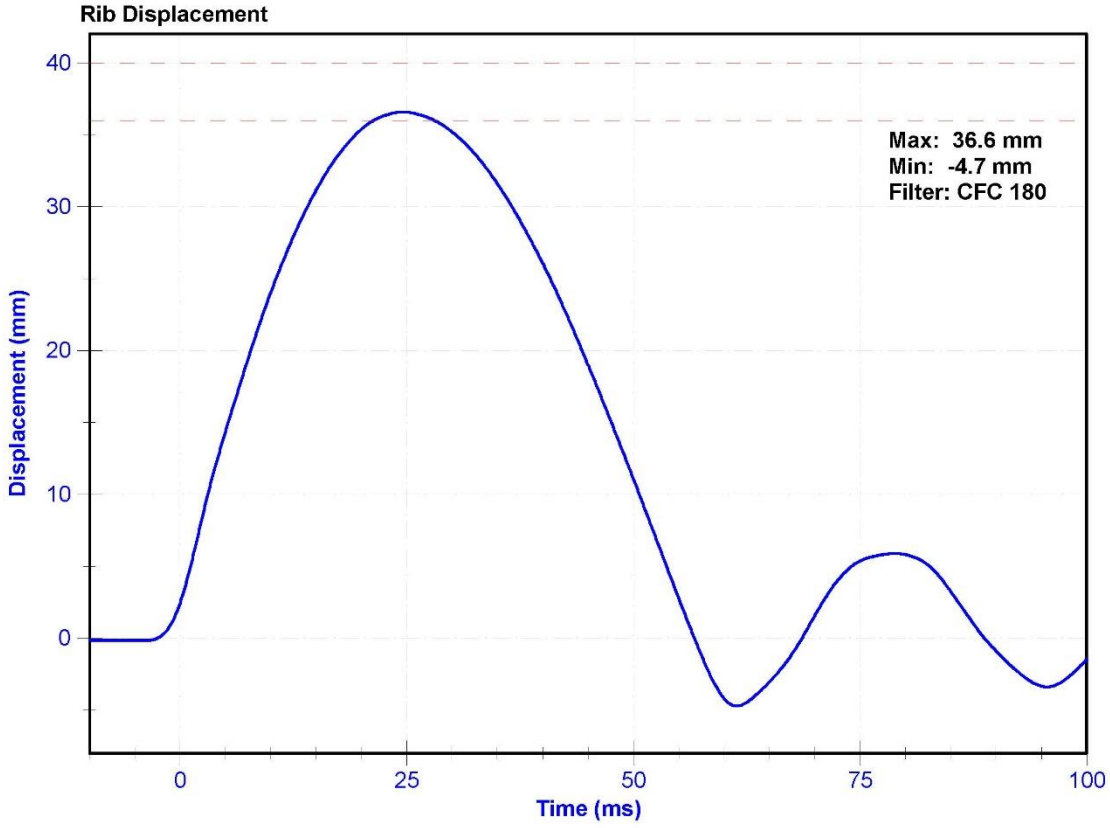
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M. Goehle |
| ATD Serial Number | F034 | Laboratory Supervisor | M. Goehle |

**Results**

| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 20.8 | Pass |
| Humidity | 10 | 70 | % | 28.4 | Pass |
| Rib Displacement | 36 | 40 | mm | 36.6 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Rib Potentiometer | Honeywell MLT-38000203 | DS-182GFE | 10/19/2015 | 10/18/2016 |



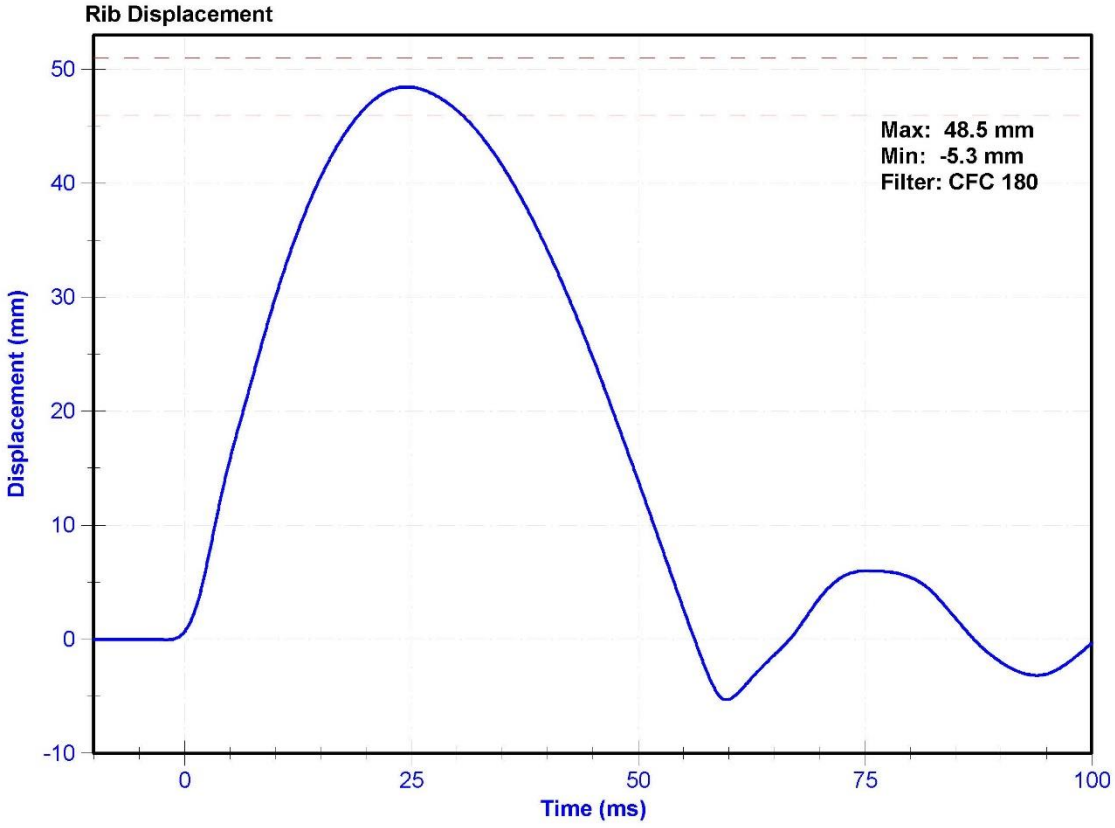
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M. Goehle |
| ATD Serial Number | F034 | Laboratory Supervisor | M. Goehle |

**Results**

| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 20.8 | Pass |
| Humidity | 10 | 70 | % | 28.4 | Pass |
| Rib Displacement | 46 | 51 | mm | 48.5 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Rib Potentiometer | Honeywell MLT-38000203 | DS-182GFE | 10/19/2015 | 10/18/2016 |



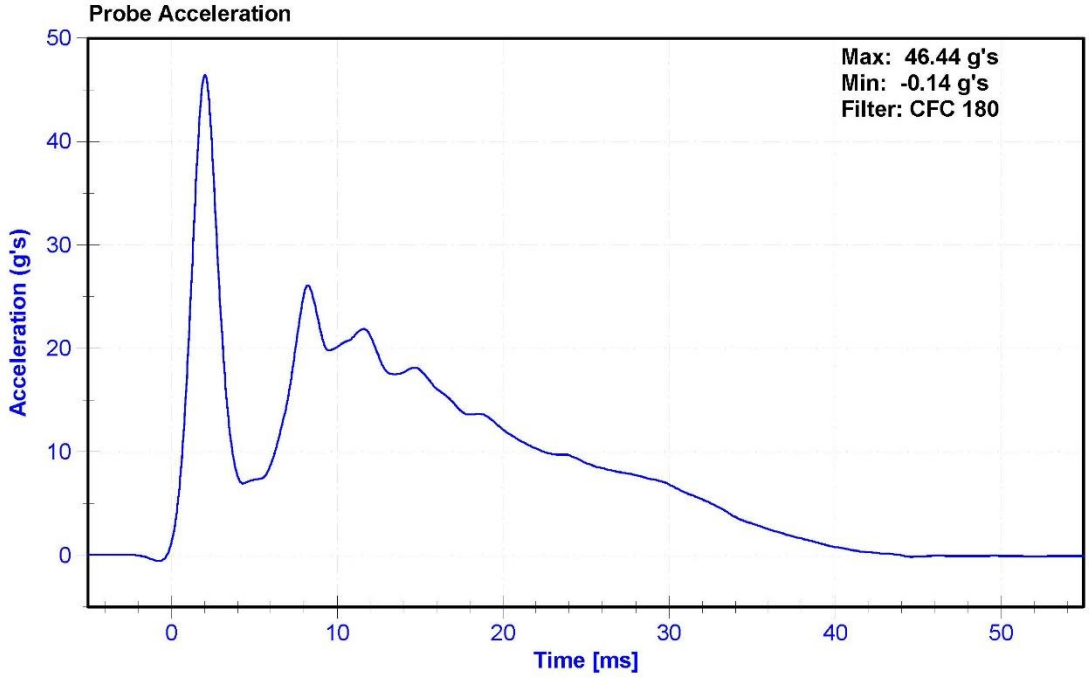
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M. Goehle |
| ATD Serial Number | F034 | Laboratory Supervisor | M. Goehle |

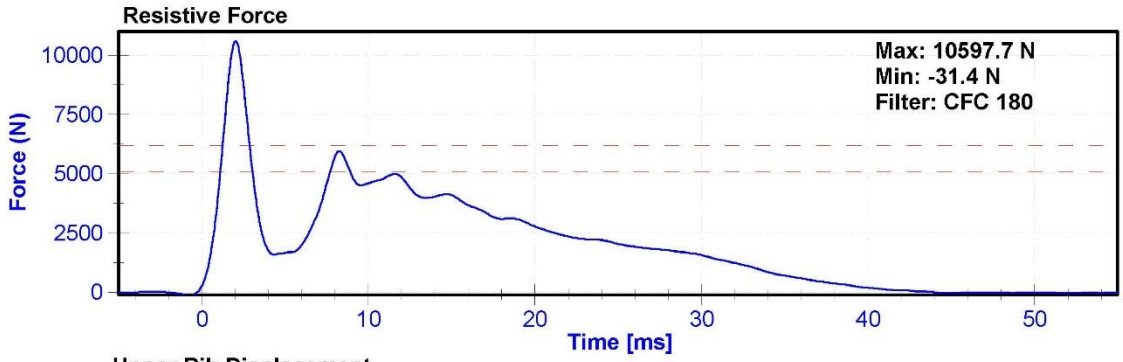
**Results**

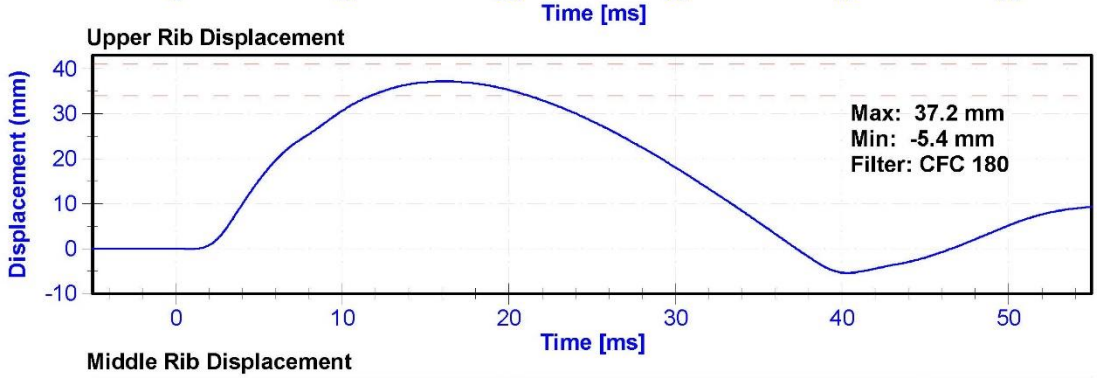
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.7 | Pass |
| Humidity | 10 | 70 | % | 21.5 | Pass |
| Velocity | 5.4 | 5.6 | m/s | 5.41 | Pass |
| Resistive Force after 6ms | 5100 | 6200 | N | 5956.1 | Pass |
| Upper Thorax Rib Deflection | 34 | 41 | mm | 37.2 | Pass |
| Mid Thorax Rib Deflection | 37 | 45 | mm | 41.0 | Pass |
| Lower Thorax Rib Deflection | 37 | 44 | mm | 40.5 | Pass |

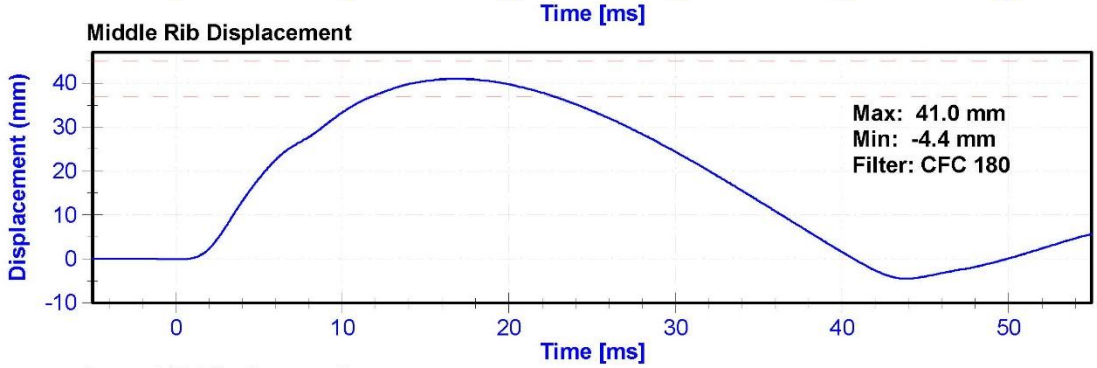
**Transducer Calibrations**

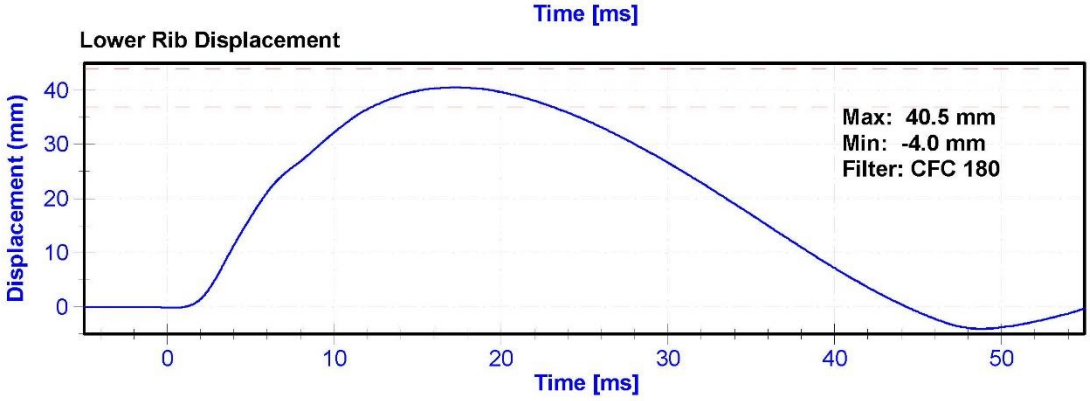
| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Probe Accelerometer | ENDEVCO 7264CT | AC-P23155 | 1/13/2016 | 7/14/2016 |
| Upper Thorax Rib Potentiometer | Honeywell MLT-38000203 | DS-183GFE | 10/19/2015 | 10/18/2016 |
| Middle Thorax Rib Potentiometer | Honeywell MLT-38000203 | DS-184GFE | 10/19/2015 | 10/18/2016 |
| Lower Thorax Rib Potentiometer | Honeywell MLT-38000203 | DS-182GFE | 10/19/2015 | 10/18/2016 |




Resistive Force
Force (N)
10000
7500
5000
2500
0
0
10
20
30
40
50
Time [ms]
Max: 10597.7 N
Min: -31.4 N
Filter: CFC 180


Upper Rib Displacement
Displacement (mm)
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]
Max: 37.2 mm
Min: -5.4 mm
Filter: CFC 180


Middle Rib Displacement
Displacement (mm)
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]
Max: 41.0 mm
Min: -4.4 mm
Filter: CFC 180


Lower Rib Displacement
Displacement (mm)
40
30
20
10
0
0
10
20
30
40
50
Time [ms]
Max: 40.5 mm
Min: -4.0 mm
Filter: CFC 180

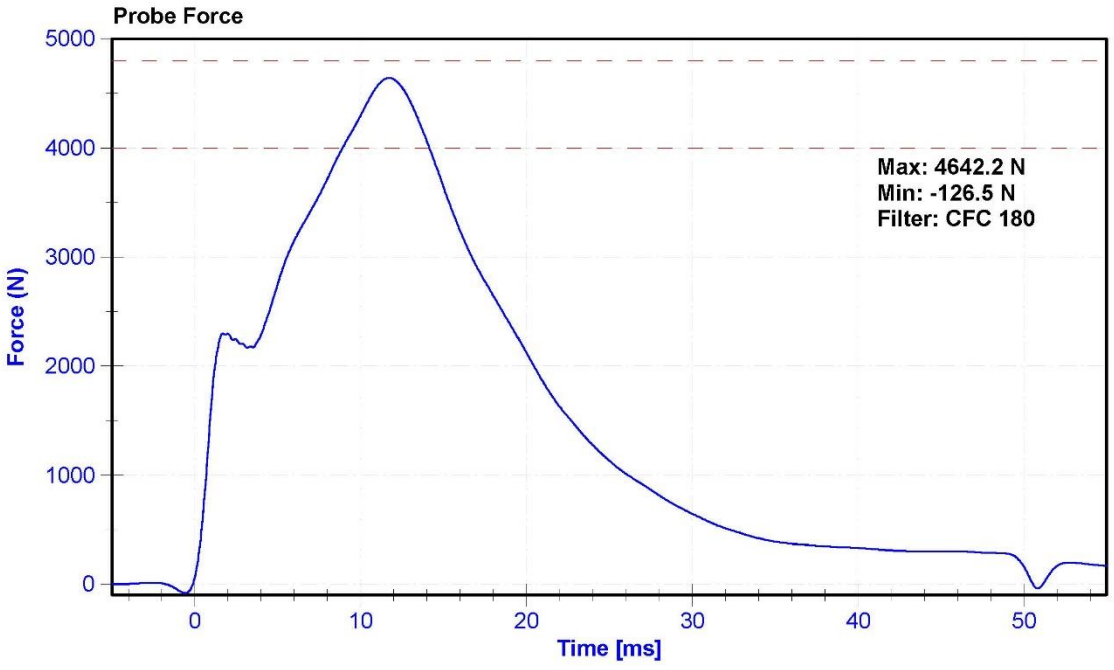
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M. Goehle |
| ATD Serial Number | F034 | Laboratory Supervisor | M. Goehle |

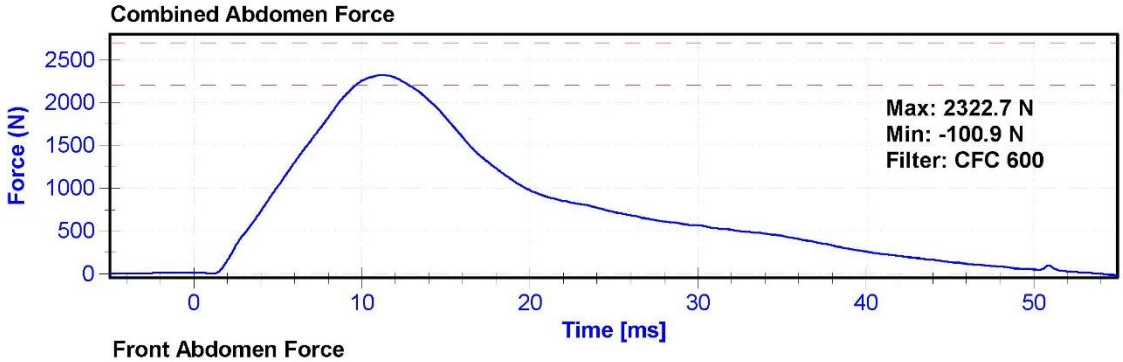
**Results**

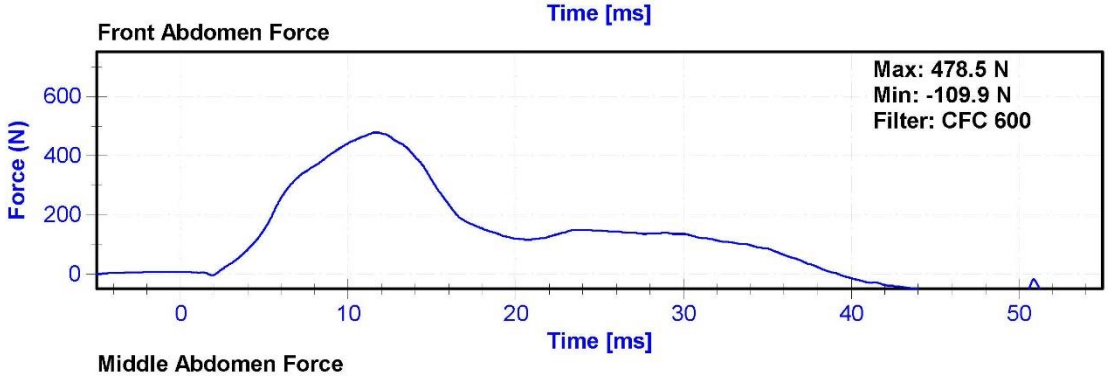
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21 | Pass |
| Humidity | 10 | 70 | % | 30.2 | Pass |
| Velocity | 3.9 | 4.1 | m/s | 4.07 | Pass |
| Combined Abdomen Force | 2200 | 2700 | N | 2322.7 | Pass |
| Time at Peak Abdomen Force | 10.0 | 12.3 | ms | 11.20 | Pass |
| Resistive Probe Force | 4000 | 4800 | N | 4642.2 | Pass |
| Time at Peak Resistive Force | 10.6 | 13.0 | ms | 11.70 | Pass |

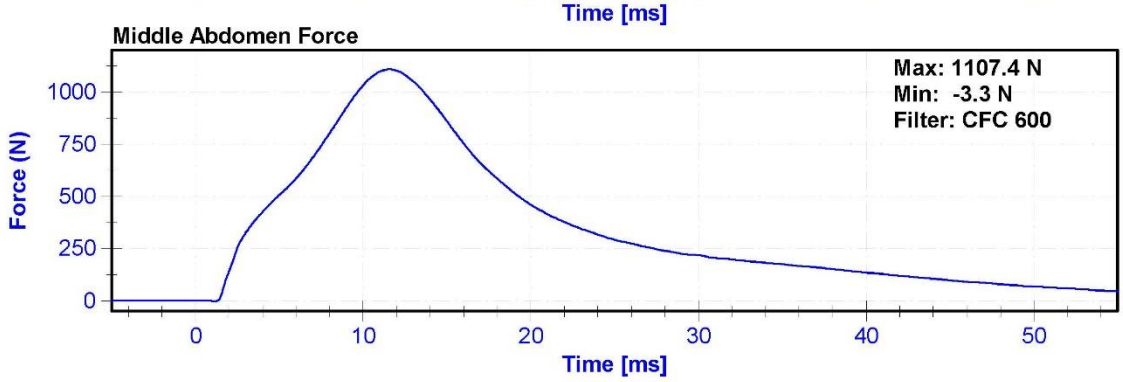
**Transducer Calibrations**

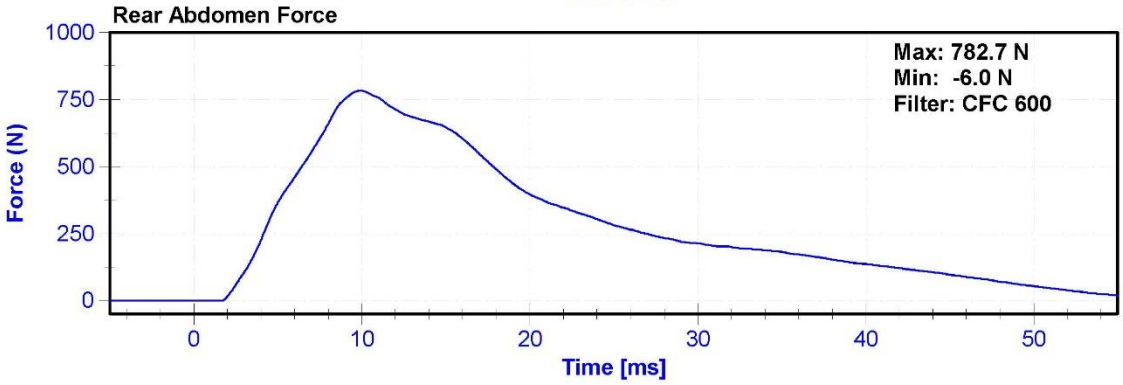
| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7264CT | AC-P23155 | 1/13/2016 | 7/14/2016 |
| Front Abdomen Load Cell | DENTON 2631 | LC-1512 | 6/25/2015 | 6/24/2016 |
| Middle Abdomen Load Cell | DENTON 2631 | LC-1526 | 6/25/2015 | 6/24/2016 |
| Rear Abdomen Load Cell | DENTON 2631 | LC-1516 | 6/25/2015 | 6/24/2016 |




Combined Abdomen Force
Force (N)
2500
2000
1500
1000
500
0
Max: 2322.7 N
Min: -100.9 N
Filter: CFC 600
0
10
20
30
40
50
Time [ms]


Front Abdomen Force
Force (N)
600
400
200
0
Max: 478.5 N
Min: -109.9 N
Filter: CFC 600
0
10
20
30
40
50
Time [ms]


Middle Abdomen Force
Force (N)
1000
750
500
250
0
Max: 1107.4 N
Min: -3.3 N
Filter: CFC 600
0
10
20
30
40
50
Time [ms]


Rear Abdomen Force
Force (N)
1000
750
500
250
0
Max: 782.7 N
Min: -6.0 N
Filter: CFC 600
0
10
20
30
40
50
Time [ms]

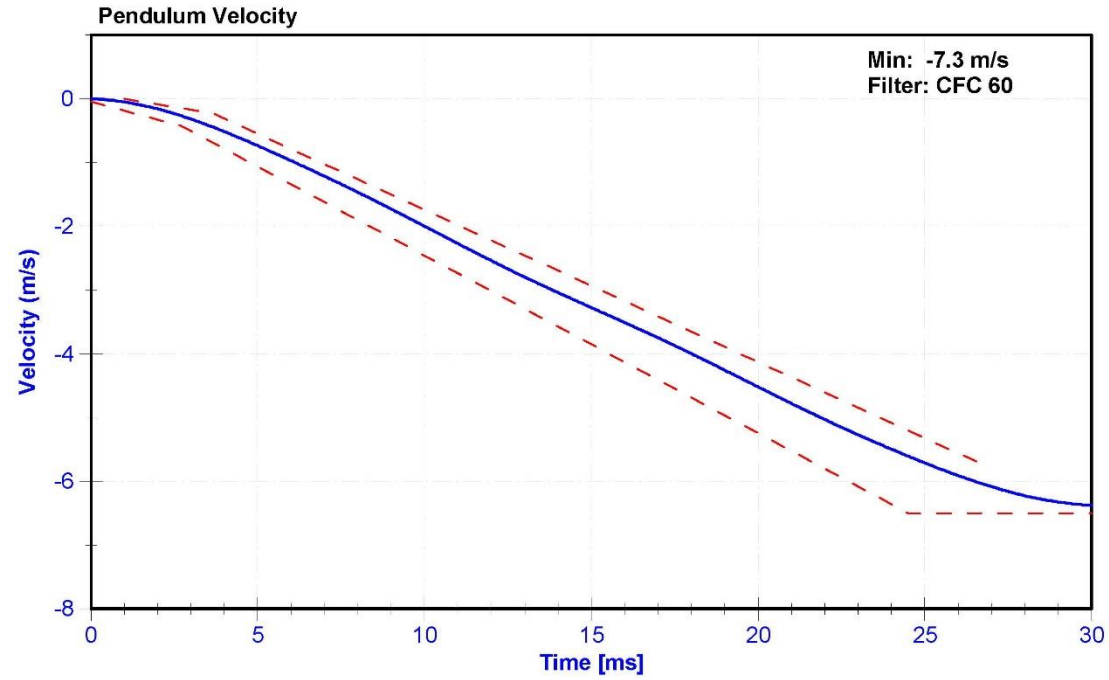
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M. Goehle |
| ATD Serial Number | F034 | Laboratory Supervisor | M. Goehle |

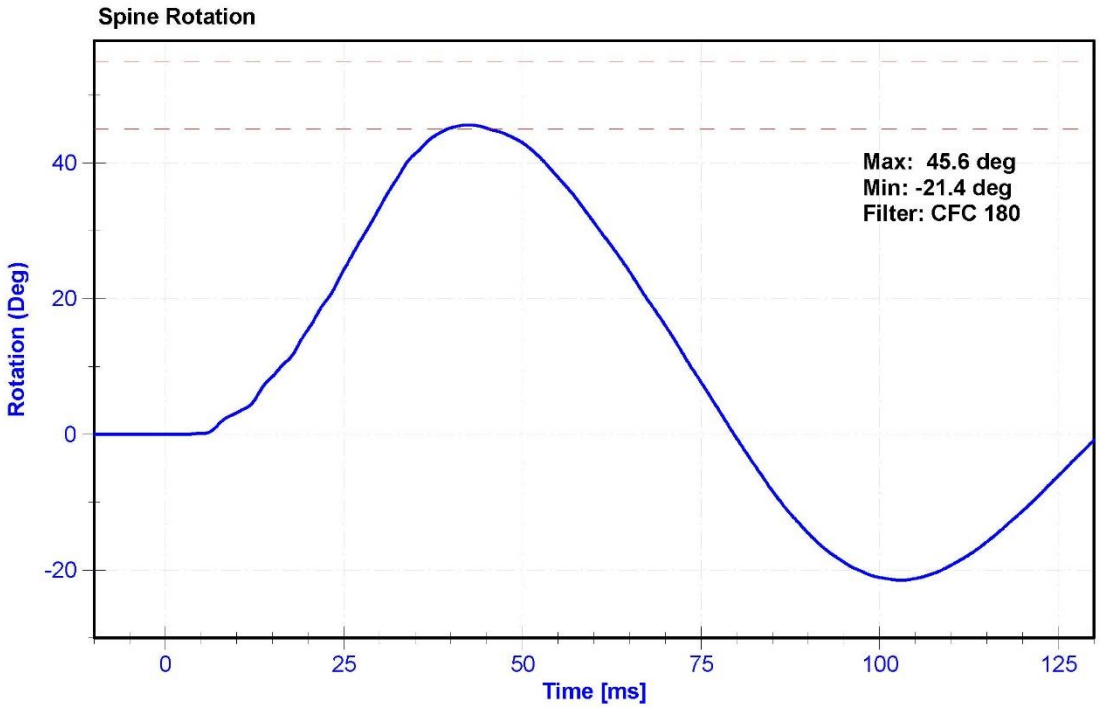
**Results**

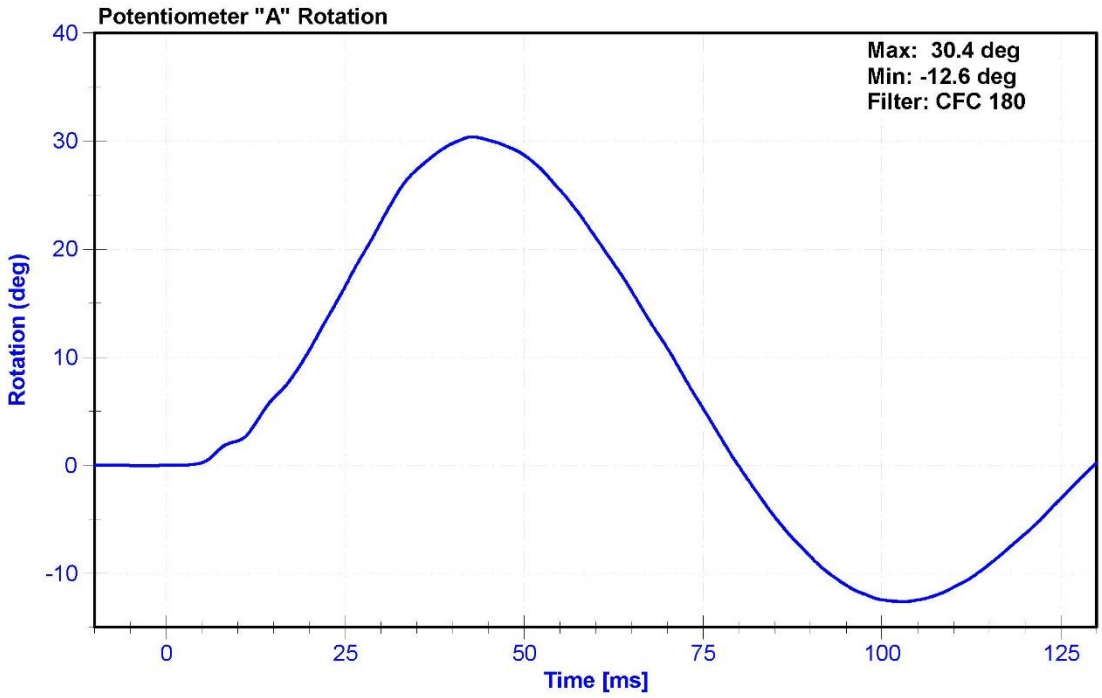
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 22.0 | Pass |
| Humidity | 10 | 70 | % | 19.1 | Pass |
| Velocity | 5.95 | 6.15 | m/s | 6.068 | Pass |
| Lateral Spine Rotation | 45 | 55 | deg | 45.6 | Pass |
| Time at Maximum Rotation | 39 | 53 | ms | 42.3 | Pass |
| Time of Decay to Zero Degrees | 37 | 57 | ms | 37.4 | Pass |
| Pulse within Corridor? | - | - | - | | |

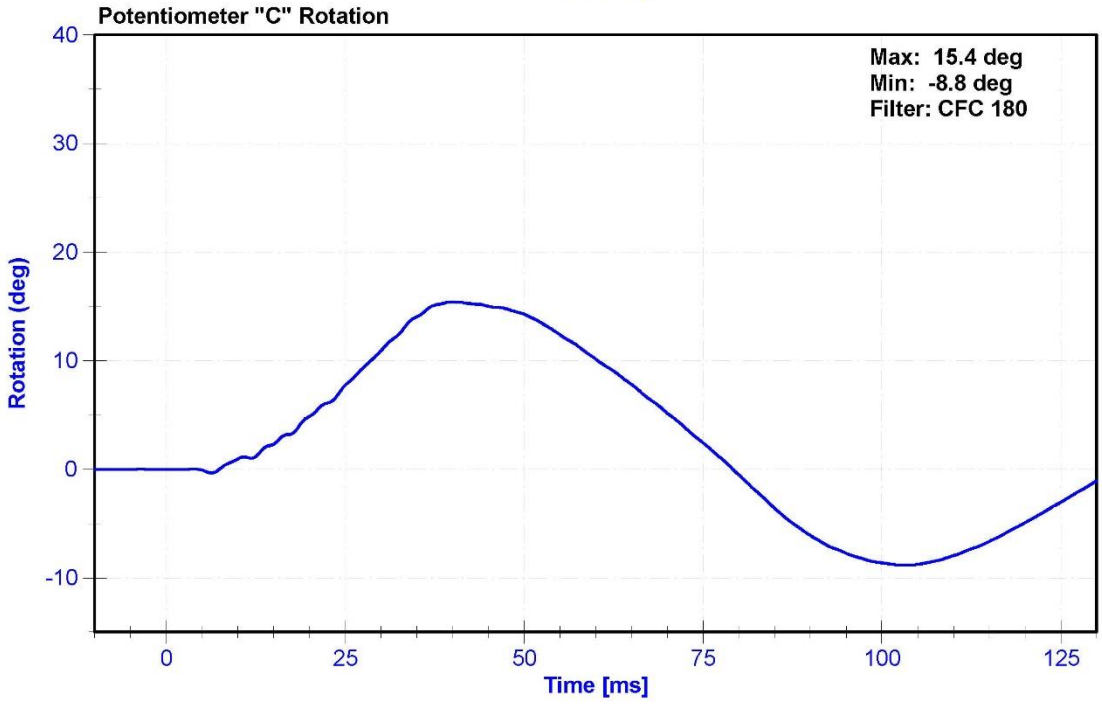
**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7231CT | AC-AH5F3 | 5/7/2015 | 5/6/2016 |
| Pendulum "A" Potentiometer | SP22G | DS-094 | 9/24/2015 | 9/23/2016 |
| Condyle "B" Potentiometer | SP22G | DS-095 | 9/24/2015 | 9/23/2016 |


Pendulum Velocity
Min: -7.3 m/s
Filter: CFC 60
Velocity (m/s)
0
-2
-4
-6
-8
0
5
10
15
20
25
30
Time [ms]


Spine Rotation
Max: 45.6 deg
Min: -21.4 deg
Filter: CFC 180
Rotation (Deg)
40
20
0
-20
0
25
50
75
100
125
Time [ms]


Potentiometer "A" Rotation
Max: 30.4 deg
Min: -12.6 deg
Filter: CFC 180
Rotation (deg)
40
30
20
10
0
-10
0
25
50
75
100
125
Time [ms]


Potentiometer "C" Rotation
Max: 15.4 deg
Min: -8.8 deg
Filter: CFC 180
Rotation (deg)
40
30
20
10
0
-10
0
25
50
75
100
125
Time [ms]

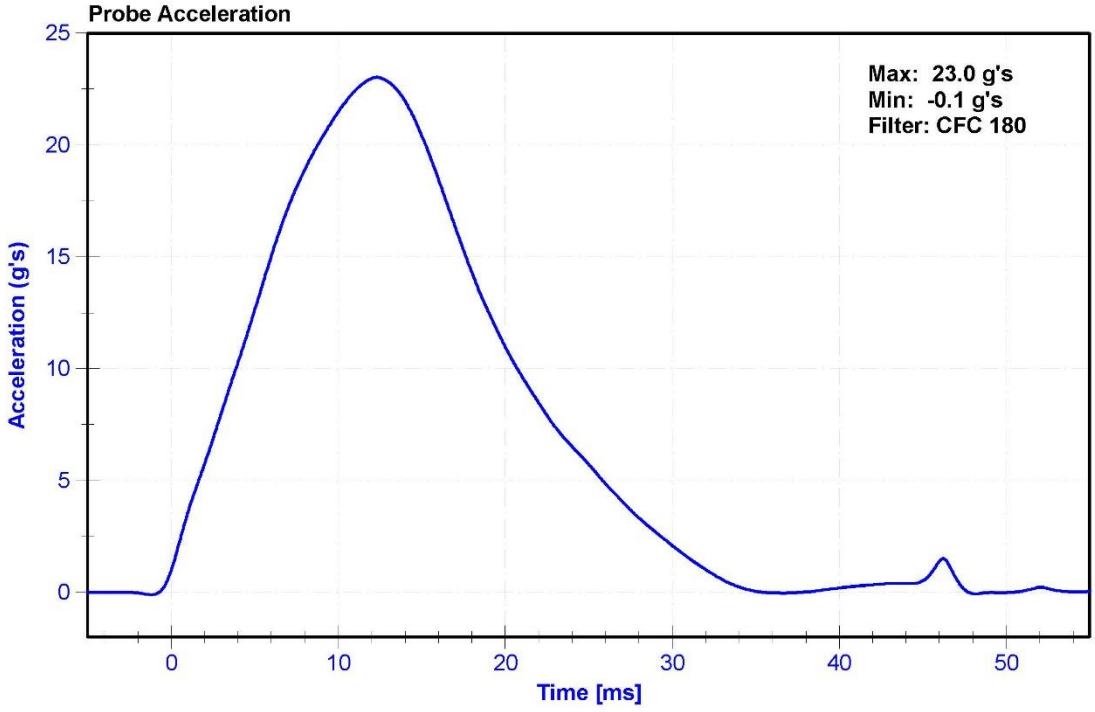
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M. Goehle |
| ATD Serial Number | F034 | Laboratory Supervisor | M. Goehle |

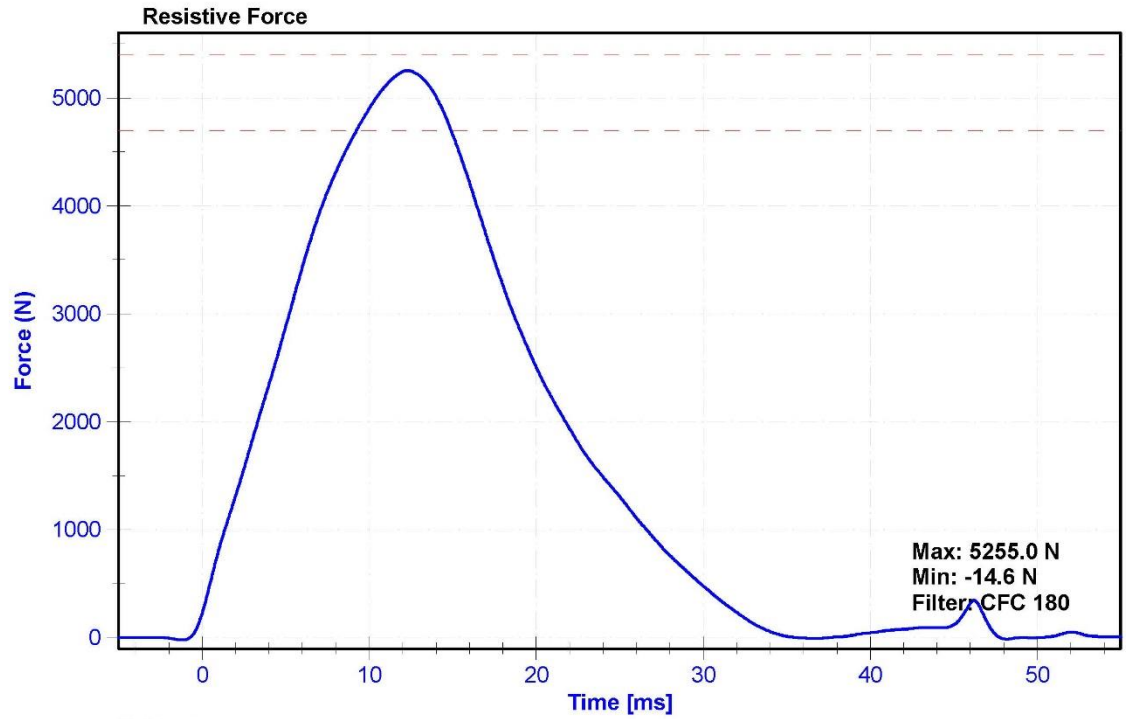
**Results**

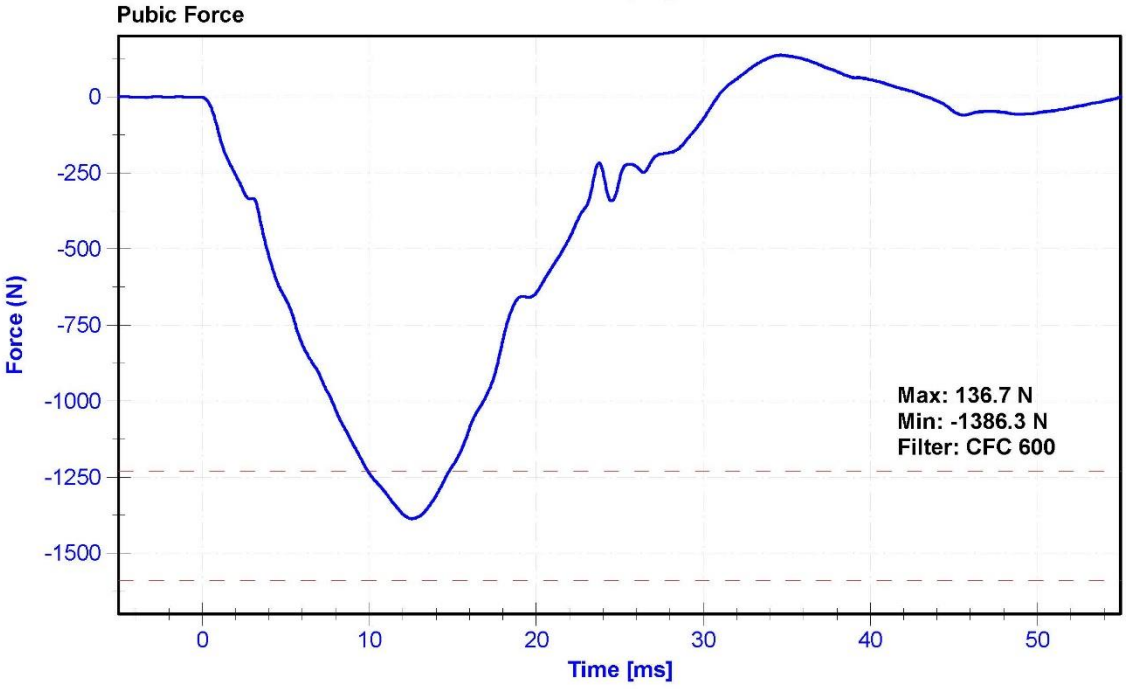
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 20.9 | Pass |
| Humidity | 10 | 70 | % | 31.2 | Pass |
| Velocity | 4.2 | 4.4 | m/s | 4.32 | Pass |
| Resistive Force | 4700 | 5400 | N | 5255.0 | Pass |
| Time at Peak Resistive Force | 11.8 | 16.1 | ms | 12.30 | Pass |
| Pubic Force | -1590 | -1230 | N | -1386.3 | Pass |
| Time at Peak Pubic Force | 12.2 | 17.0 | ms | 12.55 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7264CT | AC-P23155 | 1/13/2016 | 7/14/2016 |
| Pubic Load Cell | Denton 3096JFL | LC-465Fy | 6/25/2015 | 6/24/2016 |




Resistive Force
Force (N)
5000
4000
3000
2000
1000
0
0
10
20
30
40
50
Time [ms]
Max: 5255.0 N
Min: -14.6 N
Filter: CFC 180


Pubic Force
Force (N)
0
-250
-500
-750
-1000
-1250
-1500
0
10
20
30
40
50
Time [ms]
Max: 136.7 N
Min: -1386.3 N
Filter: CFC 600

**CALIBRATION TEST RESULTS**

**POST-TEST**

**SID-IIS 5TH PERCENTILE FEMALE - PASSENGER ATD**

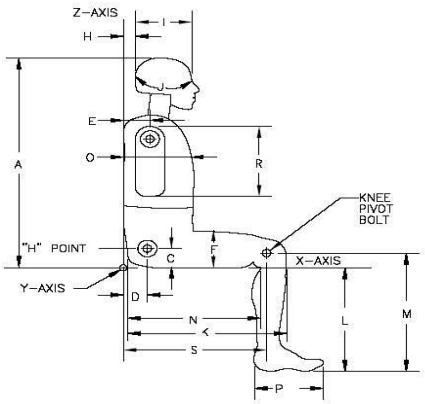
**SERIAL No: 303**

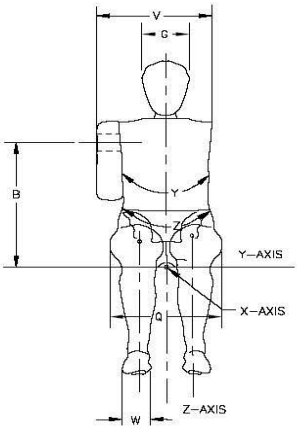
**(CONFIGURED FOR LEFT SIDE IMPACT)**

External Measurements - SID-IIs

Technician: M. Goehle  Date: 3/22/2016

Dummy Serial Number: 303




| Symbol | Description | Specification (mm) | | Result (mm) | Pass/Fail |
|---|---|---|---|---|---|
| A | Sitting Height | 772 | 788 | 781 | Pass |
| B | Shoulder Pivot Height | 437 | 453 | 443 | Pass |
| C | H-point Height | 79 | 89 | 86 | Pass |
| D | H-point from seatback | 141 | 151 | 147 | Pass |
| E | Shoulder Pivot from Backline | 97 | 107 | 103 | Pass |
| F | Thigh Clearance | 119 | 135 | 125 | Pass |
| G | Head Breadth | 140 | 148 | 143 | Pass |
| H | Head Back from Backline | 40 | 46 | 44 | Pass |
| I | Head Depth | 178 | 188 | 181 | Pass |
| J | Head Circumference | 541 | 551 | 546 | Pass |
| K | Buttock to Knee Length | 514 | 540 | 530 | Pass |
| L | Popliteal Height | 343 | 369 | 352 | Pass |
| M | Knee Pivot to floor height | 392 | 409 | 400 | Pass |
| N | Buttock Popliteal Length | 416 | 442 | 438 | Pass |
| O | Chest Depth w/o jacket | 195 | 211 | 206 | Pass |
| P | Foot Length | 216 | 232 | 219 | Pass |
| Q | Hip Breadth (w/pelvic plugs) | 313 | 323 | 320 | Pass |
| R | Arm Length | 249 | 259 | 253 | Pass |
| S | Knee Joint to seatback | 477 | 493 | 488 | Pass |
| V | Shoulder Width | 341 | 357 | 350 | Pass |
| W | Foot Width | 78 | 94 | 85 | Pass |
| Y | Chest Circumference w/jacket | 851 | 881 | 871 | Pass |
| Z | Waist Circumference | 761 | 791 | 771 | Pass |

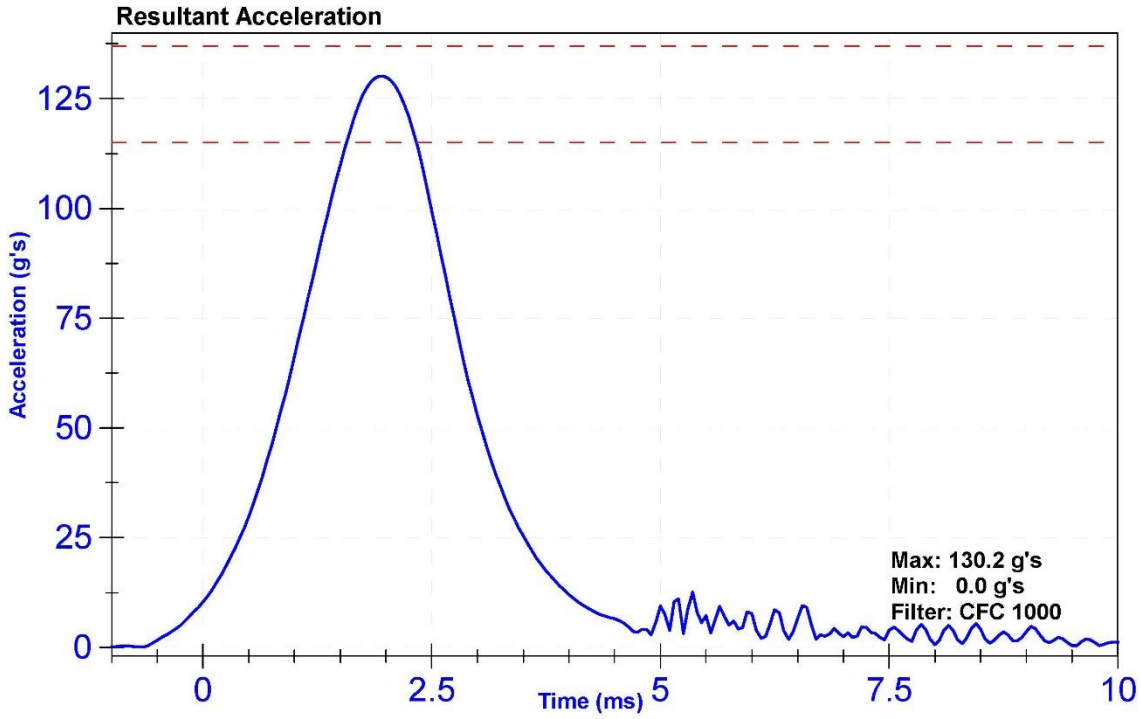
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M. Goehle |
| ATD Serial Number | 303 | Laboratory Supervisor | M. Goehle |

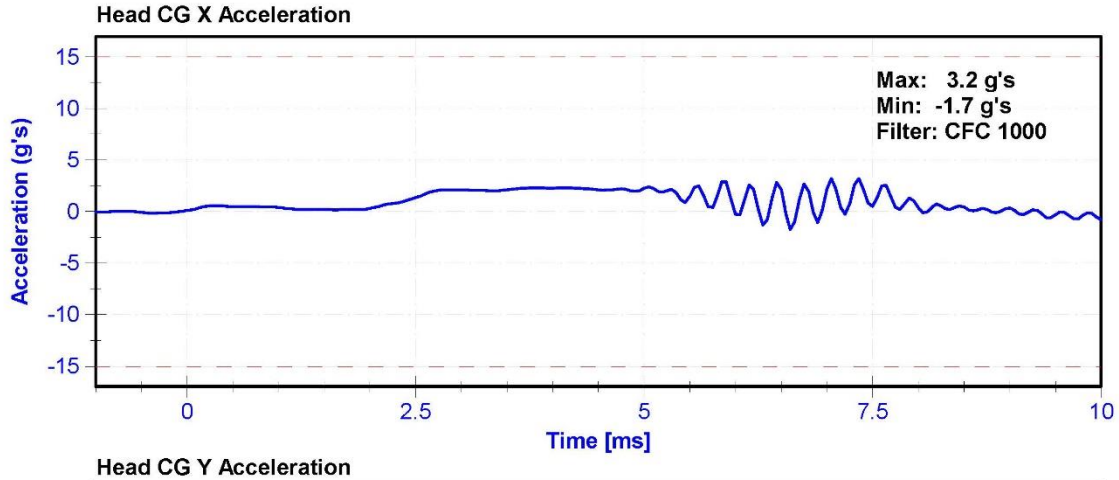
**Results**

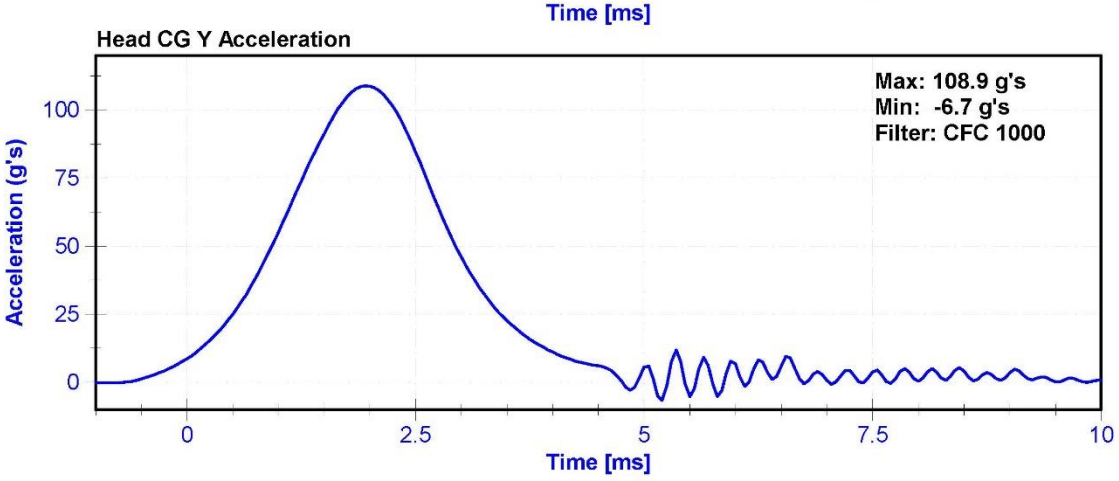
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.9 | Pass |
| Humidity | 10 | 70 | % | 30 | Pass |
| Resultant Acceleration | 115 | 137 | g's | 130.2 | Pass |
| Oscillation | 0 | 15 | % | 9.6 | Pass |
| Fore-Aft Acceleration | -15 | 15 | g's | 3.2 | Pass |

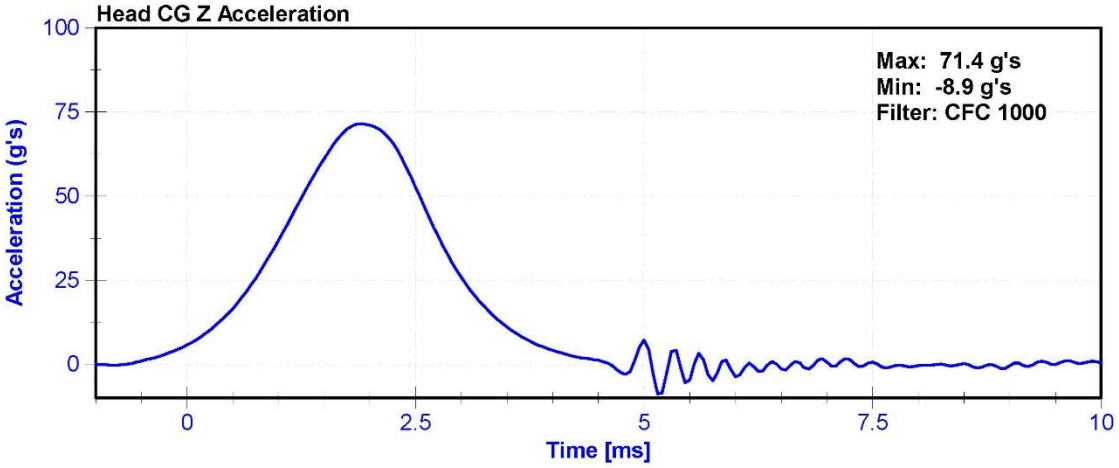
**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| X Accelerometer | ENDEVCO 7264 | AC-P83420 | 10/16/2015 | 4/15/2016 |
| Y Accelerometer | ENDEVCO 7264 | AC-P52040 | 10/14/2015 | 4/13/2016 |
| Z Accelerometer | ENDEVCO 7264CT | AC-P58737 | 10/14/2015 | 4/13/2016 |




Head CG X Acceleration
Max: 3.2 g's
Min: -1.7 g's
Filter: CFC 1000
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]


Head CG Y Acceleration
Max: 108.9 g's
Min: -6.7 g's
Filter: CFC 1000
Acceleration (g's)
100
75
50
25
0
0
2.5
5
7.5
10
Time [ms]


Head CG Z Acceleration
Max: 71.4 g's
Min: -8.9 g's
Filter: CFC 1000
Acceleration (g's)
100
75
50
25
0
0
2.5
5
7.5
10
Time [ms]

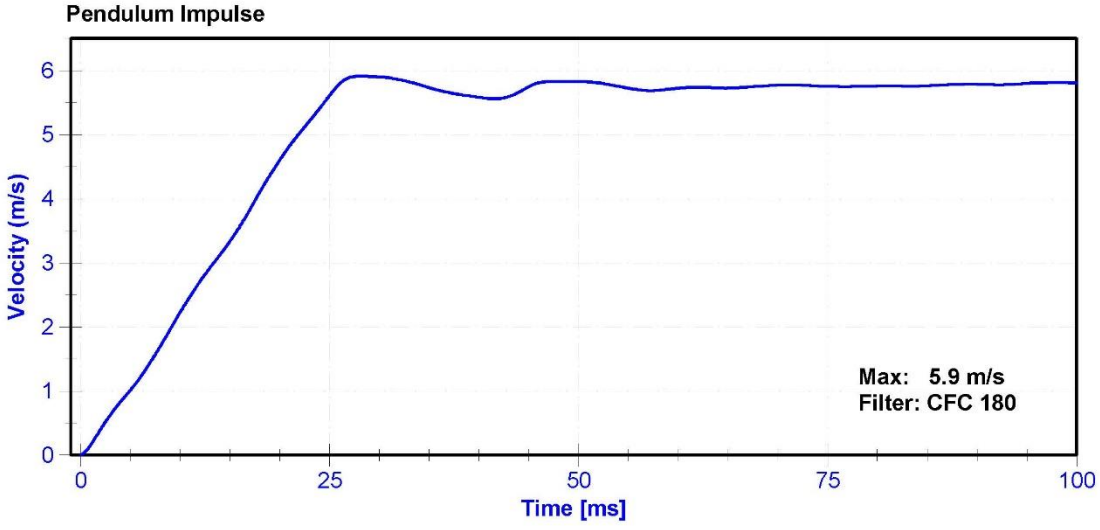
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M. Goehle |
| ATD Serial Number | 303 | Laboratory Supervisor | M. Goehle |

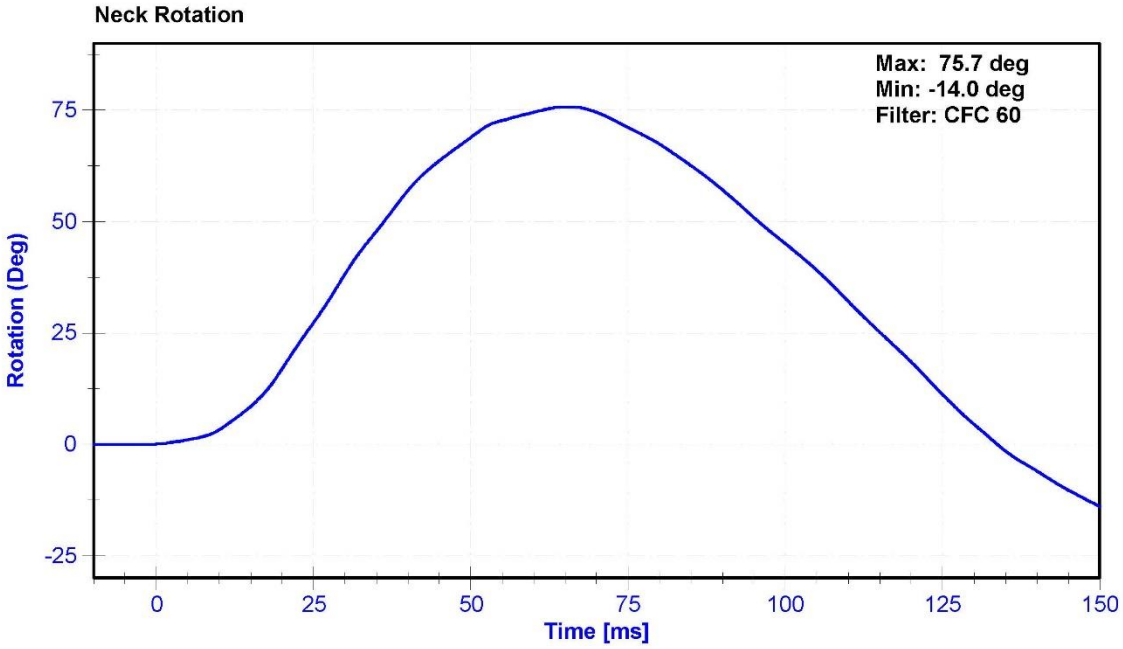
**Results**

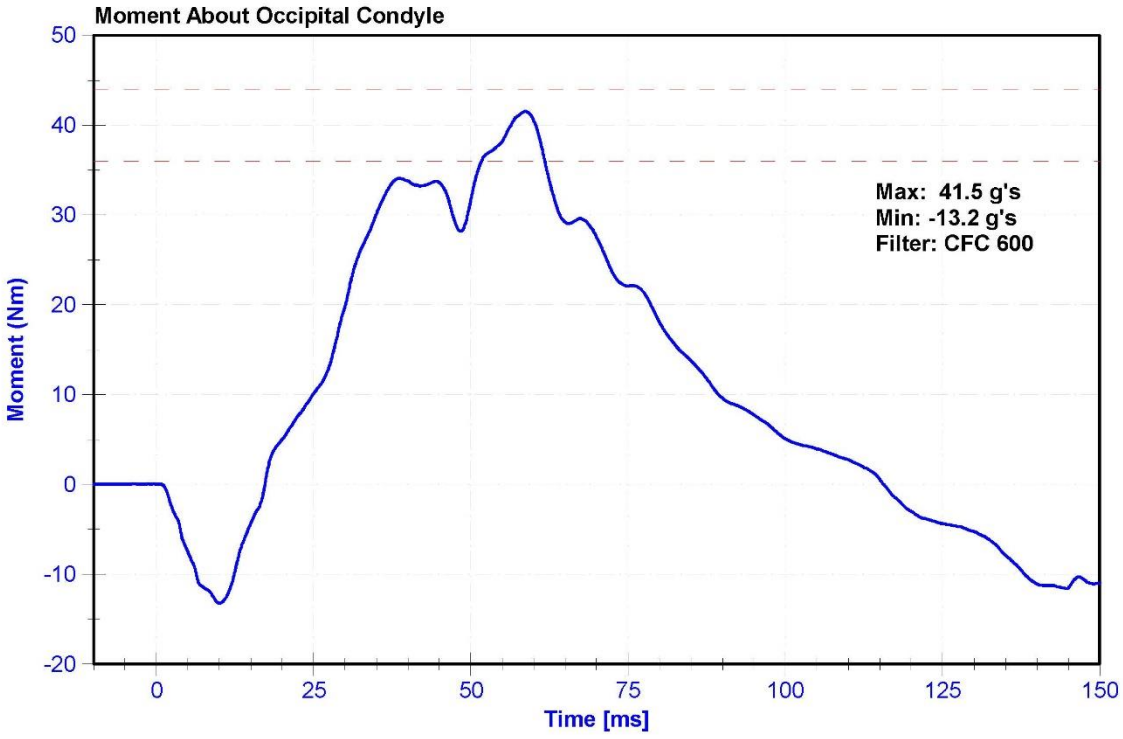
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.5 | Pass |
| Humidity | 10 | 70 | % | 29.6 | Pass |
| Velocity | 5.51 | 5.63 | m/s | 5.620 | Pass |
| Pendulum Impulse at 10ms | 2.2 | 2.8 | m/s | 2.23 | Pass |
| Pendulum Impulse at 15ms | 3.3 | 4.1 | m/s | 3.33 | Pass |
| Pendulum Impulse at 20ms | 4.4 | 5.4 | m/s | 4.61 | Pass |
| Pendulum Impulse at 25ms | 5.4 | 6.1 | m/s | 5.61 | Pass |
| Pendulum Impulse from 25 to 100ms | 5.5 | 6.2 | m/s | 5.92 | Pass |
| Neck Rotation | 71 | 81 | deg | 75.7 | Pass |
| Time at Maximum Rotation | 50 | 70 | ms | 65.3 | Pass |
| Moment about the OC | 36 | 44 | Nm | 41.5 | Pass |
| Moment Decay to 0 Nm | 102 | 126 | ms | 115.6 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7231CT | AC-AH5F3 | 5/7/2015 | 5/6/2016 |
| Pendulum Potentiometer | Denton 78051-342 | DS-185Pend | 9/25/2015 | 9/24/2016 |
| Condyle Potentiometer | Denton 78051-342 | DS-174Pend | 9/24/2015 | 9/23/2016 |
| Upper Neck Load Cell | Denton 1716A | LC-2019Fy | 6/29/2015 | 6/28/2016 |




Neck Rotation
Max: 75.7 deg
Min: -14.0 deg
Filter: CFC 60
Rotation (Deg)
75
50
25
0
-25
0
25
50
75
100
125
150
Time [ms]


Moment About Occipital Condyle
Max: 41.5 g's
Min: -13.2 g's
Filter: CFC 600
Moment (Nm)
50
40
30
20
10
0
-10
-20
0
25
50
75
100
125
150
Time [ms]

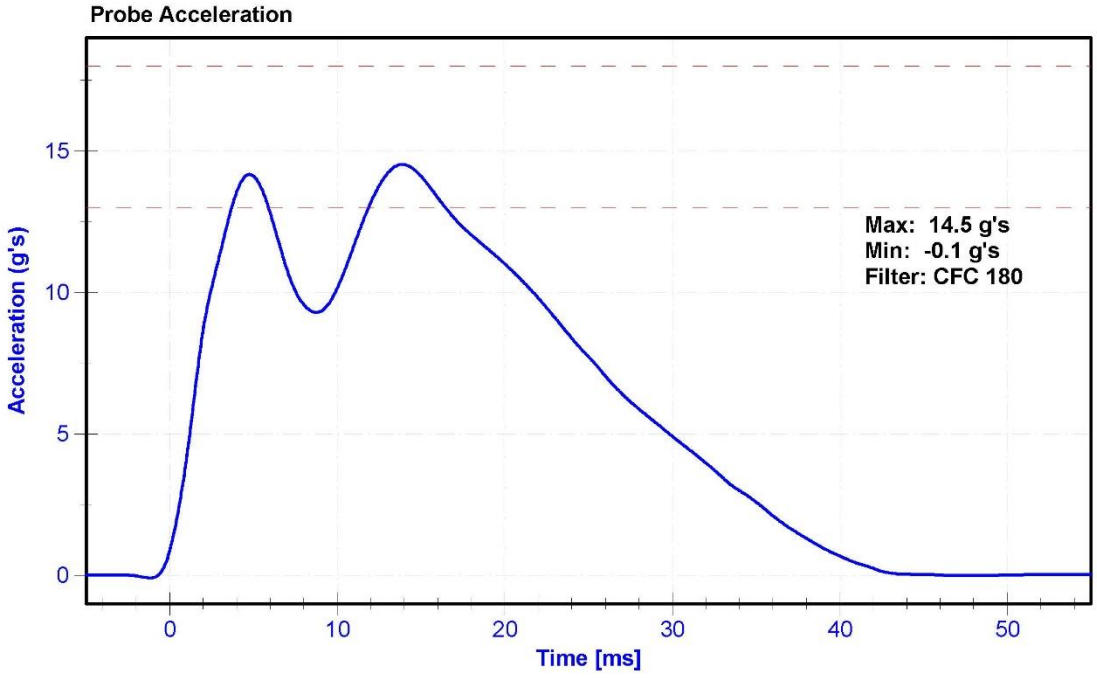
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M. Goehle |
| ATD Serial Number | 303 | Laboratory Supervisor | M. Goehle |

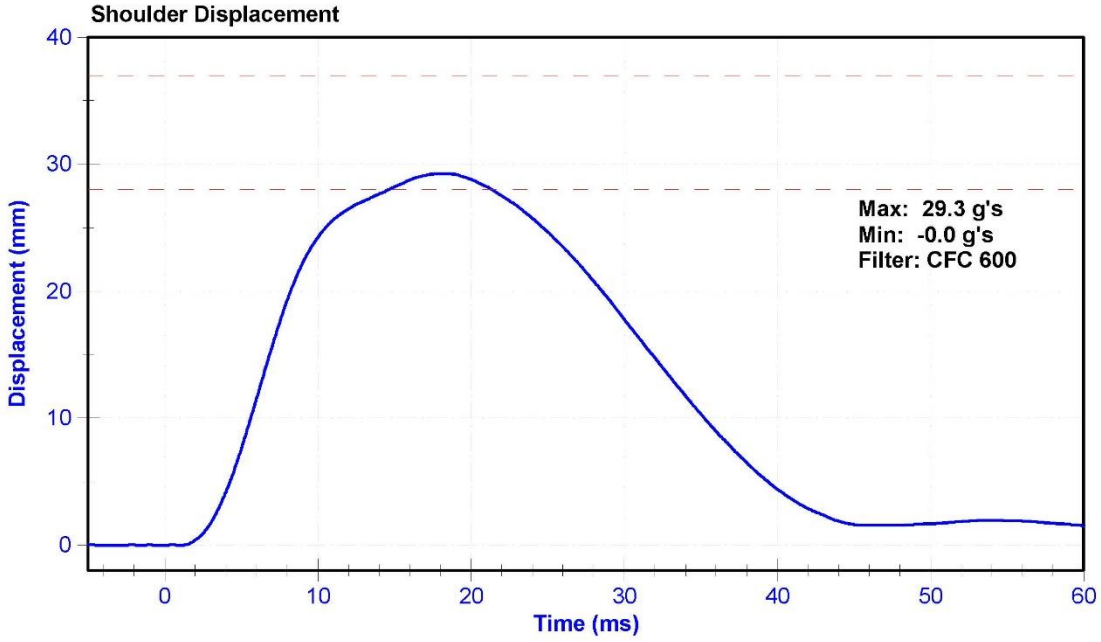
**Results**

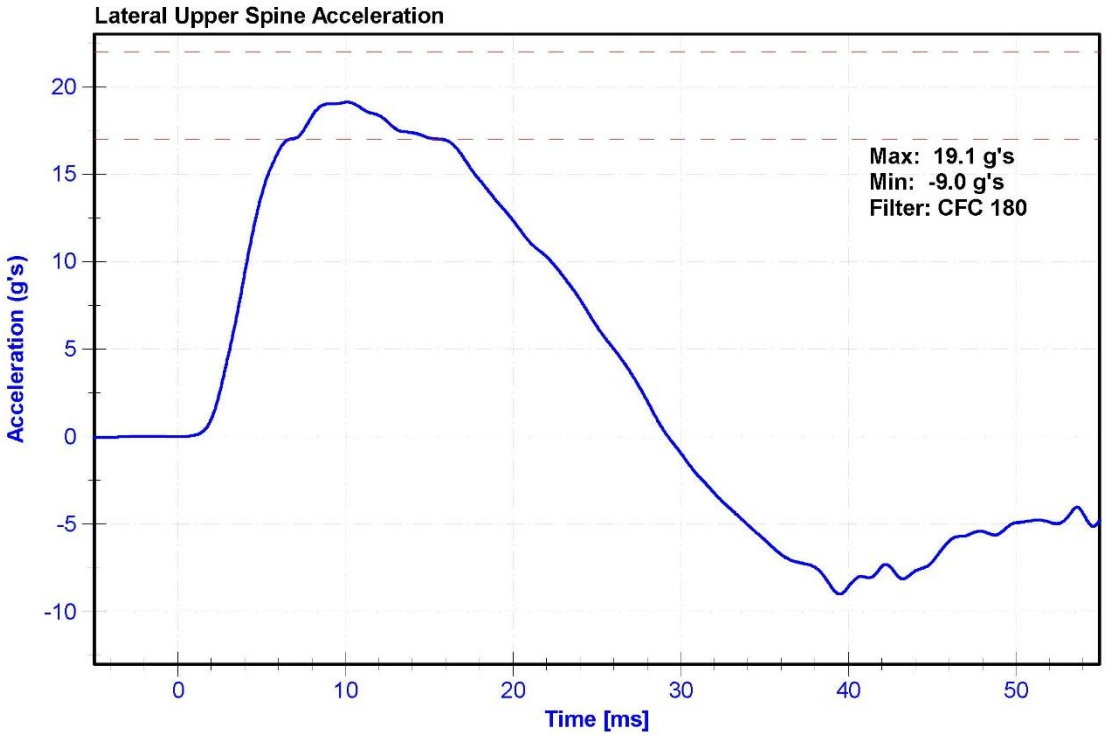
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.6 | Pass |
| Humidity | 10 | 70 | % | 27.5 | Pass |
| Velocity | 4.2 | 4.4 | m/s | 4.34 | Pass |
| Probe Acceleration | 13 | 18 | g's | 14.5 | Pass |
| Shoulder Deflection | 28 | 37 | mm | 29.3 | Pass |
| Lateral Upper Spine Acceleration | 17 | 22 | g's | 19.1 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7264CT | AC-P23155 | 1/13/2016 | 7/14/2016 |
| Shoulder Potentiometer | Servo 08TC1-3725 | DS-008GFE | 10/19/2015 | 10/18/2016 |
| Upper Spine Y Accelerometer | ENDEVCO 7264CT | AC-P63315 | 10/19/2015 | 4/18/2016 |




Shoulder Displacement
Displacement (mm)
Time (ms)
Max: 29.3 g's
Min: -0.0 g's
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 19.1 g's
Min: -9.0 g's
Filter: CFC 180

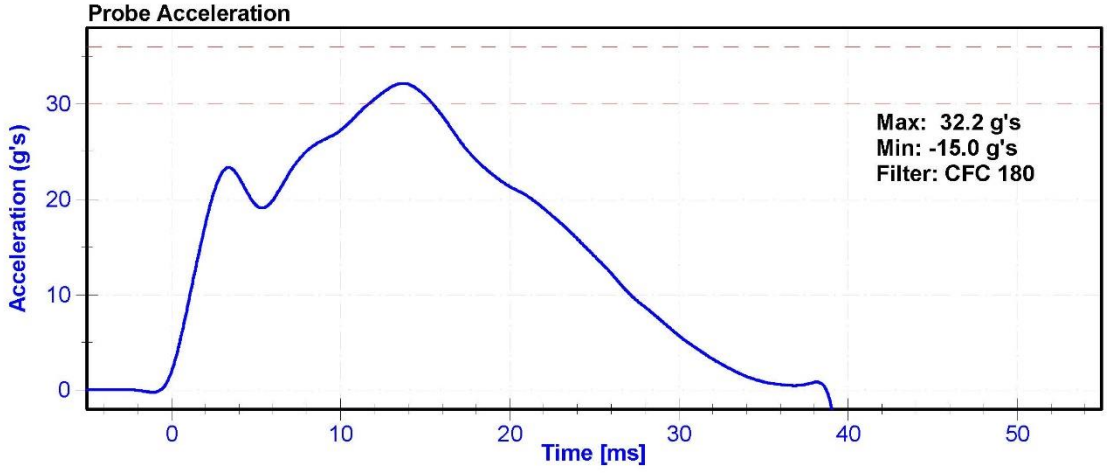
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M. Goehle |
| ATD Serial Number | 303 | Laboratory Supervisor | M. Goehle |

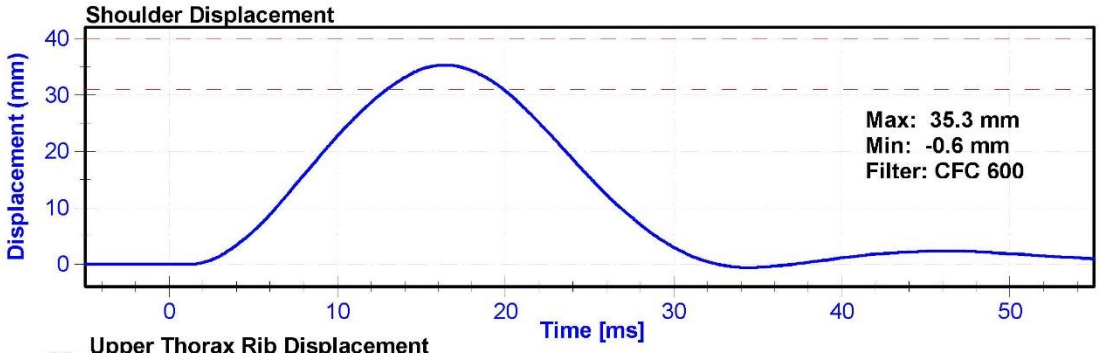
**Results**

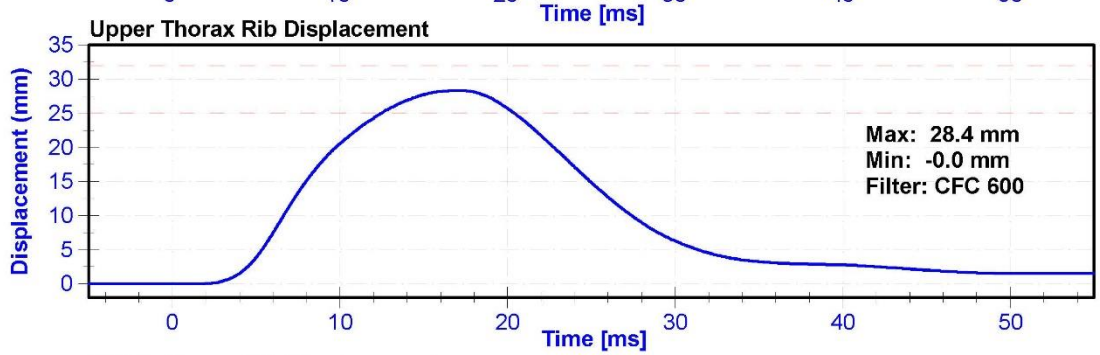
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.7 | Pass |
| Humidity | 10 | 70 | % | 30.2 | Pass |
| Velocity | 6.6 | 6.8 | m/s | 6.70 | Pass |
| Probe Acceleration after 5 ms | 30 | 36 | g's | 32.2 | Pass |
| Lateral Upper Spine Acceleration | 34 | 43 | g's | 39.3 | Pass |
| Lateral Lower Spine Acceleration | 29 | 37 | g's | 33.3 | Pass |
| Shoulder Deflection | 31 | 40 | mm | 35.3 | Pass |
| Upper Thorax Rib Deflection | 25 | 32 | mm | 28.4 | Pass |
| Mid Thorax Rib Deflection | 30 | 36 | mm | 32.6 | Pass |
| Lower Thorax Rib Deflection | 32 | 38 | mm | 34.4 | Pass |

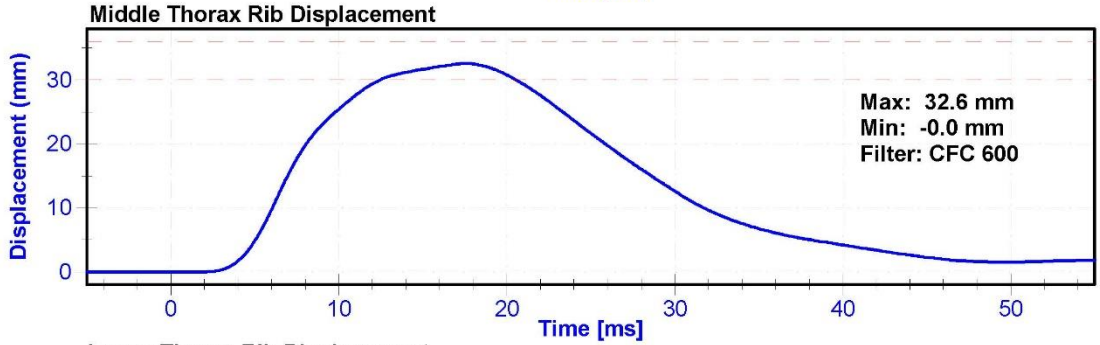
**Transducer Calibrations**

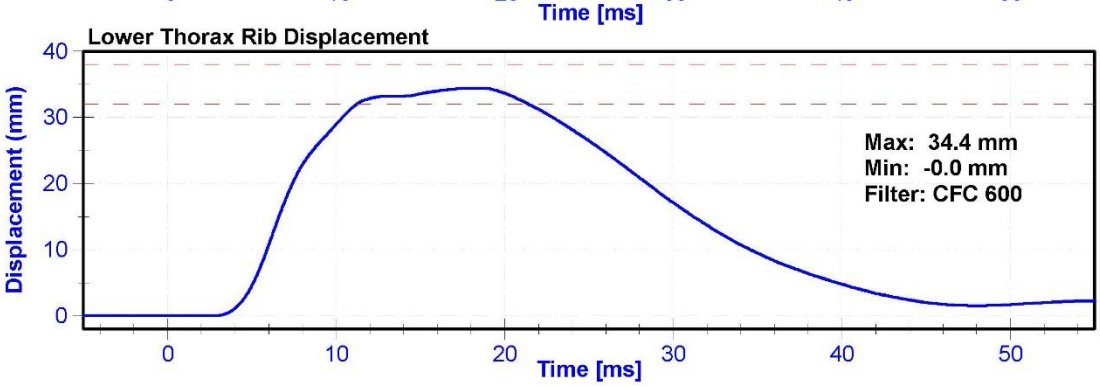
| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7264CT | AC-P23155 | 1/13/2016 | 7/14/2016 |
| Upper Spine T1 Y Accelerometer | ENDEVCO 7264CT | AC-P63315 | 10/19/2015 | 4/18/2016 |
| Upper Spine T12 Y Accelerometer | ENDEVCO 7264CT | AC-P51974 | 10/19/2015 | 4/18/2016 |
| Shoulder Potentiometer | Servo 08TC1-3725 | DS-008GFE | 10/19/2015 | 10/18/2016 |
| Upper Thorax Rib Potentiometer | Servo 08CT1-3725 | DS-1199GFE | 10/19/2015 | 10/18/2016 |
| Middle Thorax Rib Potentiometer | Servo 08CT1-3725 | DS-1246GFE | 10/19/2015 | 10/18/2016 |
| Lower Thorax Rib Potentiometer | Servo 08CT1-3725 | DS-1256GFE | 10/19/2015 | 10/18/2016 |

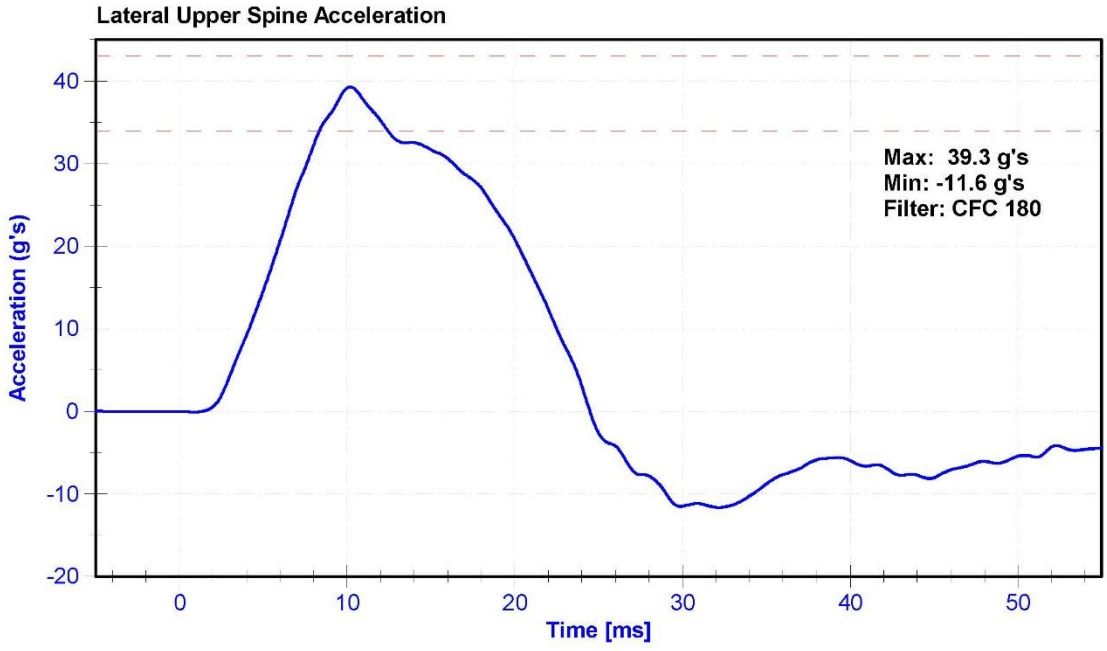


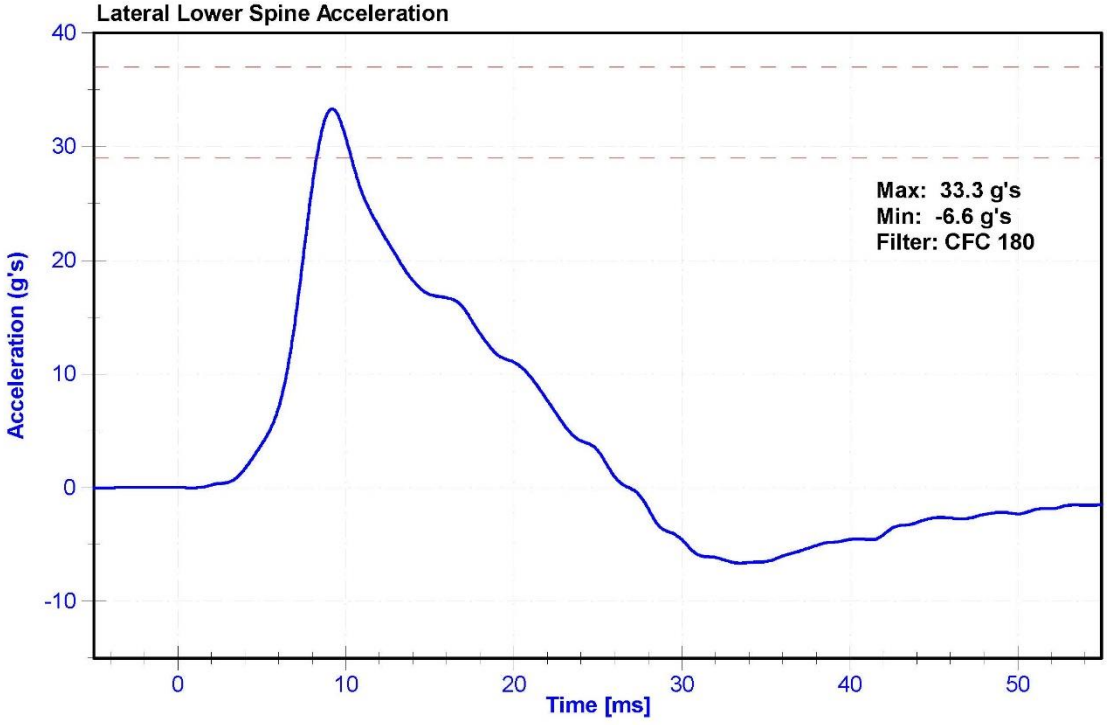

Shoulder Displacement
Displacement (mm)
Time [ms]
Max: 35.3 mm
Min: -0.6 mm
Filter: CFC 600


Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 28.4 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 32.6 mm
Min: -0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 34.4 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 39.3 g's
Min: -11.6 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
40
30
20
10
0
-10
-20
0
10
20
30
40
50


Lateral Lower Spine Acceleration
Max: 33.3 g's
Min: -6.6 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
40
30
20
10
0
-10
0
10
20
30
40
50

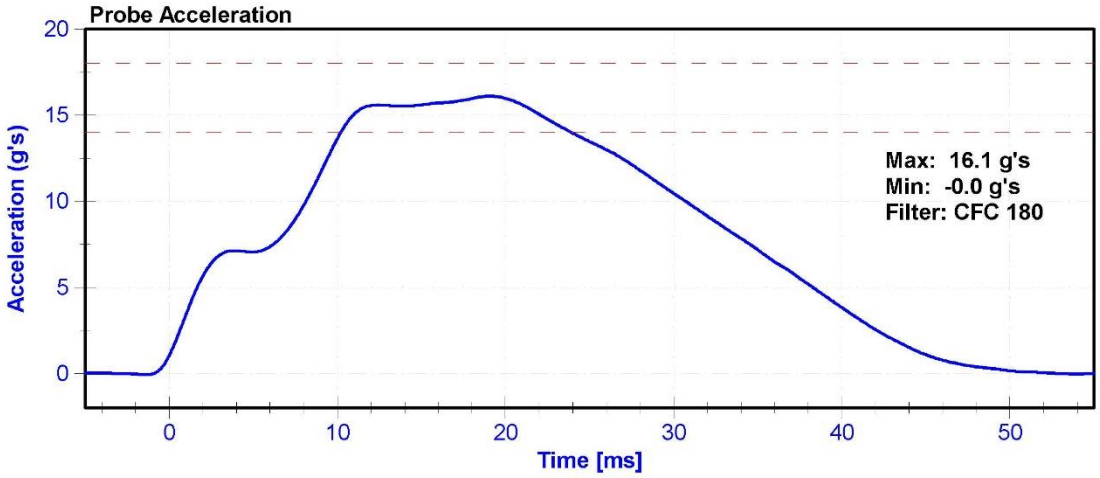
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M. Goehle |
| ATD Serial Number | 303 | Laboratory Supervisor | M. Goehle |

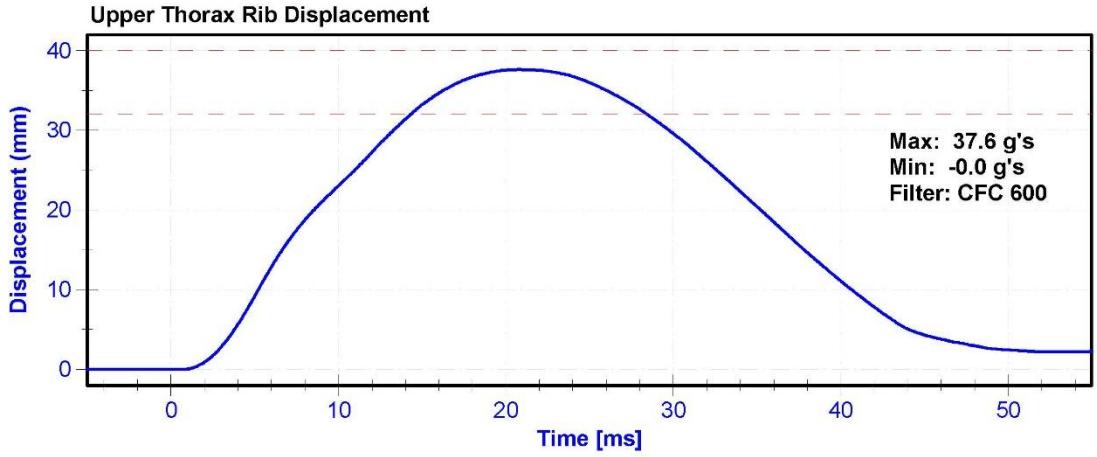
**Results**

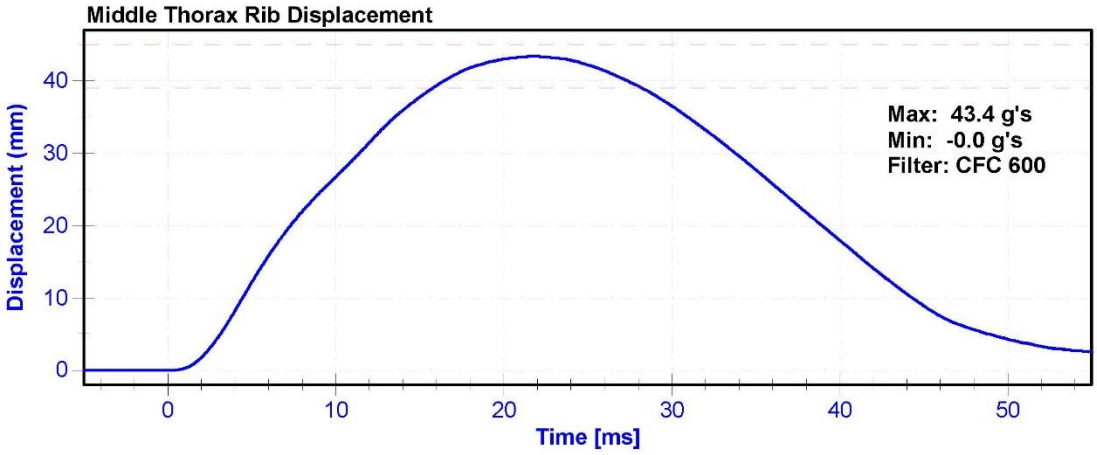
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.8 | Pass |
| Humidity | 10 | 70 | % | 27.5 | Pass |
| Velocity | 4.2 | 4.4 | m/s | 4.35 | Pass |
| Probe Acceleration | 14 | 18 | g's | 16.1 | Pass |
| Lateral Upper Spine Acceleration | 13 | 17 | g's | 16.2 | Pass |
| Lateral Lower Spine Acceleration | 7 | 11 | g's | 9.7 | Pass |
| Upper Thorax Rib Deflection | 32 | 40 | mm | 37.6 | Pass |
| Middle Thorax Rib Deflection | 39 | 45 | mm | 43.4 | Pass |
| Lower Thorax Rib Deflection | 35 | 43 | mm | 41.1 | Pass |

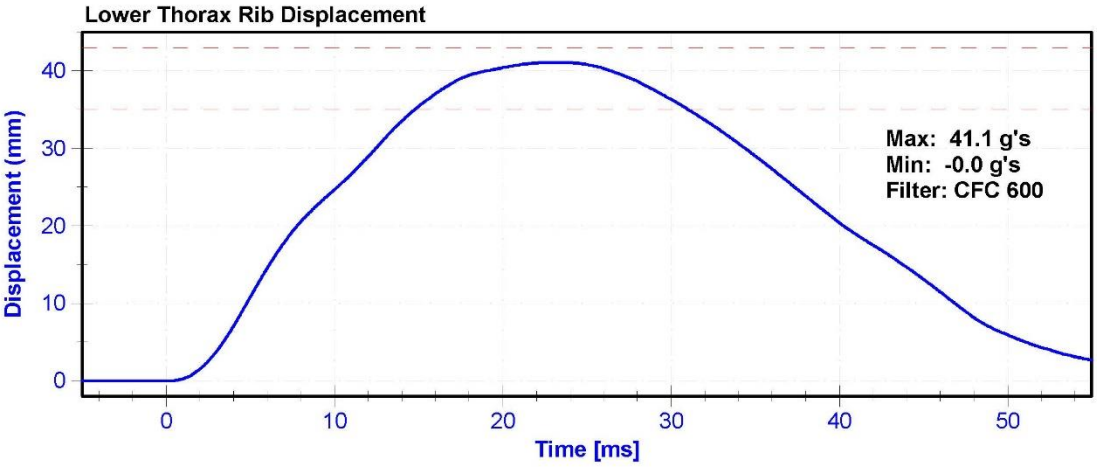
**Transducer Calibrations**

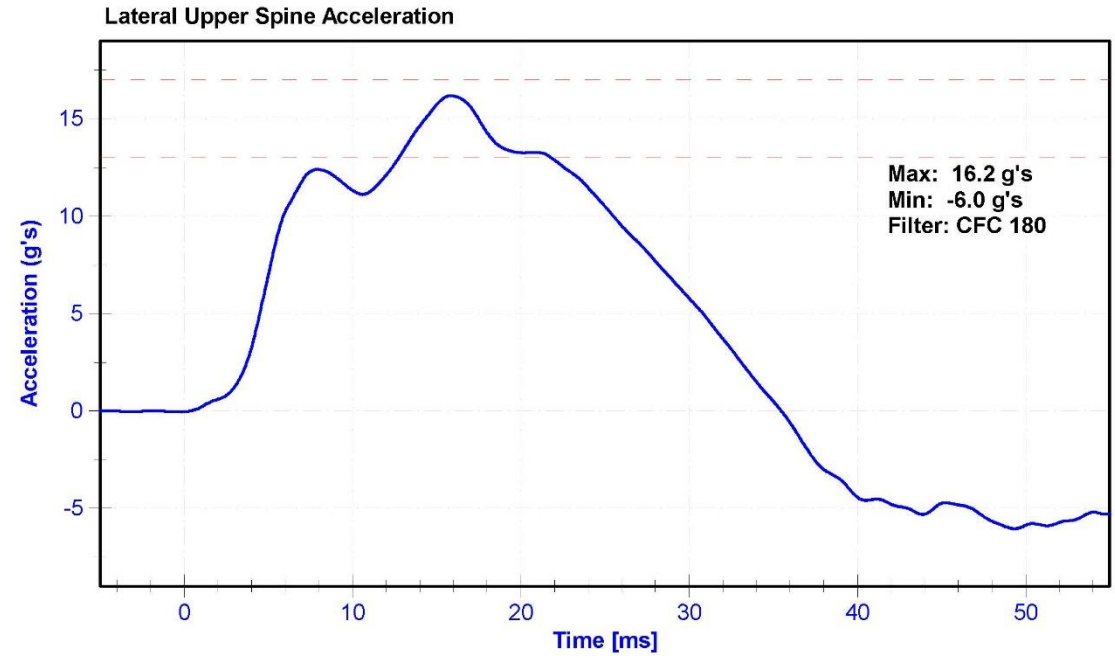
| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7264CT | AC-P23155 | 1/13/2016 | 7/14/2016 |
| Upper Spine Y Accelerometer | ENDEVCO 7264CT | AC-P63315 | 10/19/2015 | 4/18/2016 |
| Lower Spine Y Accelerometer | ENDEVCO 7264CT | AC-P51974 | 10/19/2015 | 4/18/2016 |
| Upper Thorax Rib Potentiometer | Servo 08CT1-3725 | DS-1199GFE | 10/19/2015 | 10/18/2016 |
| Middle Thorax Rib Potentiometer | Servo 08CT1-3725 | DS-1246GFE | 10/19/2015 | 10/18/2016 |
| Lower Thorax Rib Potentiometer | Servo 08CT1-3725 | DS-1256GFE | 10/19/2015 | 10/18/2016 |

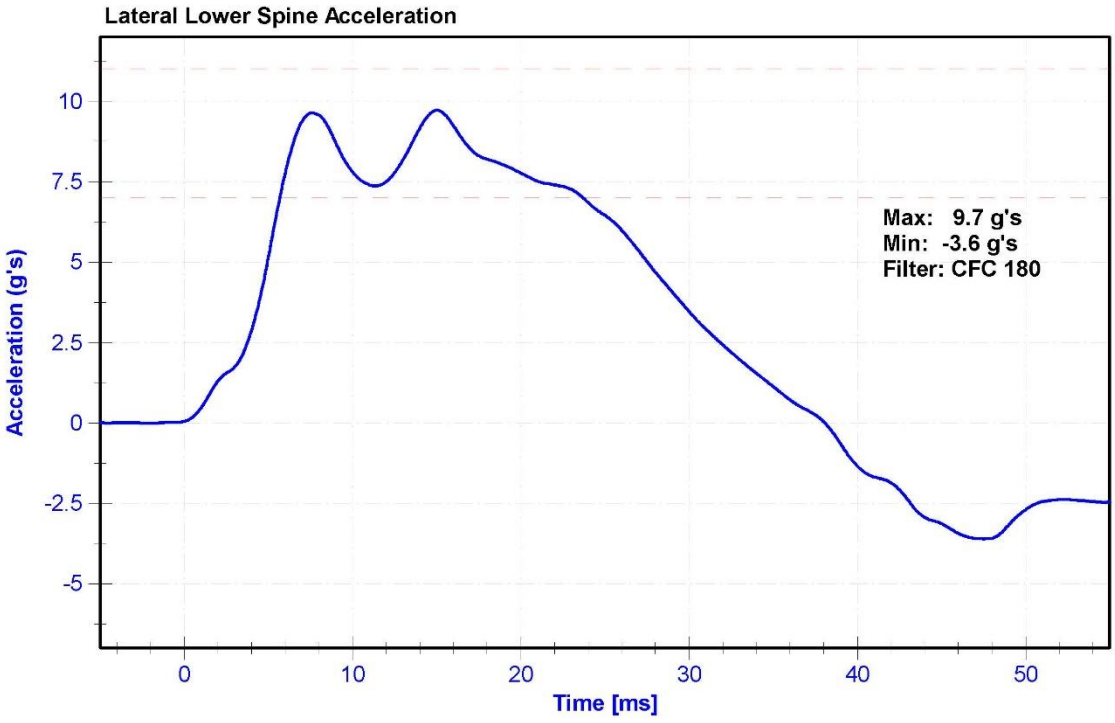



Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 37.6 g's
Min: -0.0 g's
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 43.4 g's
Min: -0.0 g's
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 41.1 g's
Min: -0.0 g's
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 16.2 g's
Min: -6.0 g's
Filter: CFC 180
Acceleration (g's)
15
10
5
0
-5
0
10
20
30
40
50
Time [ms]


Lateral Lower Spine Acceleration
Max: 9.7 g's
Min: -3.6 g's
Filter: CFC 180
Acceleration (g's)
10
7.5
5
2.5
0
-2.5
-5
0
10
20
30
40
50
Time [ms]

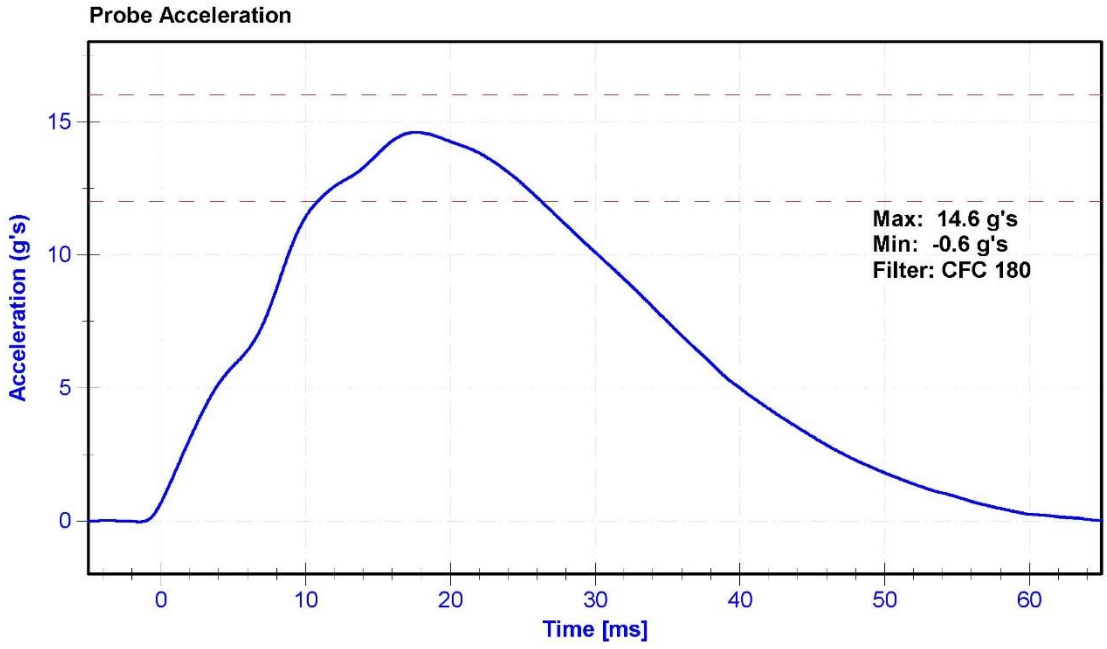
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M.Hartung |
| ATD Serial Number | 303 | Laboratory Supervisor | M.Goehle |

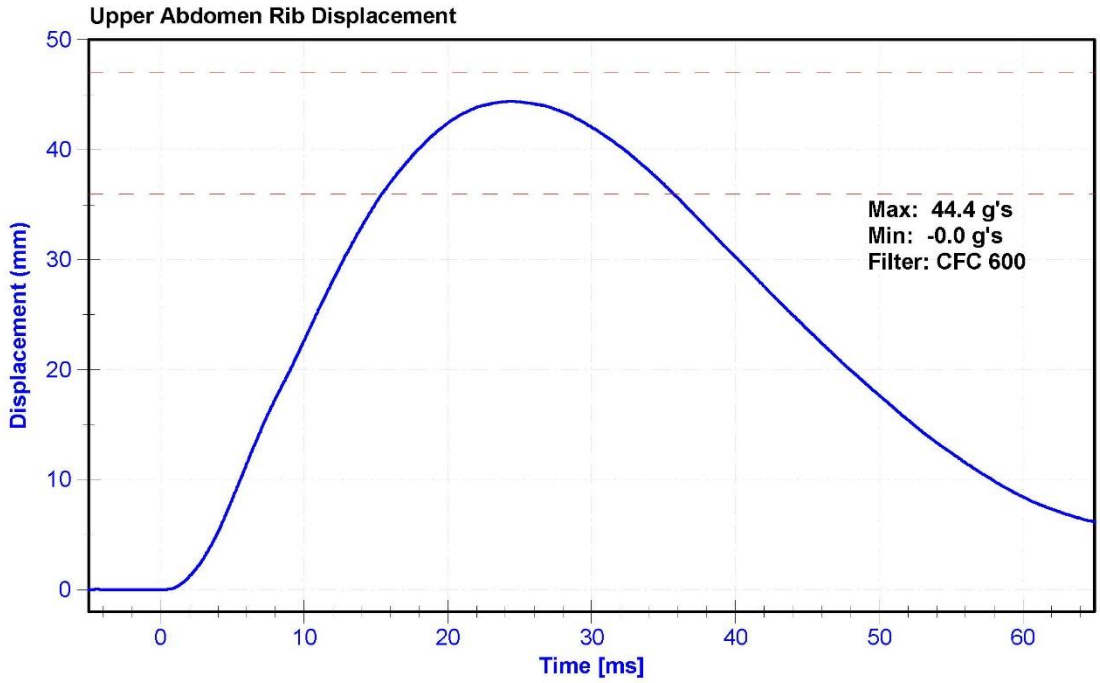
**Results**

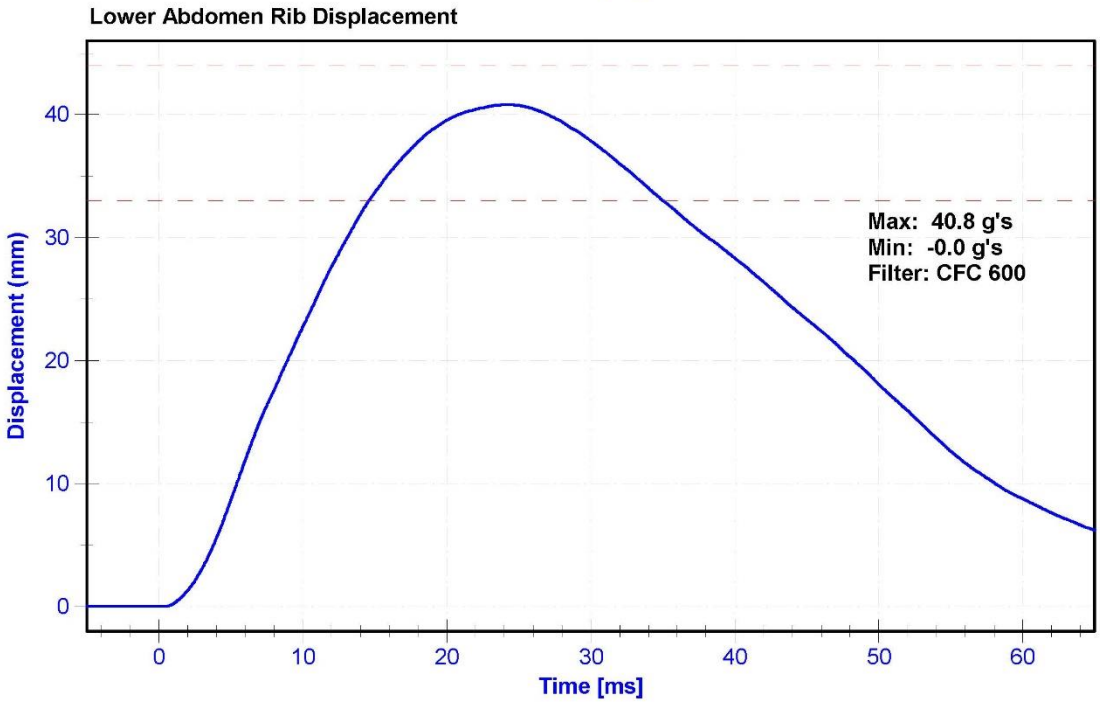
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.6 | Pass |
| Humidity | 10 | 70 | % | 28.4 | Pass |
| Velocity | 4.2 | 4.4 | m/s | 4.35 | Pass |
| Probe Acceleration | 12 | 16 | g's | 14.6 | Pass |
| Lateral Lower Spine Acceleration | 9 | 14 | g's | 10.7 | Pass |
| Upper Abdomen Rib Deflection | 36 | 47 | mm | 44.4 | Pass |
| Lower Abdomen Rib Deflection | 33 | 44 | mm | 40.8 | Pass |

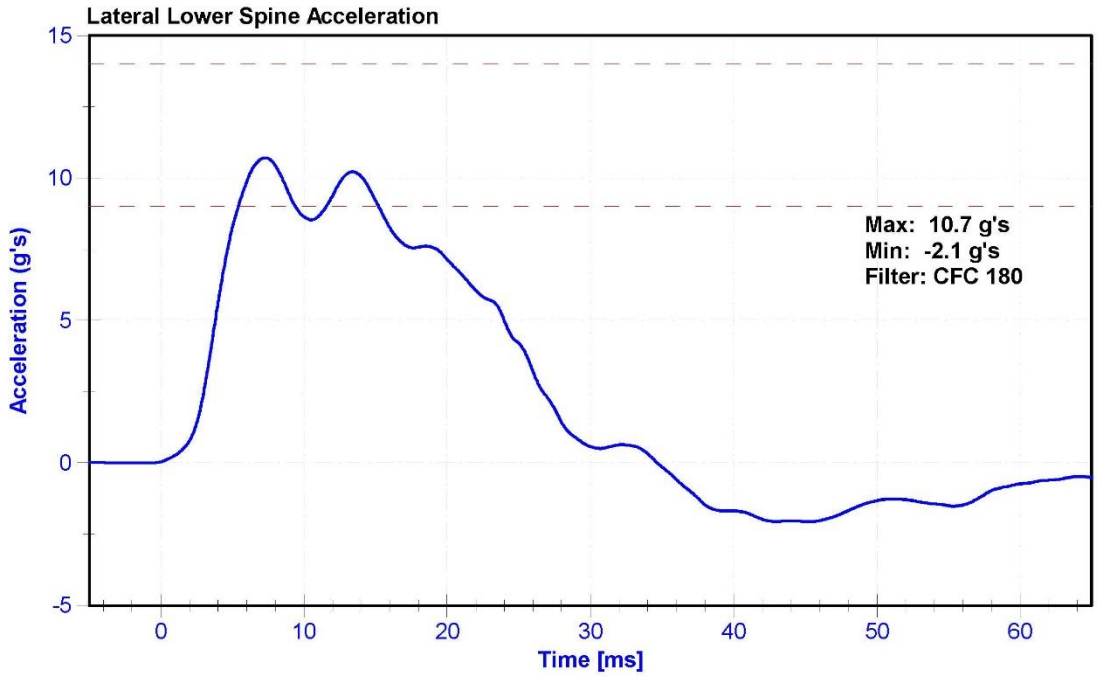
**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibratio Date | Calibration Due Date |
|---|---|---|---|---|
| Probe Accelerometer | ENDEVCO 7264CT | AC-P23155 | 1/13/2016 | 7/14/2016 |
| Lower Spine Y Accelerometer | ENDEVCO 7264CT | AC-P51974 | 10/19/2015 | 4/18/2016 |
| Upper Abdomen Rib Potentiometer | Servo 08CT1-3725 | DS-1274GFE | 10/19/2015 | 10/18/2016 |
| Lower Abdomen Rib Potentiometer | Servo 08CT1-3745 | DS-2316GFE | 10/28/2015 | 10/27/2016 |




Upper Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 44.4 g's
Min: -0.0 g's
Filter: CFC 600


Lower Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 40.8 g's
Min: -0.0 g's
Filter: CFC 600


Lateral Lower Spine Acceleration
Acceleration (g's)
15
10
5
0
-5
0
10
20
30
40
50
60
Time [ms]
Max: 10.7 g's
Min: -2.1 g's
Filter: CFC 180

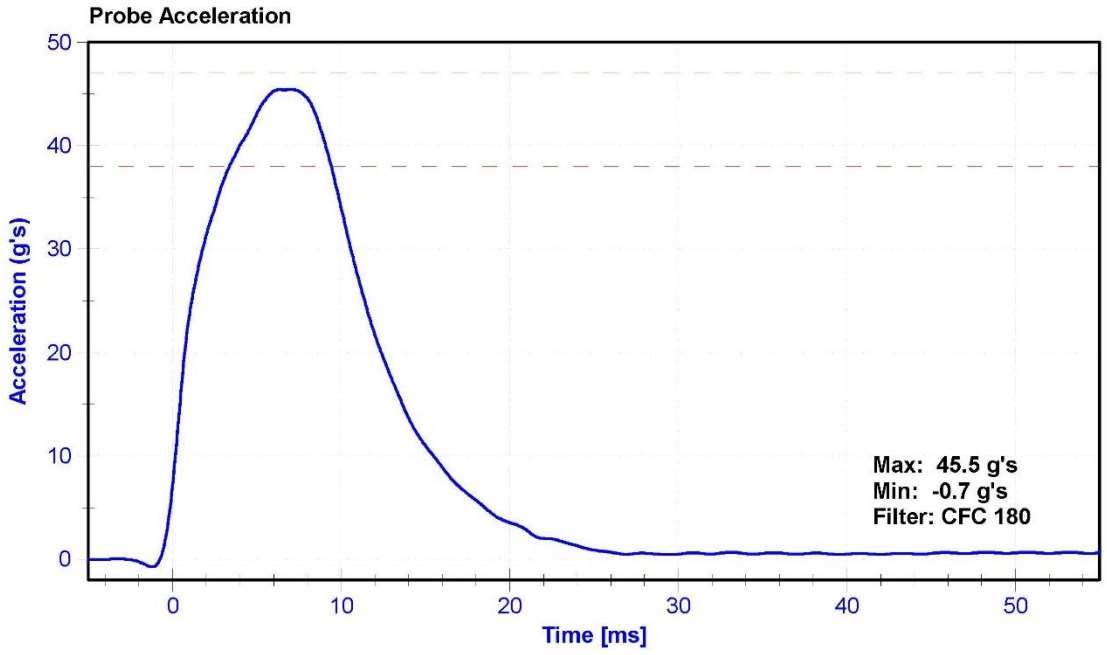
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M. Goehle |
| ATD Serial Number | 303 | Laboratory Supervisor | M. Goehle |

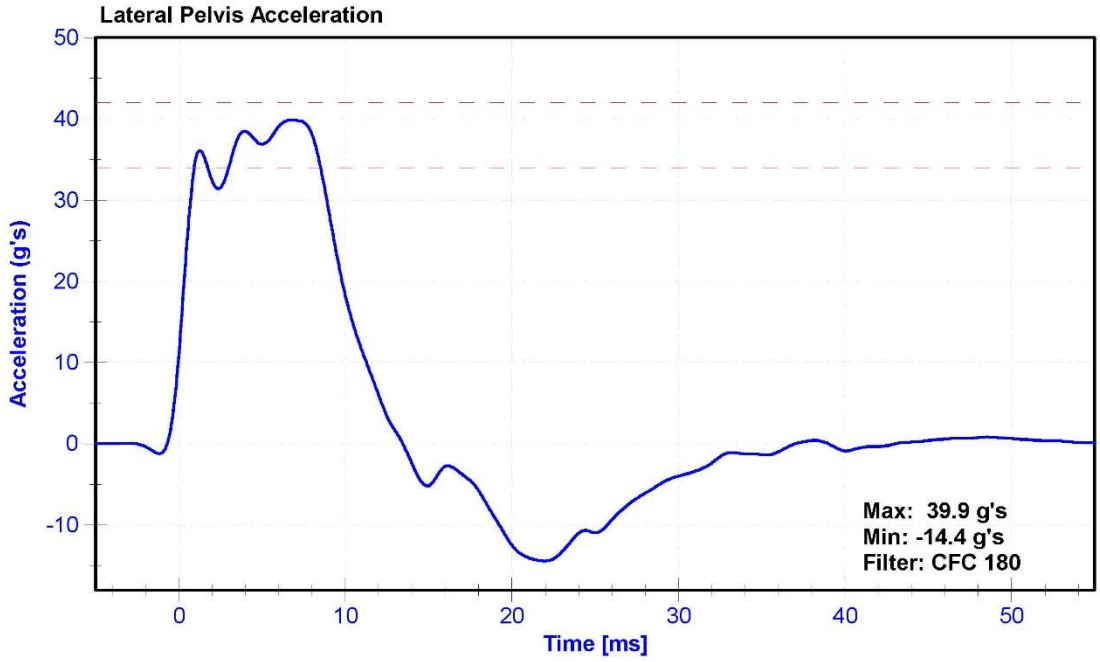
**Results**

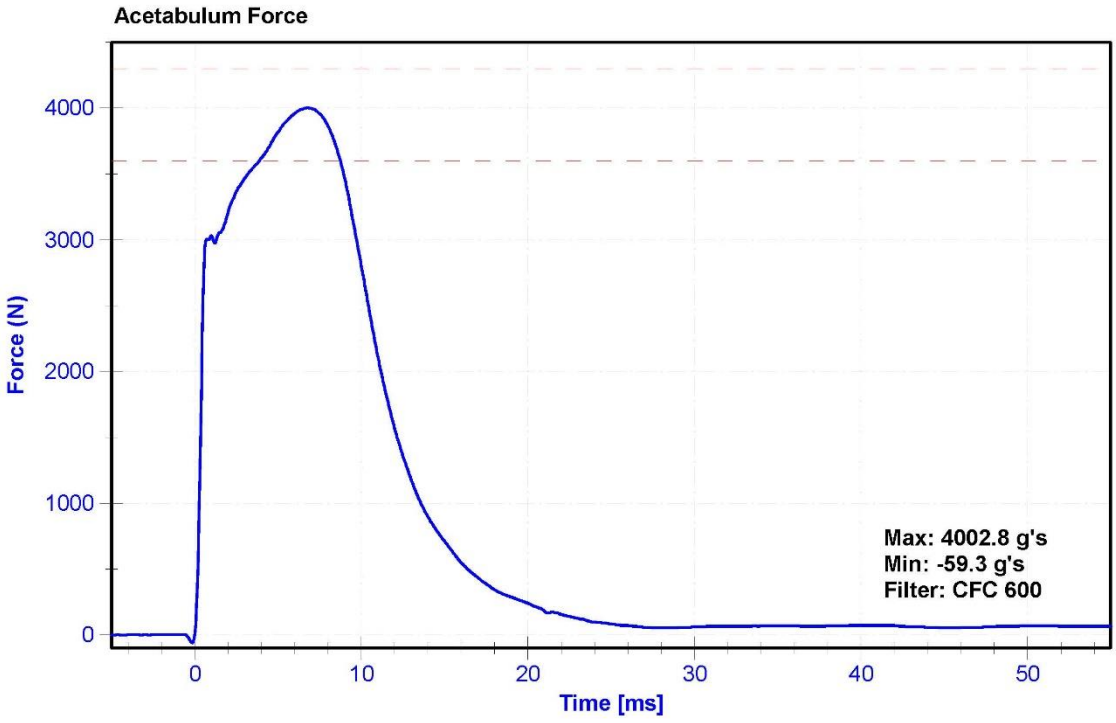
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.8 | Pass |
| Humidity | 10 | 70 | % | 29.1 | Pass |
| Velocity | 6.6 | 6.8 | m/s | 6.61 | Pass |
| Probe Acceleration | 38 | 47 | g's | 45.5 | Pass |
| Lateral Pelvis Acceleration after 6ms | 34 | 42 | g's | 39.9 | Pass |
| Acetabulum Force | 3600 | 4300 | N | 4002.8 | Pass |

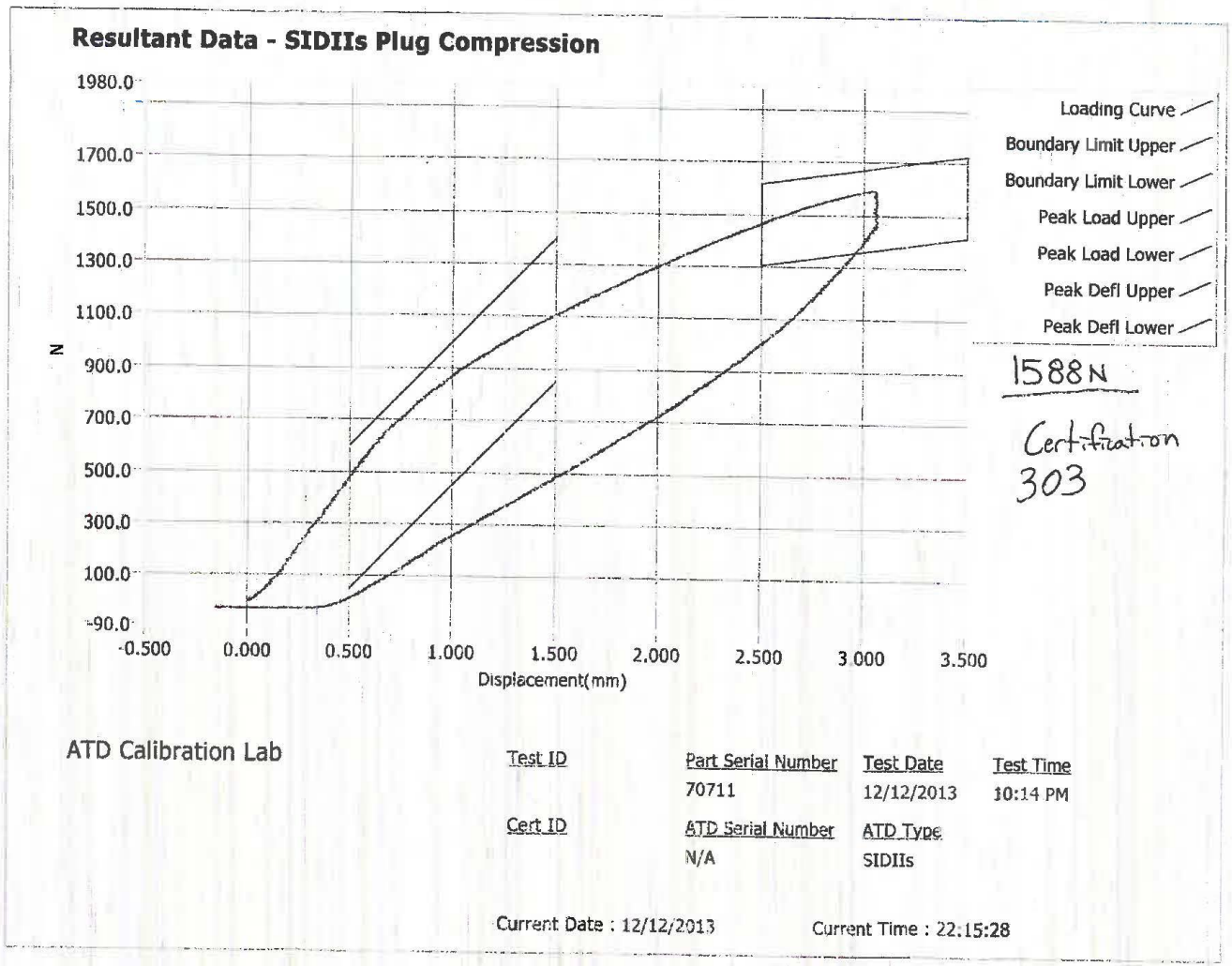
**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7264CT | AC-P23155 | 1/13/2016 | 7/14/2016 |
| Pelvis Y Accelerometer | ENDEVCO 7264 | AC-P51259 | 10/19/2015 | 4/18/2016 |
| Acetabulum Load Cell | Denton IF-520 | LC-236Fy | 6/29/2015 | 6/28/2016 |
| Certification Plug | Humanetics | 70711 | 12/12/2013 | N/A |
| Crash Test Plug | Humanetics | 81138 | 12/4/2014 | N/A |

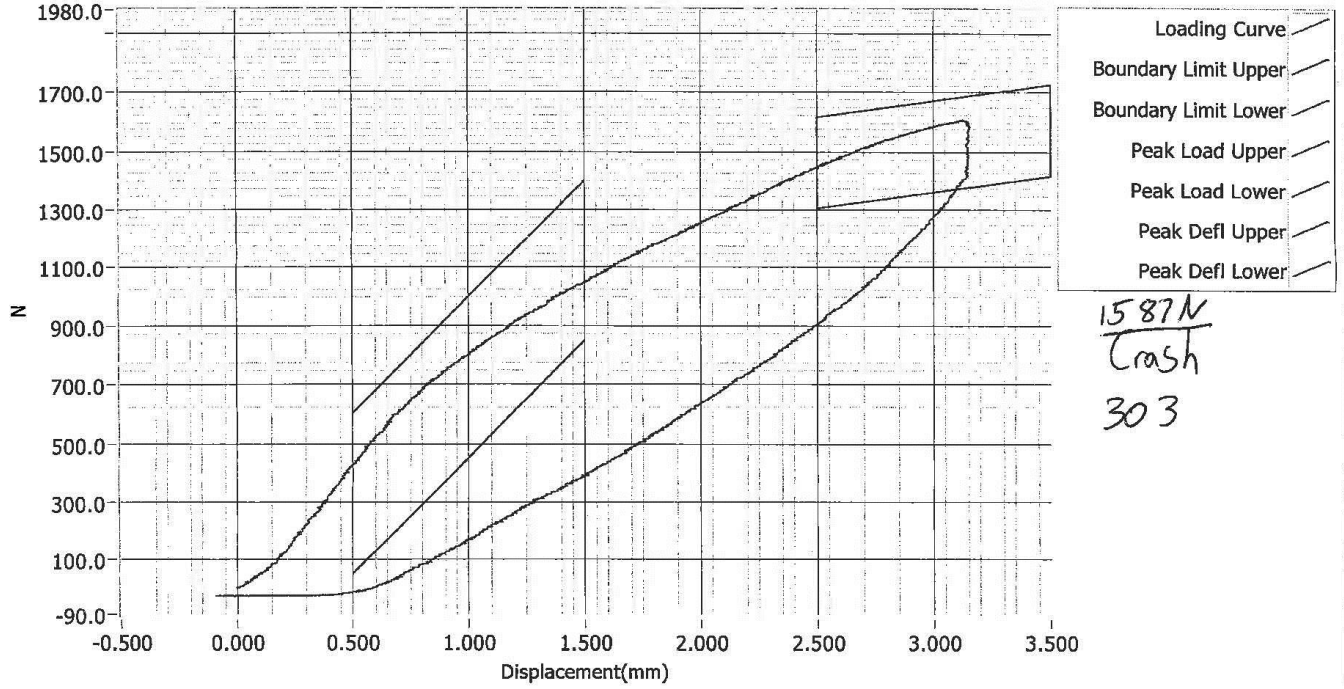



Lateral Pelvis Acceleration
Acceleration (g's)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]
Max: 39.9 g's
Min: -14.4 g's
Filter: CFC 180


Acetabulum Force
Force (N)
4000
3000
2000
1000
0
0
10
20
30
40
50
Time [ms]
Max: 4002.8 g's
Min: -59.3 g's
Filter: CFC 600


Resultant Data - SIDIIs Plug Compression
1980.0
1700.0
1500.0
1300.0
1100.0
900.0
700.0
500.0
300.0
100.0
-90.0
N
-0.500
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
Displacement(mm)
Loading Curve
Boundary Limit Upper
Boundary Limit Lower
Peak Load Upper
Peak Load Lower
Peak Defl Upper
Peak Defl Lower
1588 N
Certification
303
ATD Calibration Lab
Test ID
Part Serial Number
70711
Test Date
12/12/2013
Test Time
10:14 PM
Cert ID
ATD Serial Number
N/A
ATD Type
SIDIIs
Current Date : 12/12/2013
Current Time : 22:15:28

## Resultant Data - SIDIIs Plug Compression




1587 N
Crash
303

ATD Calibration Lab

| Test ID | Part Serial Number | Test Date | Test Time |
|---|---|---|---|
| | 81138 | 12/4/2014 | 11:43 PM |
| Cert ID | ATD Serial Number | ATD Type | |
| | N/A | SIDIIs | |

Current Date : 12/4/2014 Current Time : 23:44:25

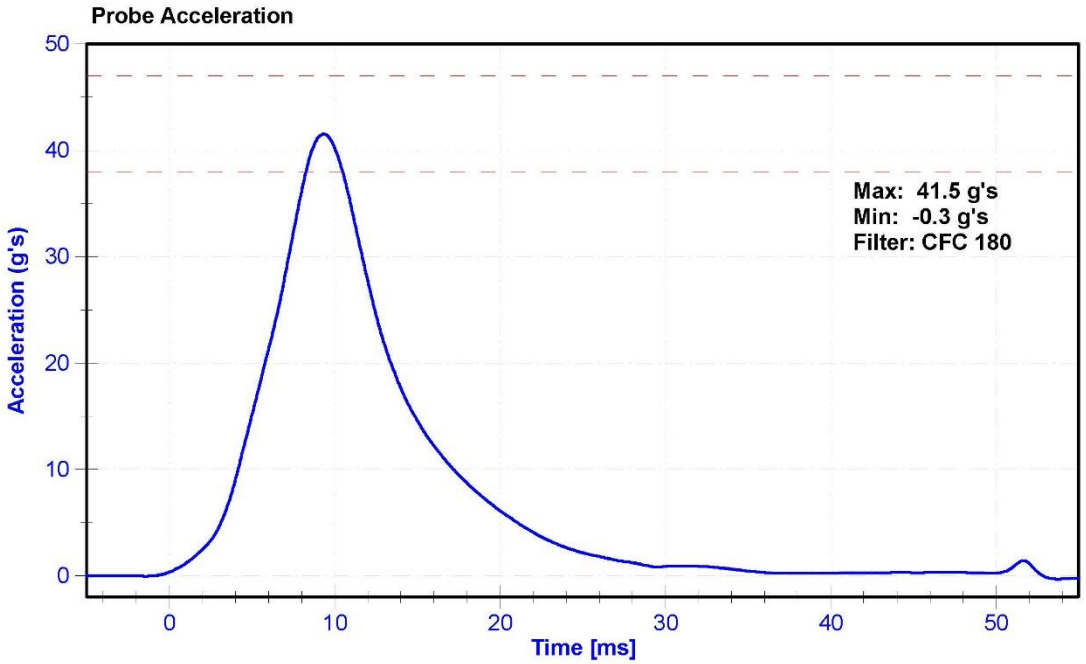
| | | | |
|---|---|---|---|
| ATD Manufacturer | FTSS | Test Technician | M. Goehle |
| ATD Serial Number | 303 | Laboratory Supervisor | M. Goehle |

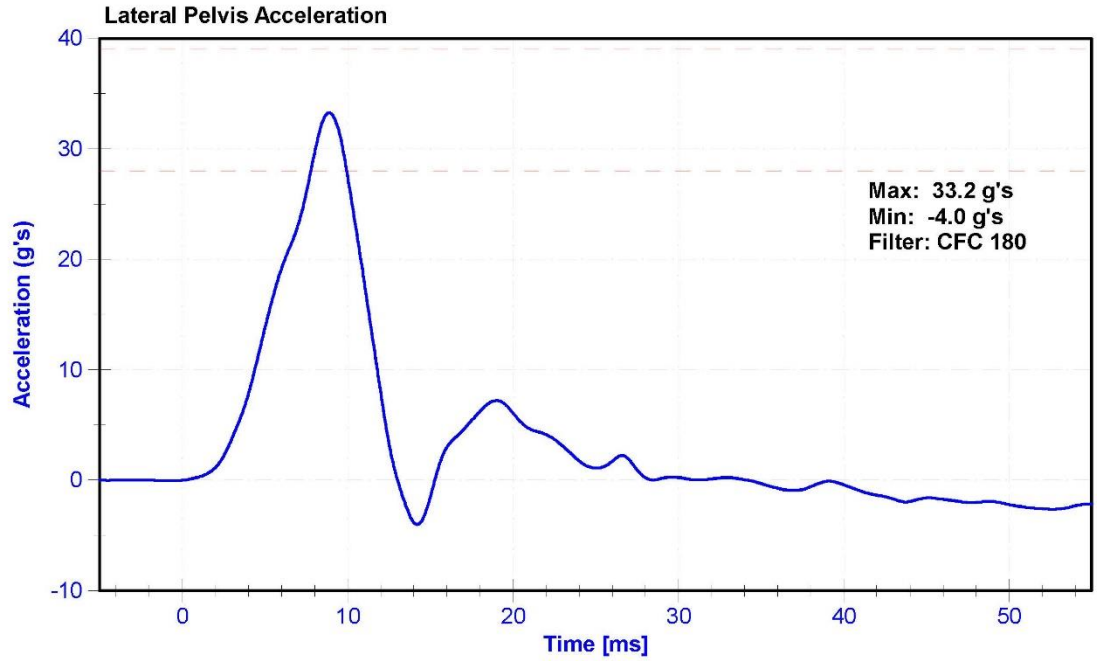
**Results**

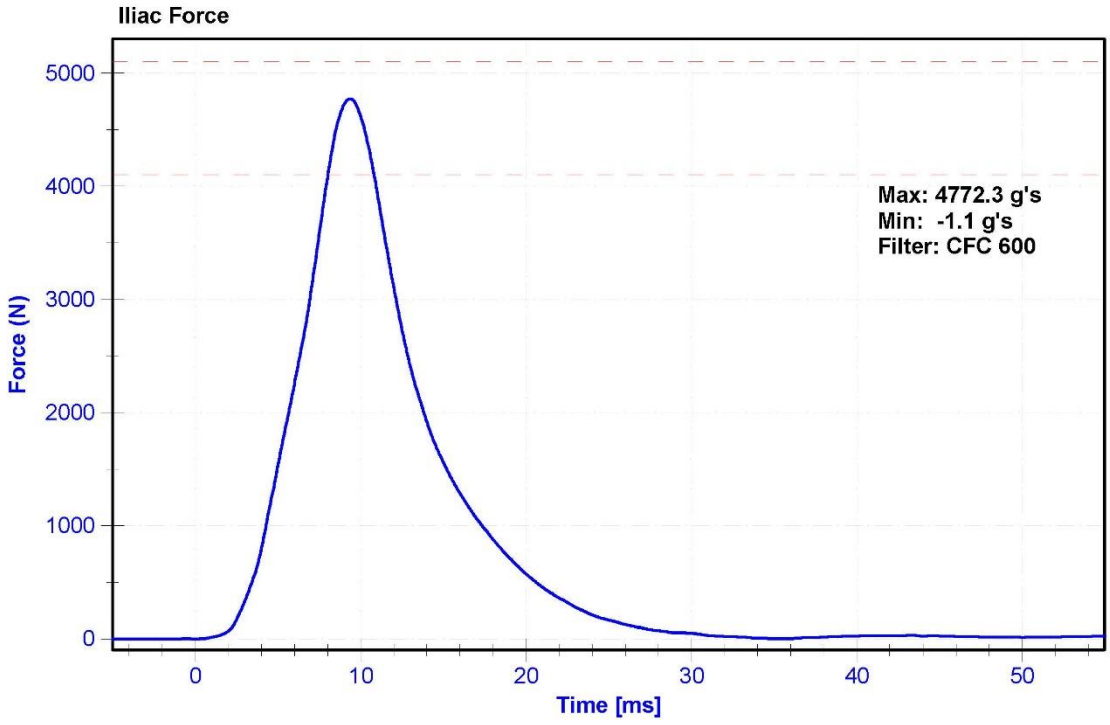
| Test Parameter | Minimum Specification | Maximum Specification | Unit | Result | Pass/Fail |
|---|---|---|---|---|---|
| Temperature | 20.6 | 22.2 | °C | 21.9 | Pass |
| Humidity | 10 | 70 | % | 29.8 | Pass |
| Velocity | 4.2 | 4.4 | m/s | 4.35 | Pass |
| Probe Acceleration | 36 | 45 | g's | 41.5 | Pass |
| Lateral Pelvis Acceleration | 28 | 39 | g's | 33.2 | Pass |
| Iliac Force | 4100 | 5100 | N | 4772.3 | Pass |

**Transducer Calibrations**

| Channel | Manufacturer | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|
| Pendulum Accelerometer | ENDEVCO 7264CT | AC-P23155 | 1/13/2016 | 7/14/2016 |
| Pelvis Y Accelerometer | DENTON 3228J | LC-285Fy | 7/21/2015 | 7/20/2016 |
| Iliac Load Cell | ENDEVCO 7264 | AC-P51259 | 10/19/2015 | 4/18/2016 |




Lateral Pelvis Acceleration
Acceleration (g's)
Time [ms]
Max: 33.2 g's
Min: -4.0 g's
Filter: CFC 180


Iliac Force
Force (N)
Time [ms]
Max: 4772.3 g's
Min: -1.1 g's
Filter: CFC 600

# APPENDIX D

# TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

**Table 1 – Dummy Instrumentation (ES-2re)**

| | | | ES-2re S/N: F034 | | |
|---|---|---|---|---|---|
| | | | Serial Number | Manufacturer | Calibration Date |
| Head Accelerometers | Primary | X | AC-P58904 | ENDEVCO | 10/19/2015 |
| | | Y | AC-P58911 | ENDEVCO | 10/19/2015 |
| | | Z | AC-P58776 | ENDEVCO | 10/19/2015 |
| | Redundant | X | AC-P58887 | ENDEVCO | 10/19/2015 |
| | | Y | AC-P58888 | ENDEVCO | 10/19/2015 |
| | | Z | AC-P51734 | ENDEVCO | 10/19/2015 |
| Thorax Rib Displacement Potentiometers | Upper | Y | DS-183GFE | HONEYWELL | 10/19/2015 |
| | Middle | Y | DS-184GFE | HONEYWELL | 10/19/2015 |
| | Lower | Y | DS-182GFE | HONEYWELL | 10/19/2015 |
| Abdomen Load Cells | Forward | Y | LC-1512 | DENTON | 6/25/2015 |
| | Middle | Y | LC-1526 | DENTON | 6/25/2015 |
| | Rear | Y | LC-1516 | DENTON | 6/25/2015 |
| Lower Spine Accelerometers (T12) | | X | AC-P52079 | ENDEVCO | 10/16/2015 |
| | | Y | AC-P51948 | ENDEVCO | 10/16/2015 |
| | | Z | AC-P51269 | ENDEVCO | 10/16/2015 |
| Pubic Symphysis Load Cell | | Y | LC-465Fy | DENTON | 6/25/2015 |

**Table 2 – Dummy Instrumentation (SID-IIs)**

| | | | | SID-IIs S/N: 303 | | |
|---|---|---|---|---|---|---|
| | | | | Serial Number | Manufacturer | Calibration Date |
| Head Accelerometers | | Primary | X | AC-P83420 | ENDEVCO | 10/16/2015 |
| | | | Y | AC-P52040 | ENDEVCO | 10/14/2015 |
| | | | Z | AC-P58737 | ENDEVCO | 10/14/2015 |
| | | Redundant | X | AC-P51668 | ENDEVCO | 10/14/2015 |
| | | | Y | AC-P51327 | ENDEVCO | 10/14/2015 |
| | | | Z | AC-P51695 | ENDEVCO | 10/14/2015 |
| Displacement Potentiometers | Thoracic Rib | Upper | Y | DS-1199GFE | SERVO | 10/19/2015 |
| | | Middle | Y | DS-1246GFE | SERVO | 10/19/2015 |
| | | Lower | Y | DS-1256GFE | SERVO | 10/19/2015 |
| | Abdominal Rib | Upper | Y | DS-1274GFE | SERVO | 10/19/2015 |
| | | Lower | Y | DS-2316GFE | SERVO | 10/28/2015 |
| Lower Spine Accelerometers (T12) | | | X | AC-P51945 | ENDEVCO | 10/19/2015 |
| | | | Y | AC-P51974 | ENDEVCO | 10/19/2015 |
| | | | Z | AC-P51946 | ENDEVCO | 10/19/2015 |
| Acetabulum Load Cell | | | Y | LC-236Fy | DENTON | 6/29/2015 |
| Iliac Wing Load Cell | | | Y | LC-285Fy | DENTON | 7/21/2015 |
| Pelvis Plug (struck side) | | | | 81138 | HUMANETICS | 12/4/2014 |
| Pelvis Plug (non-struck side) | | | | - | - | - |

**Table 3 – Vehicle Instrumentation**

| Vehicle Instrumentation | | | Serial Number | Manufacturer | Calibration Date |
|---|---|---|---|---|---|
| 1 | Vehicle Center of Gravity | X | AC-A189616 | MSI 1201-1000 | 1/13/2016 |
| | Vehicle Center of Gravity | Y | AC-A189602 | MSI 1201-1000 | 1/13/2016 |
| | Vehicle Center of Gravity | Z | AC-A189620 | MSI 1201-1000 | 1/13/2016 |
| 2 | Right Sill at Front Seat | X | AC-A156913 | MSI 1201 | 10/9/2015 |
| | Right Sill at Front Seat | Y | AC-A156934 | MSI 1201 | 10/9/2015 |
| | Right Sill at Front Seat | Z | AC-A156928 | MSI 1201 | 10/9/2015 |
| 3 | Right Sill at Rear Seat | X | AC-A126803 | MSI 1201 | 10/15/2015 |
| | Right Sill at Rear Seat | Y | AC-A120604 | MSI 1201 | 9/17/2015 |
| | Right Sill at Rear Seat | Z | AC-A126818 | MSI 1201 | 10/14/2015 |
| 4 | Left Sill at Front Door | Y | AC-A120603 | MSI 1201 | 12/4/2015 |
| 5 | Left Sill at Rear Door | Y | AC-A156924 | MSI 1201 | 10/19/2015 |
| 6 | Left A-Post Lower | Y | AC-A081446 | MSI 1201 | 12/4/2015 |
| 7 | Left A-Post Middle | Y | AC-A126816 | MSI 1201 | 10/14/2015 |
| 8 | Left B-Post Lower | Y | AC-A189624 | MSI 1201-1000 | 1/13/2016 |
| 9 | Left B-Post Middle | Y | AC-A189605 | MSI 1201-1000 | 1/13/2016 |
| 10 | Front Seat Track | Y | AC-A002415 | MSI 1201 | 10/20/2015 |
| 11 | Rear Seat Track or Structure | Y | AC-A002413 | MSI 1201 | 11/17/2015 |
| 12 | Right Rear Occ. Compartment | Y | AC-A189595 | MSI 1201-1000 | 1/13/2016 |
| 13 | Engine Block | X | AC-A189608 | MSI 1201-1000 | 1/13/2016 |
| | Engine Block | Y | AC-A189585 | MSI 1201-1000 | 1/13/2016 |
| 14 | Rear Floorpan Above Axle | X | AC-A189612 | MSI 1201-1000 | 1/13/2016 |
| | Rear Floorpan Above Axle | Y | AC-A189621 | MSI 1201-1000 | 1/13/2016 |
| | Rear Floorpan Above Axle | Z | AC-A189597 | MSI 1201-1000 | 1/13/2016 |

**TABLE 4 – MDB Instrumentation**

| MDB Instrumentation | | Serial Number | Manufacturer | Calibration Date |
|---|---|---|---|---|
| MDB Center of Gravity | X | AC-C14901 | ENDEVCO | 1/27/2016 |
| MDB Center of Gravity | Y | AC-CP30 | ENDEVCO | 1/27/2016 |
| MDB Center of Gravity | Z | AC-C16680 | ENDEVCO | 1/27/2016 |
| Left Frame at Rear Axle Centerline | X | AC-AH5M8 | ENDEVCO | 1/28/2016 |
| Left Frame at Rear Axle Centerline | Y | AC-C16499 | ENDEVCO | 1/28/2016 |