Final Report Number: NCAP-TRC-23-003

New Car Assessment Program (NCAP)

Frontal Barrier Impact Test

HYUNDAI MOTOR COMPANY

2023 Hyundai Kona Electric

NHTSA Number: M20234214

PREPARED BY:
Transportation Research Center Inc.
10820 State Route 347
P. O. Box B-67
East Liberty, OH 43319

Report Date: November 27, 2023

FINAL REPORT

Prepared For:
U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crashworthiness Standards
1200 New Jersey Ave, SE
Washington, DC 20590

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Prepared By: ILO Project Operations Group

Approved By: John Shultz

Approval Date: November 27, 2023

FINAL REPORT ACCEPTANCE BY OCWS:

_____

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

Date _____

_____

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

Date _____

Technical Report Documentation Page

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Final Report of NEW CAR ASSESSMENT PROGRAM Frontal Impact Testing of a 2023 Hyundai Kona Electric NHTSA No. M20234214	November 27, 2023
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15. Supplemental Notes

16. Abstract

A 56.0 km/h NCAP Frontal Impact Test was conducted on a 2023 Hyundai Kona Electric, in accordance with the specifications of the Office of Crashworthiness Standards Laboratory Procedure for NCAP Full Frontal Rigid Barrier Impact Testing. The test was conducted at the Transportation Research Center Inc. in East Liberty, Ohio on April 4, 2023.

The impact velocity was 56.44 km/h, and the ambient temperature at the barrier face at the time of impact was 20.5° C. The target vehicle post-test maximum crush was 545 millimeters at vehicle center line. The test vehicle's performance is as follows:

	Driver ATD			Passenger ATD		
Measurement Description	Units	Threshold	Result	Units	Threshold	Result
Head Injury Criteria (HIC_{15})	NA	700	127.750	NA	700	184.270
Maximum Chest Compression	mm	63	-30.360	mm	52	-18.300
3ms Chest Clip	Gs	60	44.540	Gs	60	41.320
Nij	NA	1	0.237	NA	1	0.297
Neck Tension	Newtons	4170	1076.500	Newtons	2620	842.030
Neck Compression	Newtons	4000	-508.520	Newtons	2520	-88.360
Left Femur Force	Newtons	10008	-230.280	Newtons	6805	-1448.080
Right Femur Force	Newtons	10008	-279.020	Newtons	6805	-411.010

17. Key Words	18. Distribution Statement
56.3 km/h (35 mph) Full Frontal Rigid Barrier Impact Test New Car Assessment Program (NCAP)	Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services Division 1200 New Jersey Ave, SE Washington, DC 20590

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. Number of Pages	22. Price
Unclassified	Unclassified	206	

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1: PURPOSE AND SUMMARY OF THE TEST

PURPOSE

This 56 km/h frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. 693JJ919D000007. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for consumer information purposes.

This 56 km/h frontal barrier impact test was conducted in accordance with the Office of Crashworthiness Standards Laboratory Test Procedure or NCAP Full Frontal Rigid Barrier Impact Testing dated May 2018.

SUMMARY

A load cell barrier consisting of 288 load cells was impacted by a 2023 Hyundai Kona Electric at a velocity of 56.44 km/h. The test was performed at Transportation Research Center, Inc. on April 4, 2023. Pre- and post-test photographs of the vehicle and dummies can be found in Appendix A.

One real-time camera and 16 high-speed cameras were used to document the frontal barrier impact event. Camera locations and other pertinent camera information can be found in this report.

One Part 572E 50th percentile male anthropomorphic test device (ATD) was placed in the driver seating position and one Part 572O 5th percentile female ATD was placed in the right-front passenger position according to dummy placement instructions specified in the Laboratory Procedure for NCAP Full Frontal Rigid Barrier Impact Testing.

Both ATDs were fully instrumented with head, chest and pelvis tri-axial accelerometers, chest displacement potentiometers, upper neck transducers, femur load cells, and lower leg instrumentation.

The driver (position 1) ATD (Serial No. 037), and the right-front passenger (position 2) ATD (Serial No. DH1659) were qualified prior to this test. Certification details, along with instrumentation calibration data, are found in Appendix C of this report.

The 102 channels of data were recorded on an on-board data acquisition system. Appendix B contains the vehicle, load cell barrier and dummy response data traces.

There was 100.0 percent windshield retention and no intrusion into the protected zone of the windshield during the event. There was no Stoddard solvent leakage (or electrolyte spillage) after the event or during any phase of the static rollover.

The maximum static crush of the vehicle was 545 mm and both the driver and passenger side doors remained closed during the impact event and were operable after the impact.

The driver's visible contact points were as follows: front airbag, headrest and knee bolster. The passenger's visible contact points were as follows: front airbag, headrest and glove box.

The occupant data is summarized below:

ATD Position	HIC_{15}	Nij	Neck Tension (N)	Neck Compression (N)	3 ms Chest Clip (Gs)	Chest Disp. (mm)	Left Femur (N)	Right Femur (N)
Driver (50^{th} Male)	127.750	0.237	1076.500	-508.520	44.540	-30.360	-230.280	-279.020
Passenger (5^{th} Female)	184.270	0.297	842.030	-88.360	41.320	-18.300	-1448.080	-411.010

TEST COMMENTS:

Driver Pelvis Z Acceleration vs. Time: Channel failed at 71.0 ms

Vehicle Engine Top X: Channel failed at 49.0 ms

Vehicle Engine Bottom X: Channel failed at 53.0 ms

2.2 REPORT AREA 2: DATA SHEETS

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

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023

TEST VEHICLE INFORMATION

NHTSA No.	M20234214
Model Year	2023
Make	Hyundai
Model	Kona Electric
Body Style	MPV
VIN	KM8K33AG4PU173015
Body Color	Lunar White
Odometer Reading (km/mi)	16 mi.
Engine Displacement (L)	N/A
Type/No. Cylinders	Electric
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	1
Overdrive	No
Final Drive	FWD
Roof Rack	No
Sunroof/T-Top	Yes
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	Yes
Anti-Lock Brakes (ABS)	Yes
Automatic Door Locks (ADLs)	Yes

TEST VEHICLE OPTIONS

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

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

DATA FROM CERTIFICATION LABEL

Manufactured by	HYUNDAI MOTOR COMPANY
Date of Manufacture	DEC/2022

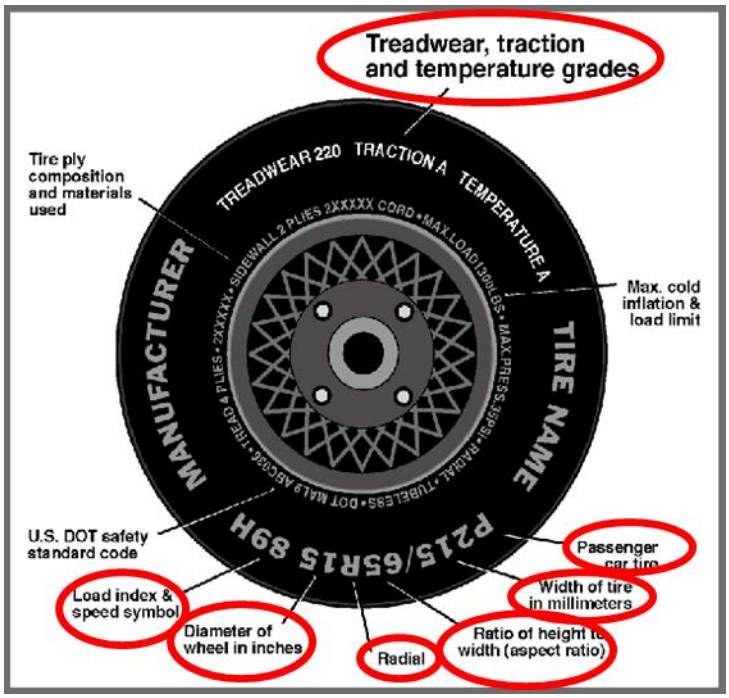
GVWR (lbs)	4762
GAWR Front (lbs)	2425
GAWR Rear (lbs)	2469

VEHICLE SEATING AND WEIGHT CAPACITY

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench	N/A	
Number of Occupants	2	3	N/A	5
Capacity Wt. (VCW) (kg)				390.0
Cargo Wt. (RCLW) (kg)				50.0

DATA SHEET NO. 1 - GENERAL TEST AND VEHICLE PARAMETER DATA (CONT'D)

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023



DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	350	350
Cold / Test Pressure (kPa)	250	250
Recommended Tire Size	215/55R17	215/55R17
Tire Size on Vehicle	215/55R17	215/55R17
Tire Manufacturer	Nexen	Nexen
Tire Model	NPriz AH8	NPriz AH8
Treadwear	500	500
Traction Grade	A	A
Temperature Grade	A	A
Tire Plies Sidewall	1	1
Tire Plies Body	4	4
Load Index/Speed Symbol	94V	94V
Tire Material	Polyester, Steel, Nylon	Polyester, Steel, Nylon
DOT Safety Code Right	UA8V DMFR 4622	UA8V CACL 4622
DOT Safety Code Left	UA8V AAMR 4622	UA8V DMFR 4622

DATA SHEET NO. 1 - GENERAL TEST AND VEHICLE PARAMETER DATA (CONT'D)

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	459.4	393.2		505.6	444.4	
Right	kg	451.4	382.6		480.4	439.6	
Ratio	%	54.0	46.0		52.7	47.3	
Totals	kg	910.8	775.8	1686.6	986.0	884.0	1870.0

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1686.6
Weight of 1 P572E ATD & 1 P572O ATD	kg	139.3
Rated Cargo/Luggage Weight (RCLW)	kg	50.0
Vehicle Target Weight (TVTW)	kg	1875.9

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front)
As Delivered	mm	747	749	758	759	1196
As Tested	mm	736	744	744	739	1229
Post Test	mm	N/A	N/A	719	750	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Test Vehicle Wheel Base	mm	2600
Total Vehicle Length at Left Side	mm	4050
Total Vehicle Length at Centerline	mm	4175
Total Vehicle Length at Right Side	mm	4050
Weight of Ballast in Cargo Area	kg	0.0
Weight of Vehicle Components Removed	kg	17.6
Amount of Stoddard Solvent in Fuel Tank	liters	N/A

LIST OF COMPONENTS REMOVED TO MEET TEST WEIGHT: Rear bumper, tail lights, and rear door trim

DATA SHEET NO. 1 - GENERAL TEST AND VEHICLE PARAMETER DATA (CONT'D)

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023

TARGET VEHICLE STRUCTURAL MEASUREMENT

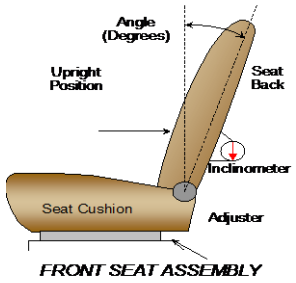
	Elements	Pre-Test (mm)
1	Total Length	4175
2	Total Width	1770
3	Bumper Top Height	565
4	Bumper Bottom Height	465
5	Longitudinal Member Top Height	545
6	Distance Between Longitudinal Members	910
7	Longitudinal Member Width	70
8	Engine Top Height	805
9	Engine Bottom Height	260
10	Engine and Gearbox Width	800
11	Front Bumper-Engine Distance	430
12	Front Shock Absorber Fixing Height	880
13	Bonnet Leading Edge Height	860
14	Front Shock Absorber Fixing Width	1060
15	Front Bumper – Front Axle Distance	855
16	Front Axle – A-Pillar Distance	520
17	A-Pillar – B-Pillar Distance	1020
18	B-Pillar – Rear Axle Distance	1050
19	B-Pillar – C-Pillar Distance	900
20	Roof Sill Bottom Height	1405
21	Roof Sill Top Height	1470
22	Floor Sill Bottom Height	360
23	Floor Sill Top Height	405

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

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023

NORMAL DESIGN RIDING POSITION

For adjustable driver and passenger seat backs. Please describe how to position the inclinometer to measure the seat back angle. Include description of the location of the adjustment latch detent, if applicable



	Degree
Driver Seat back angle:	0.4
Passenger Seat back angle:	4.0

SEAT FORE/AFT POSITIONS

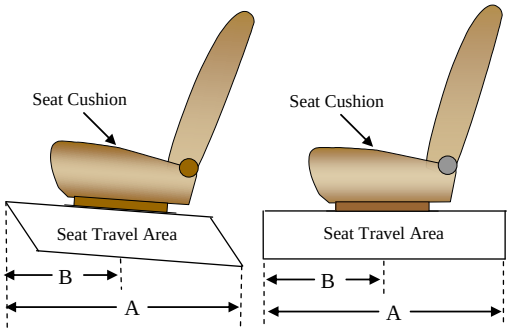
Describe the method of determining seat fore/aft positions.
Driver: Mid position, Positioned according to Form 1
Passenger: Full forward, Positioned according to Form 1

	Total Fore/Aft Travel	Placed in Position No.
Driver Seat	240 mm	130
Passenger Seat	240 mm	0

SEAT BELT UPPER ANCHORAGE

Describe the method of positioning seat belt upper anchorages.
Driver: One below uppermost, Positioned according to Form 1
Passenger: One below uppermost, Positioned according to Form 1

	Total No. of Positions	Placed in Position No.
Driver Seat	3	0, Full Up
Passenger Seat	3	0, Full Up



DATA SHEET NO. 2 - SEAT ADJUSTMENT, FUEL SYSTEM AND STEERING WHEEL DATA (CONT'D)

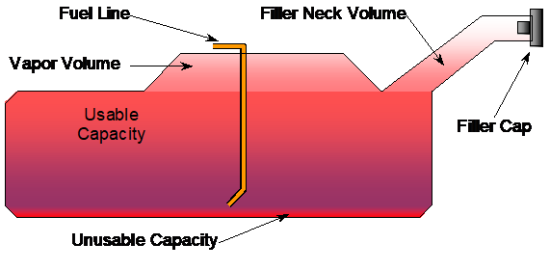
Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023

FUEL TANK CAPACITY

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

Describe the fuel system - what type of fuel pump, details about how it operates, etc.

The vehicle is fully electric. The charge port is on the left side of the front of the vehicle

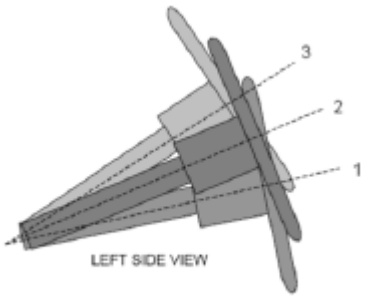


VEHICLE FUEL TANK ASSEMBLY

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when moved through its full range of motion. Describe how this measurement was taken.

Steel square was placed across the rim of the steering wheel, an inclinometer was placed on plate and the angle was measured. Telescope travel was measured full in and full out and set at the midpoint.



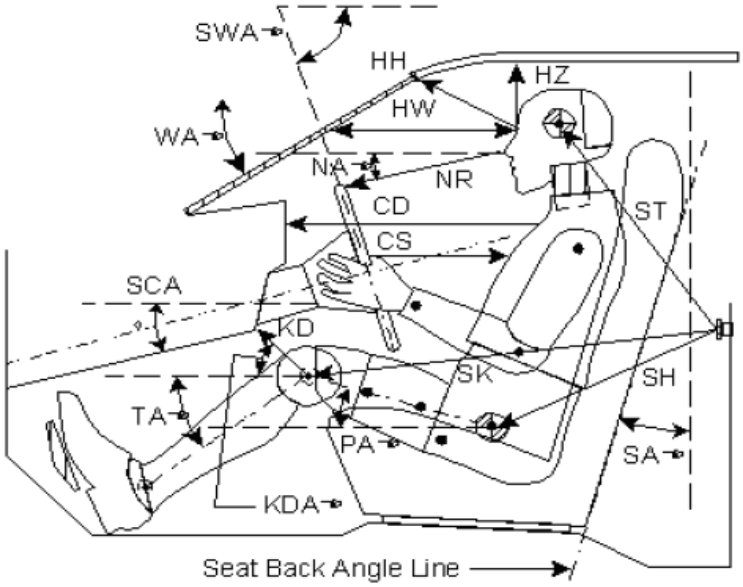
STEERING COLUMN ASSEMBLY

STEERING COLUMN POSITIONS

	Degrees	Fore/Aft Position (mm)
Lowermost Position No. 1	23.3	0
Geometric Center Position No. 2	26.0	21
Uppermost Position No. 3	28.7	42
Telescoping Steering Wheel Travel		42
Test Position	26.0	21

DATA SHEET NO. 3 - DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

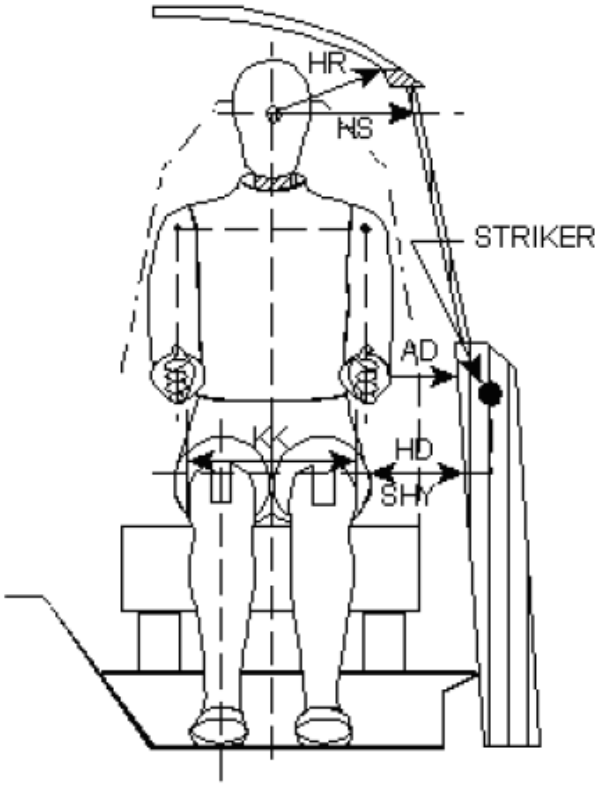
Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023



Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WAº	Windshield Angle		27.8		
SWAº	Steering Wheel Angle		64.1		
SCAº	Steering Column Angle		20.0		
SAº	Seat Back Angle (on head rest post)		0.4		4.0
HZ	Head to Roof (Z)	159		206	
HH	Head to Header	304		297	
HW	Head to Windshield	578		604	
NR	Nose to Rim	361	15.1		
CD	Chest to Dash	510		432	
CS	Chest to Steering Hub	291			
RA	Rim to Abdomen	167			
KDL	Left Knee to Dash	177	35.4	81	42.1
KDR	Right Knee to Dash	123	17.7	97	37.6
PAº	Pelvic Angle		20.4		21.0
TAº	Tibia Angle		51.9		59.4
SK	Striker to Knee	575	15.4	672	14.2
ST	Striker to Head	427	75.6	370	58.7
SH	Striker to H-Point	335	56.1	407	37.4

DATA SHEET NO. 4 - DUMMY LATERAL CLEARANCE DIMENSIONS

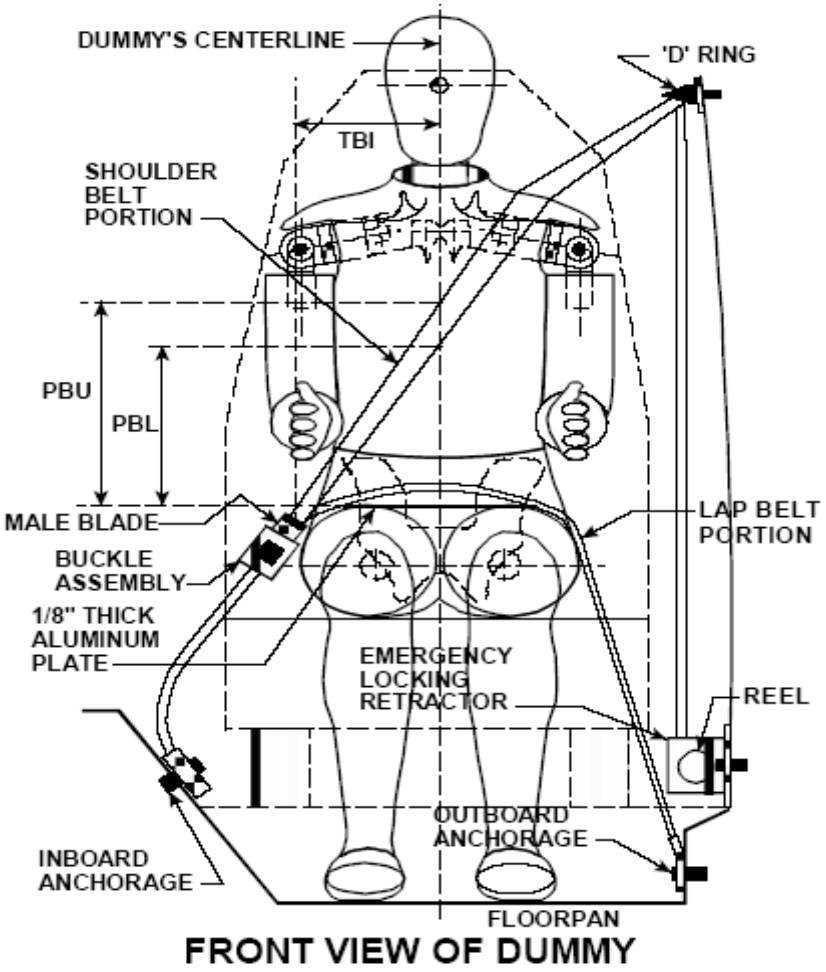
Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023



Code	Measurement Description	Driver	Passenger
AD	Arm to Door	51	79
HD	H-Point to Door	145	174
HR	Head to Side Header	209	256
HS	Head to Side Window	319	375
KK	Knee to Knee	390	270
SHY	Striker to H-Point (Y Direction)	245	278
AA	Ankle to Ankle	360	165

DATA SHEET NO. 5 - SEAT BELT POSITIONING DATA

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023



FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU – Top surface of reference to belt upper edge	mm	320	278
PBL – Top surface of reference to belt lower edge	mm	230	185

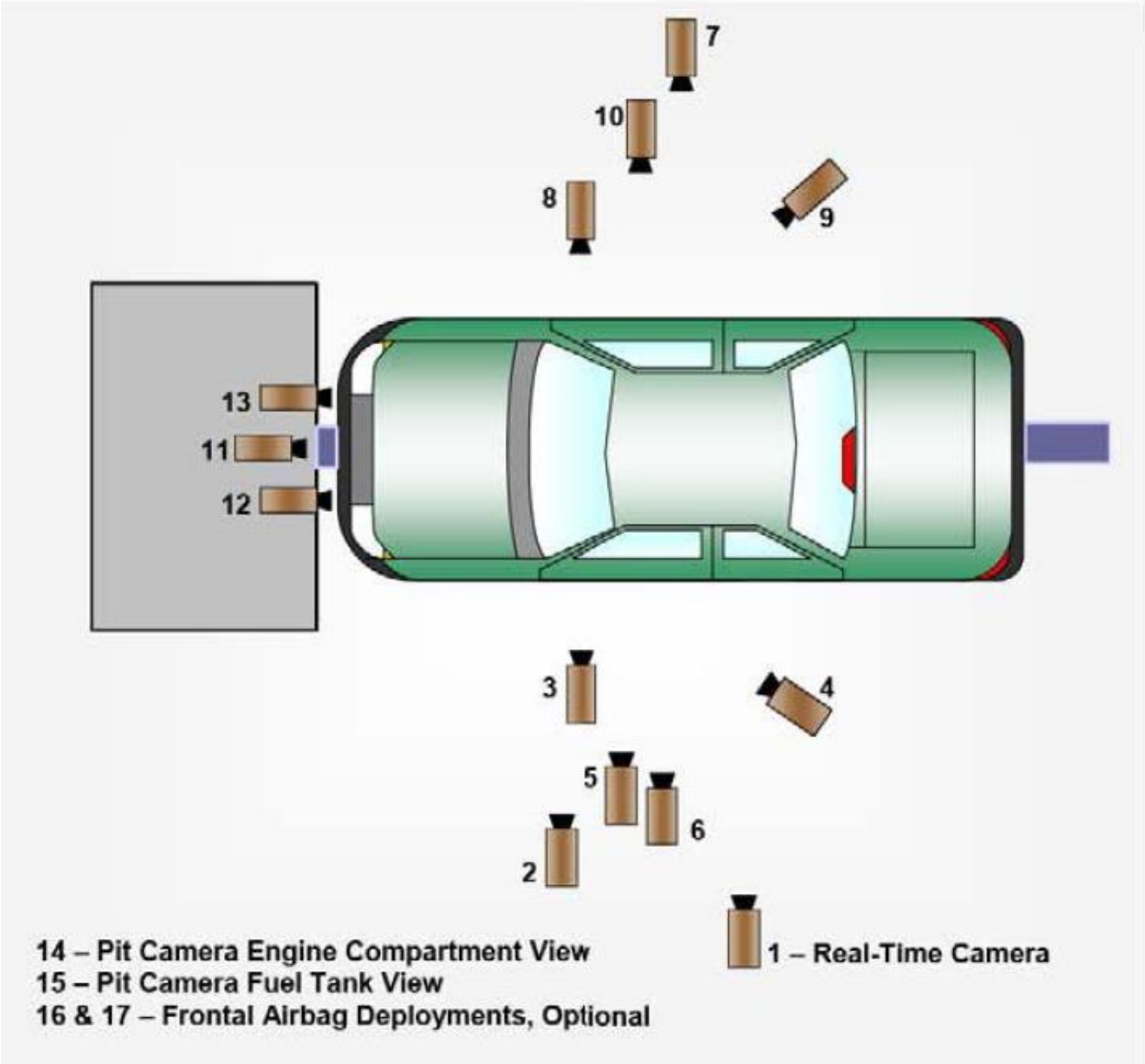
BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder belt length as measured on ATD	mm	930	975
Lap belt length as measured on ATD	mm	665	640
Remainder of belt on reel	mm	845	825
Total belt length for continuous webbing systems	mm	2440	2440

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

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023

CAMERA POSITIONS FOR FRONTAL IMPACTS



DATA SHEET NO. 6 - HIGH SPEED CAMERA LOCATIONS AND DATA (CONT'D)

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023

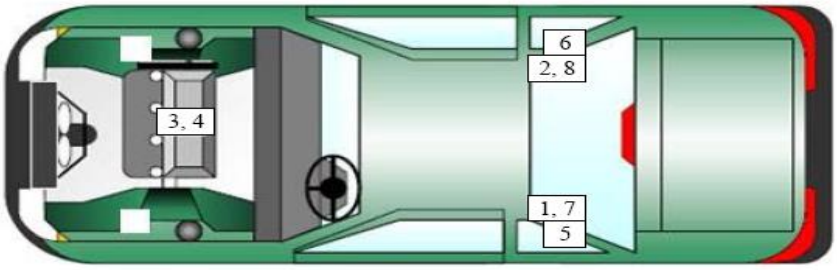
CAMERA LOCATIONS

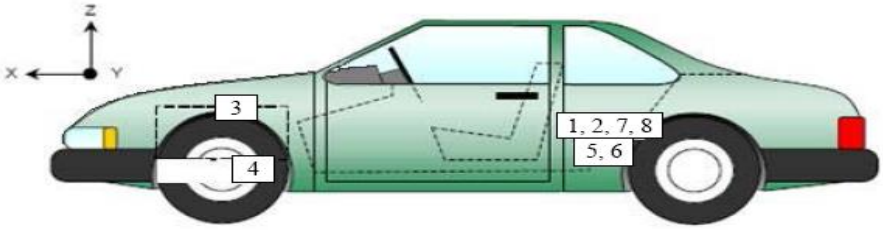
No.	Camera View	Location (mm)			Lens (mm)	Frame Speed (fps)
		X	Y	Z		
1	REAL-TIME LEFT OVERALL	-910	-5866	-1466	Zoom	30
2	LEFT OVERALL	-2601	-4055	-1431	8.5	1000
3	DRIVER CLOSE-UP	-2452	-4032	-1542	50	1000
4	LEFT FRONT HALF	-1523	-4911	-1219	25	1000
5	LEFT ANGLE	-3545	-2466	-1611	20	1000
6	STEERING COLUMN	-2222	-4011	-1522	50	1000
7	RIGHT OVERALL	-2432	4432	-1412	8.5	1000
8	PASSENGER CLOSE-UP	-1988	4366	-1543	50	1000
9	RIGHT FRONT HALF	-1590	4923	-1255	25	1000
10	RIGHT ANGLE	-3001	2144	-1766	20	1000
11	WINDSHIELD	0	0	-2612	20	1000
12	DRIVER WINDSHIELD	0	-312	-2631	16	1000
13	PASSENGER WINDSHIELD	0	210	-2623	16	1000
14	PIT FRONT	-880	0	3022	20	1000
15	PIT REAR	-3110	0	3067	20	1000
16	DRIVER ONBOARD				8.5	1000
17	PASSENGER ONBOARD				8.5	1000

Reference Points: +X – forward of impact plane
+Y – right of monorail center
+Z – into ground

DATA SHEET NO. 7 - VEHICLE ACCELEROMETER DATA

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023





VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear Accelerometer – X Direction	1475	-245	-555
2	Right Rear Accelerometer – X Direction	1475	235	-557
3	Engine Top X	3405	30	-695
4	Engine Bottom X	3445	30	-215
5	Left Rear Accelerometer – Z Direction	1475	-245	-560
6	Right Rear Accelerometer – Z Direction	1475	235	-562
7	Left Rear Accelerometer – X Direction Redundant	1475	-215	-555
8	Right Rear Accelerometer- X Direction Redundant	1475	205	-557

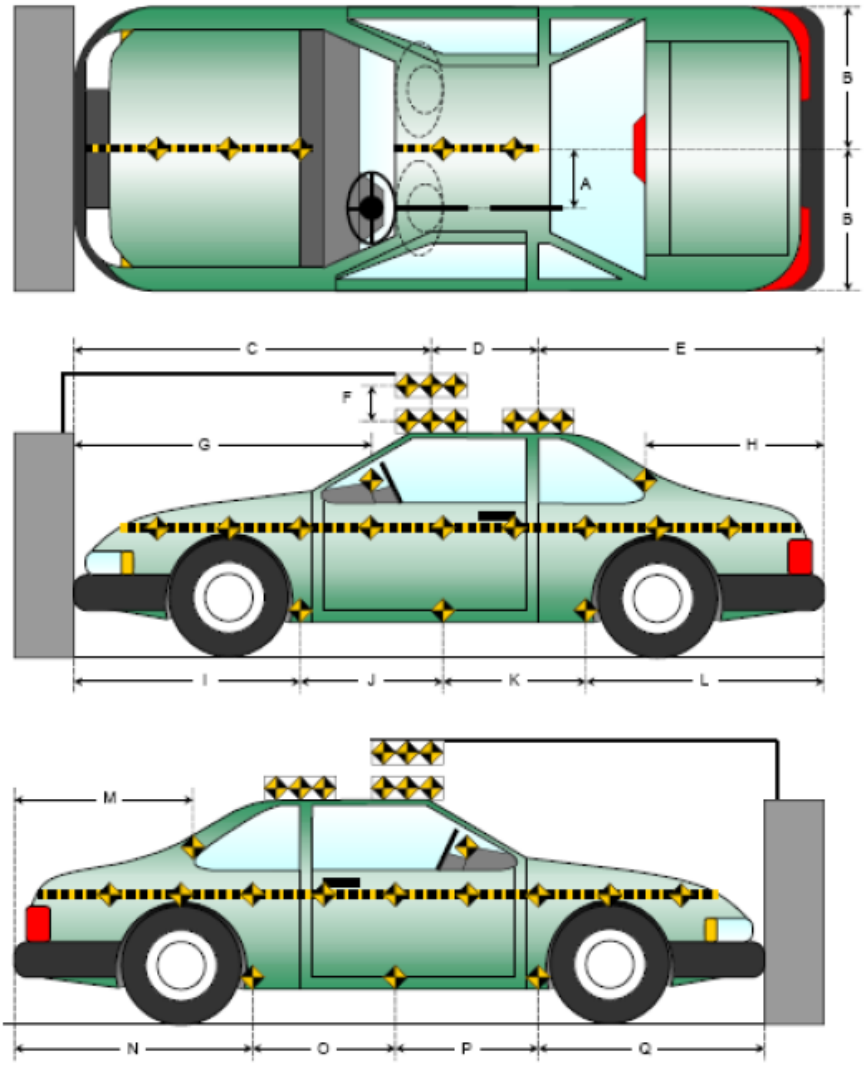
Reference Points: X – Rear Surface of Vehicle (+ forward)
Y – Vehicle Centerline (+ to right)
Z – Ground Plane (+ down)

DATA SHEET NO. 8 - PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023

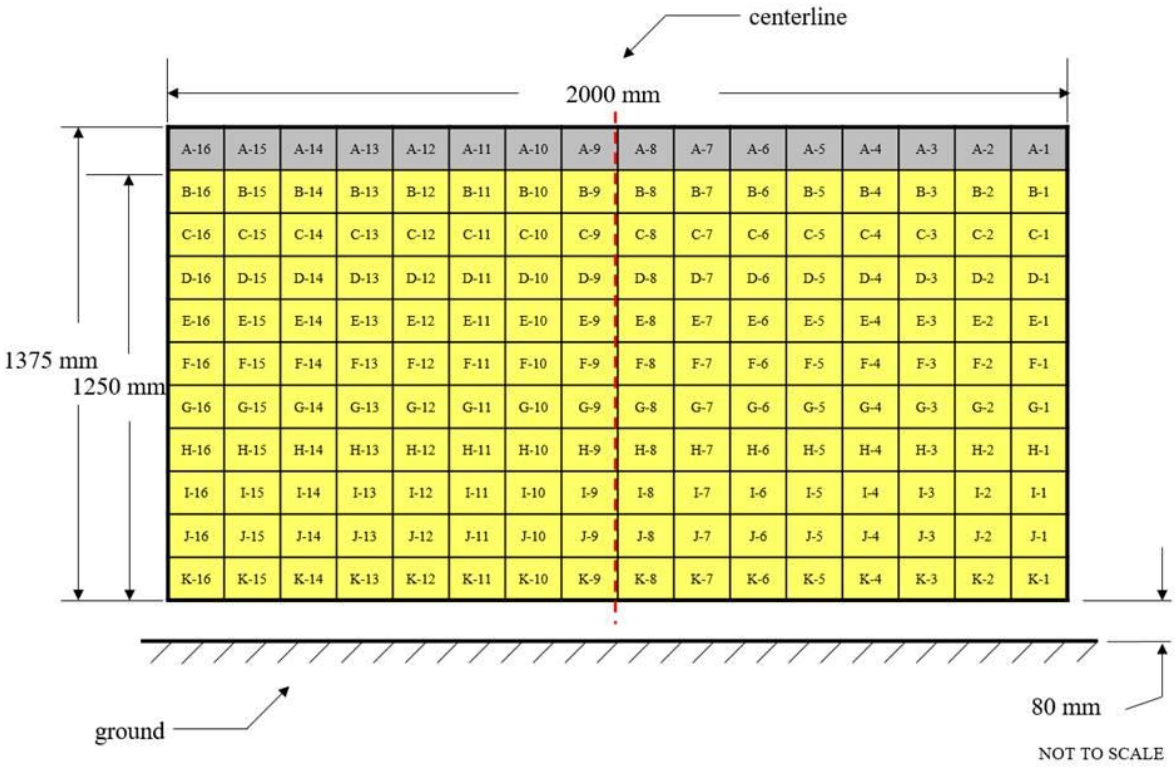
Item	Value
A	420
B	885
C	2276
D	610
E	1310
F	422
G	1605
H	1037
I	1399
J	858
K	858
L	1060
M	1035
N	1060
O	857
P	860
Q	1398

All units in millimeters



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

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023



DATA SHEET NO. 10 - TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023

INSTRUMENTATION

Instrumentation	Number of Channels Collected
Driver Dummy Accelerometers	47
Passenger Dummy Accelerometers	47
Vehicle Structure Accelerometers	8
Total	102

CAMERA COVERAGE

Type of Camera	Number Used in this Test
High-Speed Vehicle Onboard	2
High-Speed Offboard	14
Real-Time Panning	2
Total	18

DATA SHEET NO. 11 - POST-TEST OBSERVATIONS

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023

TEST DUMMY INFORMATION AND CONTACT LOCATIONS

Description	Driver	Passenger
Dummy Type / Serial No.	Hybrid III 50th / 037	Hybrid III 5th / DH1659
Head Contact	Frontal Airbag and Head Restraint	Frontal Airbag and Head Restraint
Upper Torso Contact	Airbag	Airbag
Lower Torso Contact	Airbag	Airbag
Left Knee Contact	Knee Bolster	Glove Box
Right Knee Contact	Knee Bolster	Glove Box

DOOR OPENING, TRUNK OPENING, AND SEAT TRACK INFORMATION

Description	Driver	Passenger	Other
Locked/Unlocked Doors	Locked	Locked	
Front Door Opening	No	No	
Rear Door Opening	No	No	
Trunk/Hatch/Tailgate Opening			No
Seat Track Shift (mm)	No	No	
Seat Back Movement from Initial Position	No	No	

POST- OTHER VEHICLE POST-TEST OBSERVATIONS

Critical Areas of Performance	Observations
Windshield Damage	Cracked
Window Damage	None
Other Notable Effects	None

VEHICLE REBOUND FROM BARRIER

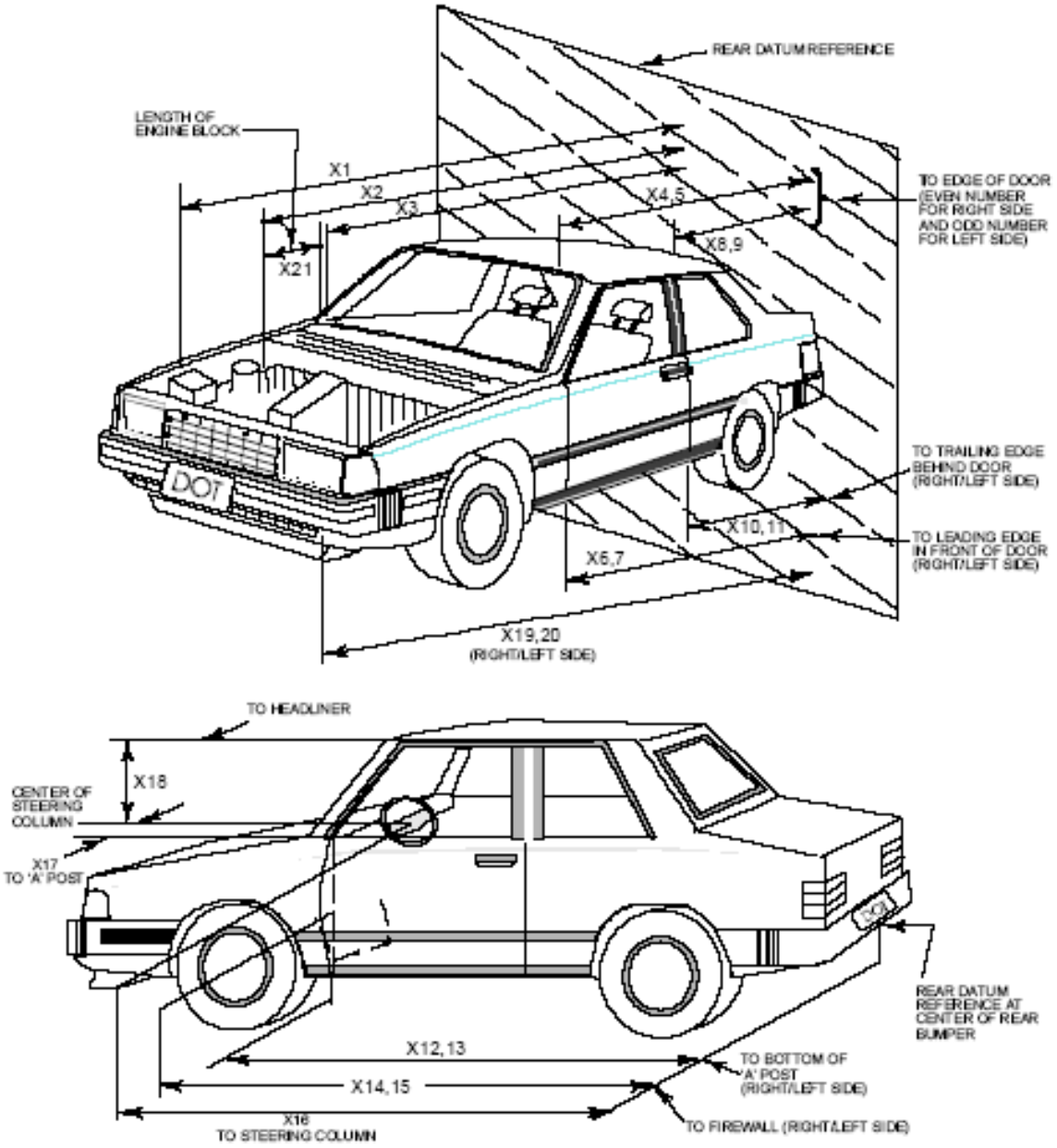
Measured Parameter	Units	Value
Left Side	mm	3013
Center	mm	3110
Right Side	mm	3046
Average	mm	3056

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

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

DATA SHEET NO. 12 - VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023



DATA SHEET NO. 12 - VEHICLE PROFILE MEASUREMENTS (CONT'D)

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023

No.	Measurement Description	Pre-Test	Post-Test	Change
1	Total Length of Vehicle at Centerline	4175	3630	-545
2	Rear Surface of Vehicle (RSOV) to Front of Engine	3745	3620	-125
3	RSOV to Firewall	3245	3235	-10
4	RSOV to Upper Leading Edge of Right Door	2795	2797	2
5	RSOV to Upper Leading Edge of Left Door	2795	2797	2
6	RSOV to Lower Leading Edge of Right Door	2812	2816	4
7	RSOV to Lower Leading Edge of Left Door	2815	2813	-2
8	RSOV to Upper Trailing Edge of Right Door	1787	1790	3
9	RSOV to Upper Trailing Edge of Left Door	1790	1788	-2
10	RSOV to Lower Trailing Edge of Right Door	1825	1830	5
11	RSOV to Lower Trailing Edge of Left Door	1830	1827	-3
12	RSOV to Bottom of "A" Post-of Right Side	2800	2804	4
13	RSOV to Bottom of "A" Post-of Left Side	2800	2804	4
14	RSOV to Firewall, Right Side	3370	3329	-41
15	RSOV to Firewall, Left Side	3370	3362	-8
16	RSOV to Steering Column	2370	2462	92
17	Center of Steering Column to "A" Post	310	345	35
18	Center of Steering Column to Headliner	440	420	-20
19	RSOV to Right Side of Front Bumper	4050	3579	-471
20	RSOV to Left Side of Front Bumper	4050	3642	-408
21	Length of Engine Block	500	500	0
RD	RSOV to Right Side of Dash Panel	2610	2612	2
CD	RSOV to Center of Dash Panel	2560	2556	-4
LD	RSOV to Left Side of Dash Panel	2620	2621	1

All Dimensions in mm

DATA SHEET NO. 13 - ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023

VEHICLE INFORMATION

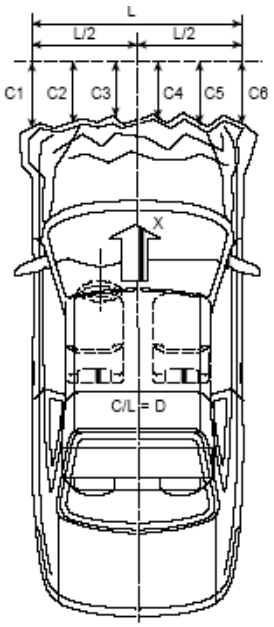
VIN: KM8K33AG4PU173015 Wheelbase: 2600
Vehicle Size Category: MPV Test Weight (kg): 1870.0

ACCELEROMETER DATA

Accelerometer Locations: As listed on Page 15 of this report.
Cal. Procedure/Interval: TRC procedure / 6 month interval
Integration Algorithm: Trapezoidal
Linearity: > 99%
Impact Velocity (km/h): 56.44
Velocity Change (km/h): 67.95
Time of Separation (ms): 101

CRUSH PROFILE

Collision Deformation Classification: 12FDEW2
Midpoint of Damage: Centerline
Damage Region Length (mm): 1320
Impact Mode: Frontal



No.	Measurement Description	Units	Pre-Test	Post-Test	Crush
C1	Crush zone 1 at left side	mm	4050	3642	408
C2	Crush zone 2 at left side	mm	4150	3655	495
C3	Crush zone 3 at left side	mm	4175	3640	535
C4	Crush zone 4 at right side	mm	4175	3635	540
C5	Crush zone 5 at right side	mm	4150	3634	516
C6	Crush zone 6 at right side	mm	4050	3579	471
L	C1 to C6	mm	1320	1120	200

DATA SHEET NO. 14 - VEHICLE INTRUSION MEASUREMENTS

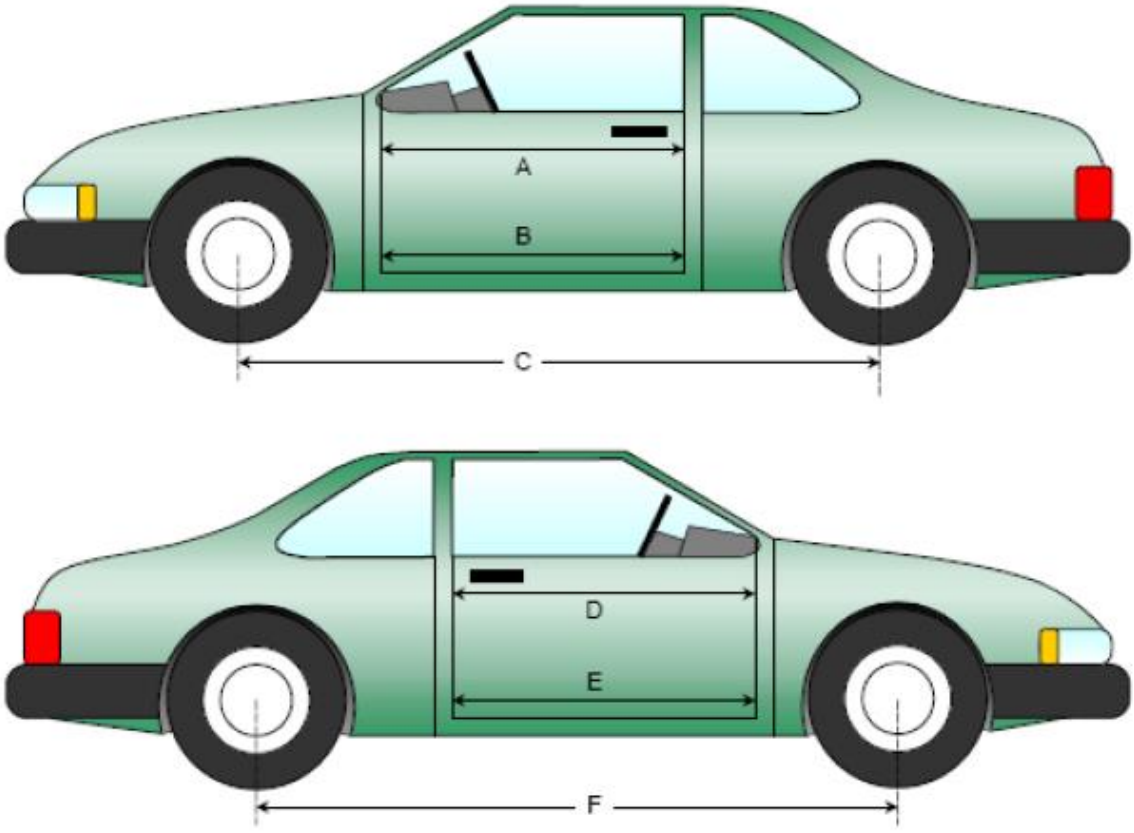
Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023

DOOR OPENING WIDTH

No.	Description	Units	Pre-Test	Post-Test	Change
A	Left Side Upper	mm	965	966	1
B	Left Side Lower	mm	866	866	0
D	Right Side Upper	mm	967	967	0
E	Right Side Lower	mm	862	862	0

WHEELBASE MEASUREMENTS

No.	Description	Units	Pre-Test	Post-Test	Change
C	Left Side Wheelbase	mm	2600	2550	-50
F	Right Side Wheelbase	mm	2600	2415	-185



[1] Front suspension damaged and wheels fell off measurements not available

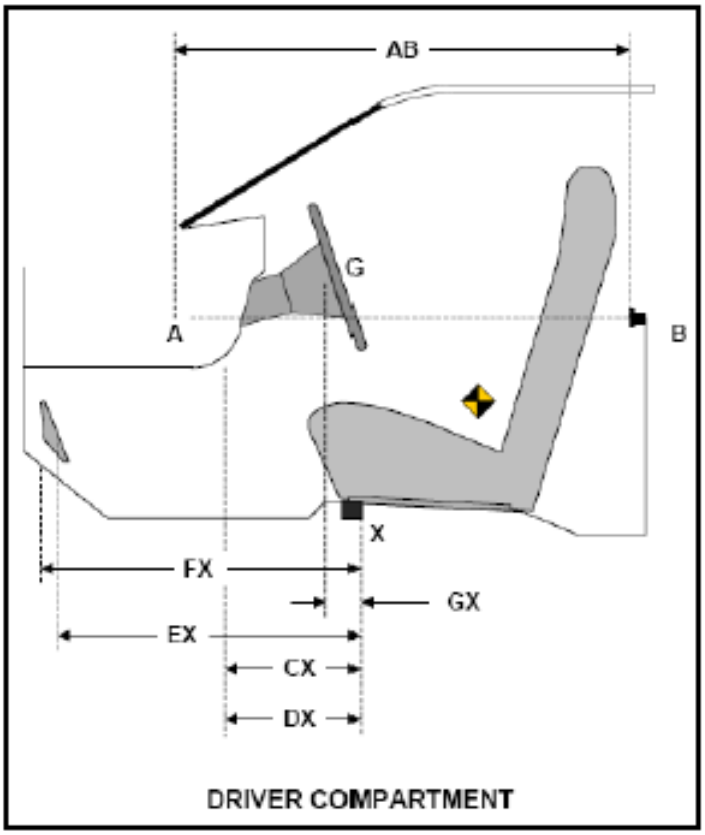
DATA SHEET NO. 14 - VEHICLE INTRUSION MEASUREMENTS (CONT'D)

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Change
AB	Door Opening (Inside Window Jam)	mm	936	936	0
CX	Left Knee Bolster to X	mm	283	260	-23
DX	Right Knee Bolster to X	mm	252	244	-8
EX	Brake Pedal to X	mm	548	445	-103
FX	Foot Rest to X	mm	575	519	-56
GX	Center of Steering Column Wheel Hub to X	mm	95	192	97

X = Front of Seat Track (Stationary)



DATA SHEET NO. 15 - SUMMARY OF INDICANT FMVSS 212 AND FMVSS 219 (PARTIAL) DATA

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023

Please provide windshield mounting details.

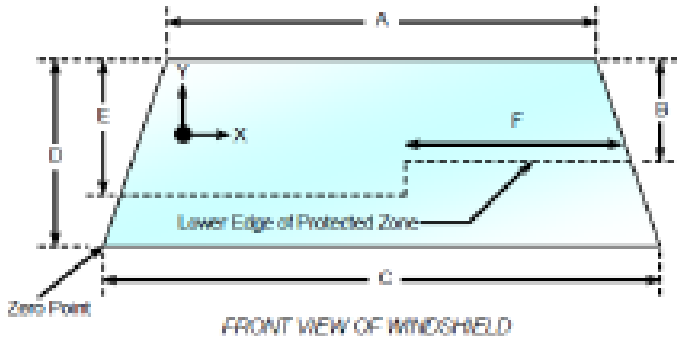
The standard requires that the post-test retention measurement be a minimum of 75% of the pre-test total periphery measurement for vehicle not equipped with occupant passive restraint and 50% for each side of the windshield for vehicle which are equipped with occupant passive restraints.

Temperature of windshield molding during test: 20.5°C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% Retention
Left Side	2175	2175	100.0
Right Side	2175	2175	100.0
Total	4350	4350	100.0

Item	Units	Value
A	mm	1210
B	mm	485
C	mm	1500
D	mm	820
E	mm	518
F	mm	515



FRONT VIEW OF WINDSHIELD

AREAS OF PROTECTED ZONE FAILURES

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

X	Y
NA	NA
NA	NA
NA	NA
NA	NA

B. The inner surface of the windshield was penetrated by the hood support beneath the protected zone.

X	Y
NA	NA
NA	NA
NA	NA
NA	NA

DATA SHEET NO. 16 - FMVSS 301 BARRIER IMPACT AND STATIC ROLLOVER RESULTS

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023

FMVSS 301 FUEL SYSTEM INTEGRTY POST IMPACT DATA

Temperature at Time of Impact: 20.5°C Test Time: 15:30

Stoddard Solvent Spillage Measurements

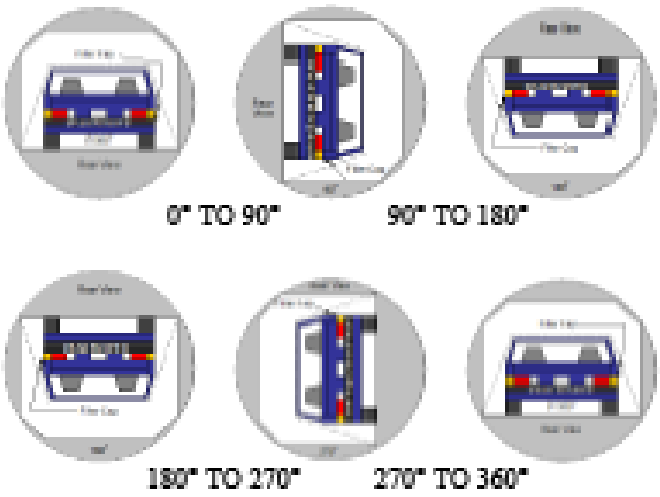
A	From impact until vehicle motion ceases: (maximum allowable – 1 oz.)	0 oz.
B	For the 5-minute period after motion ceases: (maximum allowable – 5 oz.)	0 oz.
C	For the following 25 minutes: (maximum allowable – 1 oz./minutes)	0 oz.
D	Spillage: None	

DATA SHEET NO. 16 - FMVSS 301 BARRIER IMPACT AND STATIC ROLLOVER RESULTS (CONT'D)

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023

1. The specified fixture rollover rate for each 90º of rotation is 60 to 180 seconds.
2. The position hold time at each position is 300 seconds (minimum).
3. Details of Stoddard Solvent spillage:

None



SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0º to 90º	90	330	420
90º to 180º	90	330	840
180º to 270º	90	330	1260
270º to 360º	90	330	1480

FMVSS 301 SPILLAGE TABLE

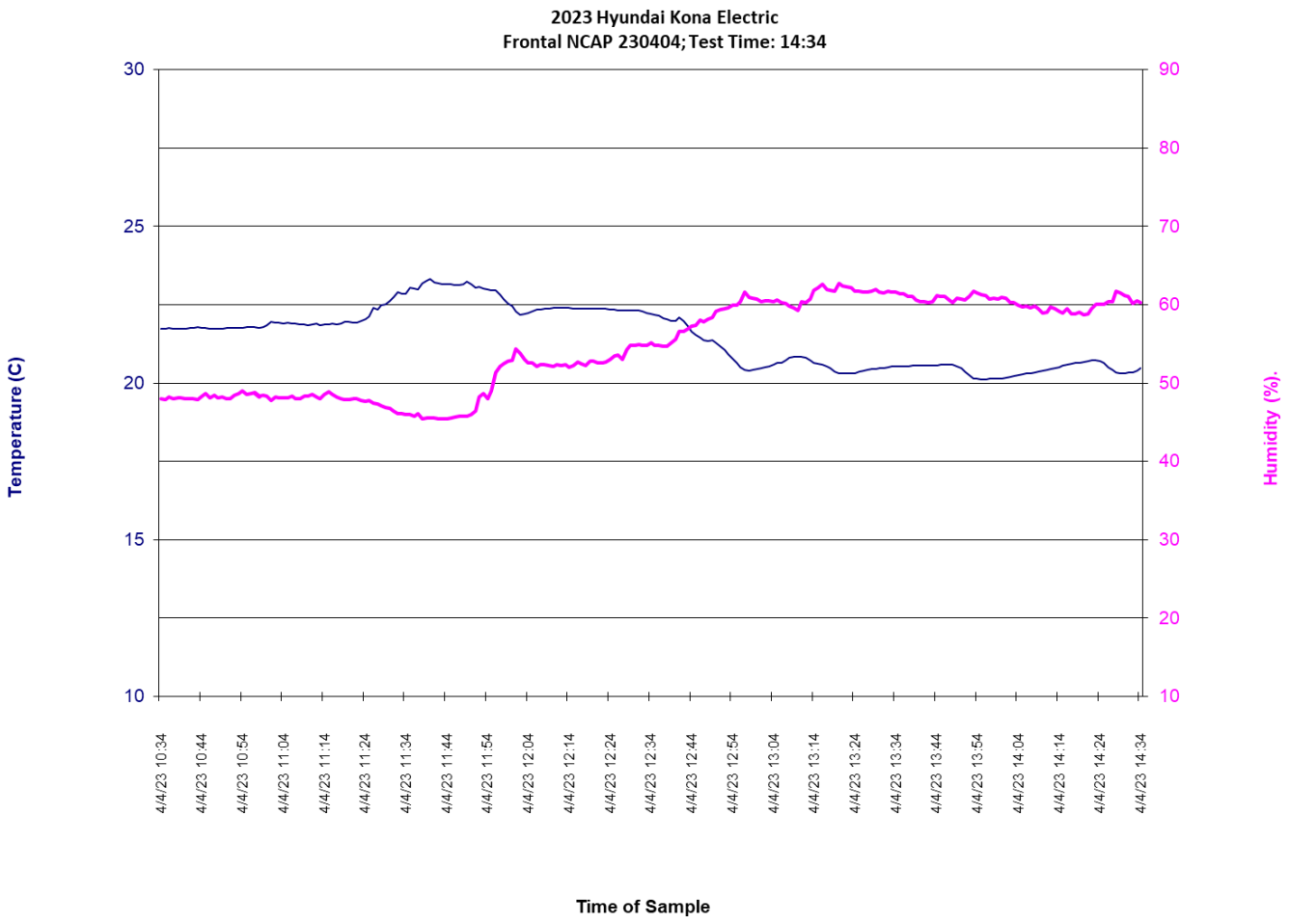
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0º to 90º	0	0	0	N/A
90º to 180º	0	0	0	N/A
180º to 270º	0	0	0	N/A
270º to 360º	0	0	0	N/A

SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0º to 90º	None
90º to 180º	None
180º to 270º	None
270º to 360º	None

DATA SHEET NO. 17 - DUMMY/VEHICLE TEMPERATURE STABILIZATION

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023



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

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023

ELECTRIC VEHICLE PROPULSION SYSTEM

Type of Electric Vehicle (Electric/Hybrid): Electric
Propulsion Battery Type: Lithium ion battery
Nominal Voltage: 356 V;
Physical Location of Automatic Propulsion Battery Disconnect: Inside battery system

Auxiliary Battery Type: 12V

PROPULSION BATTERY SYSTEM DATA (COTR-supplied):

Electrolyte Fluid Type: Liquid electrolyte containing LiPF6 salt
Electrolyte Fluid Specific Gravity: .197 g/cm3
Electrolyte Fluid Kinematic Viscosity: 3.0 cP centistokes
Electrolyte Fluid Color: Transparent pale yellow
Propulsion Battery Coolant Type, Color, Specific Gravity (if applicable): Water + ethylene glycol, blue

Location of Battery Modules

☐ Inside Passenger Compartment

☒ Outside Passenger Compartment

Propulsion Battery State of Charge:

☒ Maximum state of charge

Test Voltage (No less than 95% of Maximum State of Charge): 391.4

OR

☐ Range of Normal Operating Voltage

Test Voltage (Within Normal Operative Voltage Range):

RECORDED BY: Franklin Xu DATE: 4/4/23
APPROVED BY: John Shultz DATE: 4/5/23

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

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023

VEHICLE CHASSIS GROUND POINT(S) LOCATION(S):

Details of Vehicle Chassis Ground Point(s) & Location(s) [Supply photographs as appropriate]:
Next to battery-side high voltage cable connector

PROPULSION BATTERY SYSTEM:

Details of Propulsion Battery Components [Supply photographs as appropriate]:

Comments:

RECORDED BY: Franklin Xu DATE: 4/4/23
APPROVED BY: John Shultz DATE: 4/5/23

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

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023

VOLTMETER INFORMATION
The voltmeter used in this test shall measure DC values and have an internal impedance of at least 10MΩ.

> **NOTE:** An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles.

Make: Fluke ; Model: 87V ; S/N: 15860164
Internal Impedance Value: 50 MΩ
Resolution: 0.00001 V
Last Calibration Date: 9/23/2022

PROPULSION BATTERY VOLTAGE
The measurement shall be made with the propulsion battery connected to the vehicle propulsion system, and the vehicle in the "ready-to-drive" (propulsion motor(s) activated) position.

NOTE: If the voltage measurement is not at the voltage or within the normal operating voltage range specified by the manufacturer, the battery must be charged.

Vb = 405.8 V

ELECTRICAL ISOLATION MEASUREMENTS
PROPULSION BATTERY TO VEHICLE CHASSIS

Vehicle chassis point(s) will be determined and supplied to the Contractor by the COTR.

V1 = 286 V
V2 = 293 V

PROPULSION BATTERY TO VEHICLE CHASSIS ACROSS RESISTOR

The known resistance Ro (in ohms) should be approximately 500 times the nominal operating voltage of the vehicle (in volts) per SAE J1766.

Ro = 164,800 Ω
V1' = 30.16 V Pre-Impact
V2' = 32.3 V Pre-Impact

DATA SHEET NO. 305-3 - PRE-IMPACT ELECTRICAL ISOLATION MEASUREMENTS AND CALCULATIONS FOR INDICANT FMVSS NO. 305 TESTING (CONT'D)

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023

ELECTRICAL ISOLATION CALCULATIONS

NOTE: If measured voltage is zero and results in a division by zero, record "Zero Volts." This "zero voltage" condition is considered as being compliant.

Ri1 = Ro (1 + V2/V1) [(V1-V1')/V1']
Ri1 = 2830133 Ω Pre-Impact

Ri2 = Ro (1 + V1/V2) [(V2-V2')/V2']
Ri2 = 2628492 Ω Pre-Impact

Ri = The lesser of Ri1 and Ri2
Ri = 2628492 Ω Pre-Impact

Ri/Vb = Electrical Isolation Value/ Nominal Battery Voltage
Ri/Vb = 6477 Ω V Pre-Impact

NOTE: The minimum Electrical Isolation Value is 500 Ω/ V.

Is the measured Electrical Isolation Value ≥500 Ω/ V?

☒ Yes ☐ No

Comments:

RECORDED BY: Franklin Xu DATE: 4/4/23
APPROVED BY: John Shultz DATE: 4/5/23

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

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214
Test Program: NCAP Frontal Impact Test Date: 4/4/2023

VOLTMETER INFORMATION

The voltmeter used in this test shall measure DC values and have an internal impedance of at least 10MΩ.

NOTE: An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles.

Make: Fluke ; Model: 87V ; S/N: 15860164
Internal Impedance Value: 50 MΩ
Nominal Propulsion Battery Voltage (Vb): 0.100 V

ELECTRICAL ISOLATION MEASUREMENTS

Record V1, V2, V1', V2' voltage measurements immediately after the impacted vehicle comes to rest.

V1 =	0.007	V	Post-Impact	Time:	1	minutes	51	s
V2 =	0.063	V	Post-Impact	Time:	2	minutes	10	s
V1' =	0.002	V	Post-Impact	Time:	2	minutes	33	s
V2' =	0.002	V	Post-Impact	Time:	2	minutes	48	s

ELECTRICAL ISOLATION CALCULATIONS

NOTE: If measured voltage is zero and results in a division by zero, record "Zero Volts." This "zero voltage" condition is considered as being compliant.

Ri1 = Ro (1 + V2/V1) [(V1-V1')/V1']
Ri1 = 4120000 Ω Post-Impact Time: 2 minutes 48 s

Ri2 = Ro (1 + V1/V2) [(V2-V2')/V2']
Ri2 = 5584889 Ω Post-Impact Time: 2 minutes 48 s

Ri = The lesser of Ri1 and Ri2
Ri = 4120000 Ω Post-Impact Time: 2 minutes 48 s

Ri/Vb = Electrical Isolation Value/ Nominal Battery Voltage
Ri/Vb = 41200000 Ω/V Post-Impact Time: 2 minutes 49 s

NOTE: The minimum Electrical Isolation Value is 500 Ω/ V.

Is the measured Electrical Isolation Value ≥500 Ω/ V?

☒ Yes ☐ No (Fail)

DATA SHEET NO. 305-4 POST-IMPACT DATA FOR INDICANT FMVSS NO. 305 TESTING (CONT'D)

PROPULSION BATTERY SYSTEM COMPONENTS

Describe any Propulsion Battery Module movement within the passenger compartment. [Supply photographs as appropriate]:

None

Has the Propulsion Battery Module moved within the passenger compartment?

☐ Yes (Fail) ☒ No

Describe any intrusion of an outside Propulsion Battery Component into the passenger compartment. [Supply photographs as appropriate]:

None

Has an outside Propulsion Battery Component intruded into the passenger compartment?

☐ Yes (Fail) ☒ No

Is the Propulsion Battery Electrolyte Spillage visible in the passenger compartment?

☐ Yes (Fail) ☒ No

RECORDED BY: Franklin Xu DATE: 4/4/23

APPROVED BY: John Shultz DATE: 4/5/23

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

Test Vehicle: 2023 Hyundai Kona Electric NHTSA No.: M20234214

Test Program: NCAP Frontal Impact Test Date: 4/4/2023

PROPULSION BATTERY ELECTROLYTE COLLECTION TIME PERIOD

Test Phase	Rotation Time (spec. 1-3 min)				FMVSS No. 301 Hold Time		Total Time				Next Whole Minute Interval	
0°-90°	1	min.	3	sec.	8	min.	9	min.	3	sec.	10	min.
90°-180°	1	min.	3	sec.	9	min.	19	min.	6	sec.	20	min.
180°-270°	1	min.	4	sec.	10	min.	30	min.	10	sec.	31	min.
270°-360°	1	min.	4	sec.	8	min.	39	min.	14	sec.	40	min.

TEST VEHICLE PROPULSION BATTERY ELECTROLYTE SPILLAGE

NOTE: The maximum allowable Propulsion Battery Electrolyte Spillage is 5.0 Liters.

Test Phase	Propulsion Battery Electrolyte Spillage (L)	Spillage Location
0°-90°	0	N/A
90°-180°	0	N/A
180°-270°	0	N/A
270°-360°	0	N/A

Total Spillage: 0 **L**

Is the total Propulsion Battery Electrolyte Spillage greater than 5.0 Liters?

☐ Yes (Fail) ☒ No

Is the Propulsion Battery Electrolyte Spillage visible in the passenger compartment?

☐ Yes (Fail) ☒ No

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

VOLTMETER INFORMATION

The voltmeter used in this test shall measure DC values and have an internal impedance of at least 10MΩ.

NOTE: An oscilloscope meeting the above requirements may need to be used to adequately measure voltage in some vehicles.

Make: Fluke ; Model: 87V ; S/N: 15860164

Internal Impedance Value: 50 MΩ

Nominal Propulsion Battery Voltage (Vb): 0.100 V

ELECTRICAL ISOLATION MEASUREMENTS

Record V1, V2, V1', V2' voltage measurements at the start of each successive increment of 90º, 180º, 270º, and 360º of the static rollover test.

V1 =	0.024	V	@ 90º	Time:	1	minutes	5	s
V1 =	0.023	V	@ 180º	Time:	10	minutes	8	s
V1 =	0.032	V	@ 270º	Time:	20	minutes	9	s
V1 =	0.021	V	@ 360º	Time:	31	minutes	41	s
V2 =	0.030	V	@ 90º	Time:	1	minutes	8	s
V2 =	0.013	V	@ 180º	Time:	10	minutes	14	s
V2 =	0.040	V	@ 270º	Time:	20	minutes	13	s
V2 =	0.011	V	@ 360º	Time:	31	minutes	44	s
V1' =	0.001	V	@ 90º	Time:	1	minutes	15	s
V1' =	0.002	V	@ 180º	Time:	10	minutes	36	s
V1' =	0.001	V	@ 270º	Time:	20	minutes	22	s
V1' =	0.003	V	@ 360º	Time:	31	minutes	56	s
V2' =	0.002	V	@ 90º	Time:	1	minutes	24	s
V2' =	0.000	V	@ 180º	Time:	10	minutes	38	s
V2' =	0.023	V	@ 270º	Time:	20	minutes	27	s
V2' =	0.000	V	@ 360º	Time:	31	minutes	58	s

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

ELECTRICAL ISOLATION CALCULATIONS

NOTE: If measured voltage is zero and results in a division by zero, record "Zero Volts." This "zero voltage" condition is considered as being compliant.

Ri1 = Ro (1 + V2/V1) [(V1-V1')/V1']

Ri1 =	8528400	Ω	@ 90º	Time:	1	minutes	24	s
Ri1 =	2708452	Ω	@ 180º	Time:	10	minutes	38	s
Ri1 =	11494800	Ω	@ 270º	Time:	20	minutes	27	s
Ri1 =	1506743	Ω	@ 360º	Time:	31	minutes	58	s

Ri2 = Ro (1 + V1/V2) [(V2-V2')/V2']

Ri2 =	4152960	Ω	@ 90º	Time:	1	minutes	24	s
Ri2 =	0 volts	Ω	@ 180º	Time:	10	minutes	38	s
Ri2 =	219256	Ω	@ 270º	Time:	20	minutes	27	s
Ri2 =	0 volts	Ω	@ 360º	Time:	31	minutes	58	s

Ri = The lesser of Ri1 and Ri2

Ri =	4152960	Ω	@ 90º	Time:	1	minutes	24	s
Ri =	2708452	Ω	@ 180º	Time:	10	minutes	38	s
Ri =	219256	Ω	@ 270º	Time:	20	minutes	27	s
Ri =	1506743	Ω	@ 360º	Time:	31	minutes	58	s

Ri/Vb = Electrical Isolation Value/ Nominal Battery Voltage

RiVb =	41529600	Ω	@ 90º	Time:	1	minutes	24	s
RiVb =	27084520	Ω	@ 180º	Time:	10	minutes	38	s
RiVb =	2192560	Ω	@ 270º	Time:	20	minutes	27	s
RiVb =	15067430	Ω	@ 360º	Time:	31	minutes	58	s

NOTE: The minimum Electrical Isolation Value is 500 Ω/ V.

Is the measured Electrical Isolation Value ≥500 Ω/ V?

☒ Yes ☐ No (Fail)

Comments: _____

RECORDED BY: Franklin Xu DATE: 4/4/23

APPROVED BY: John Shultz DATE: 4/5/23

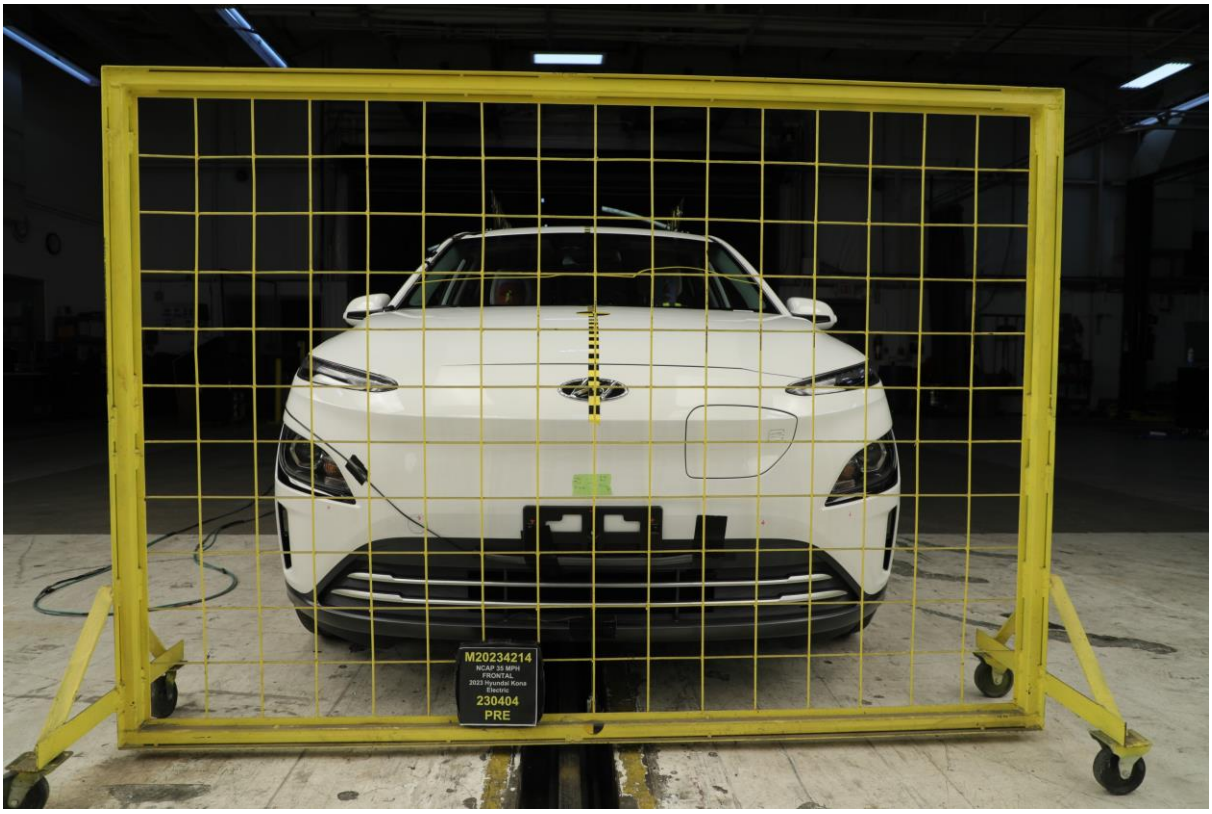
APPENDIX A
PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

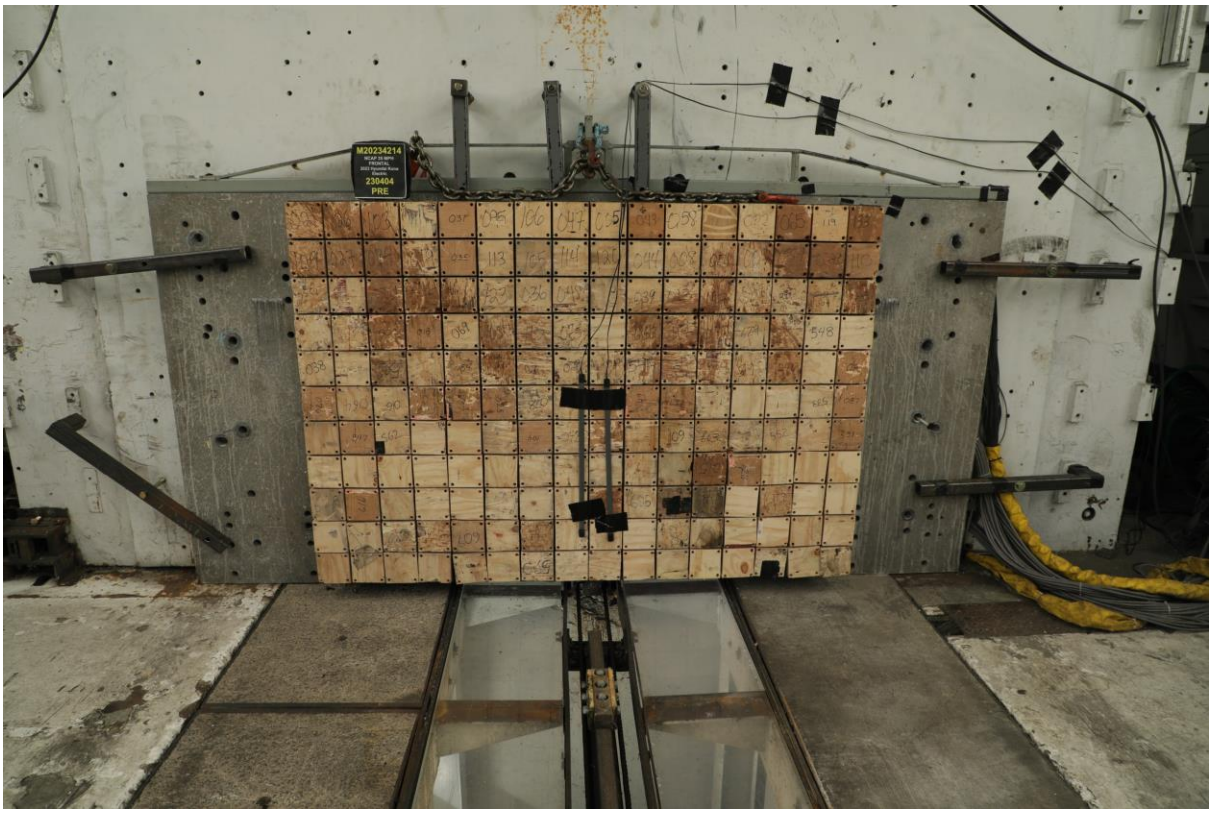
TABLE OF PHOTOGRAPHS (CONTINUED)

TABLE OF PHOTOGRAPHS (CONTINUED)

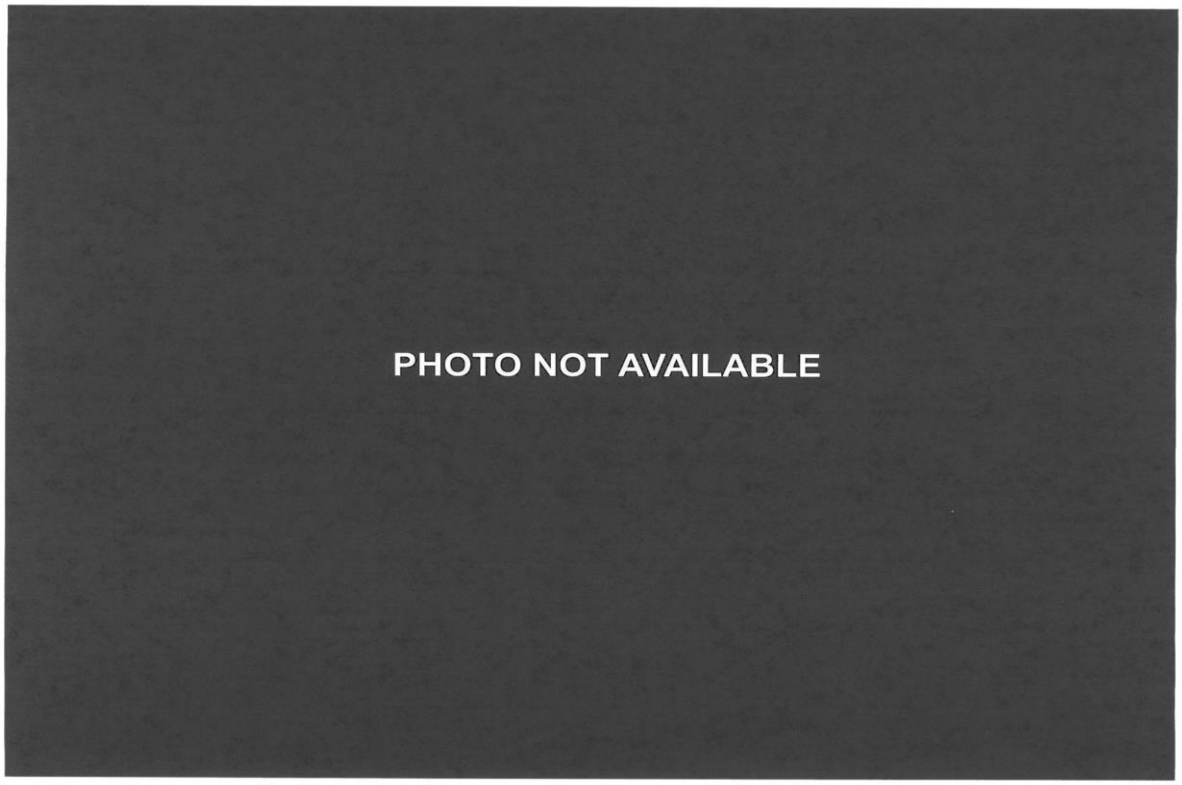
TABLE OF PHOTOGRAPHS (CONTINUED)



001 Load Cell Location

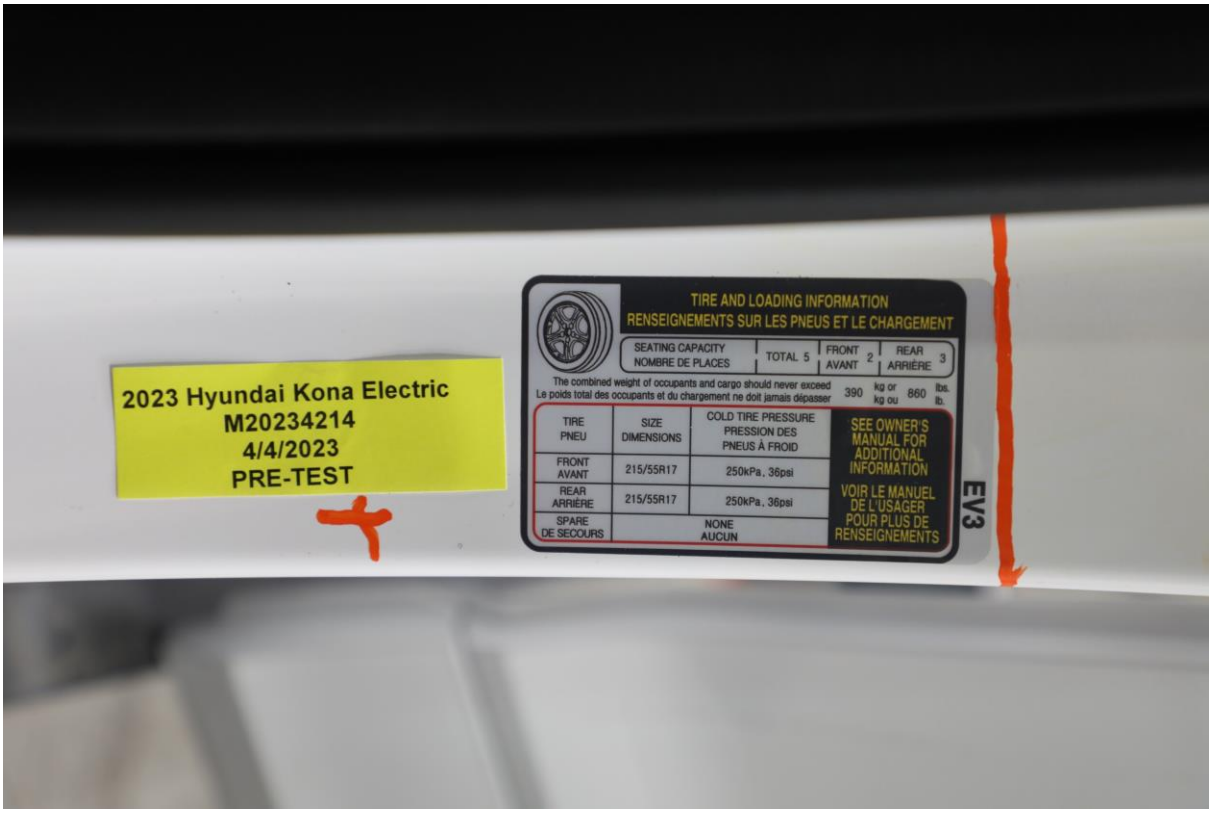


002 Pre-Test Load Cell Wall



003 Post-Test Load Cell Wall

004 Manufacturer's Label

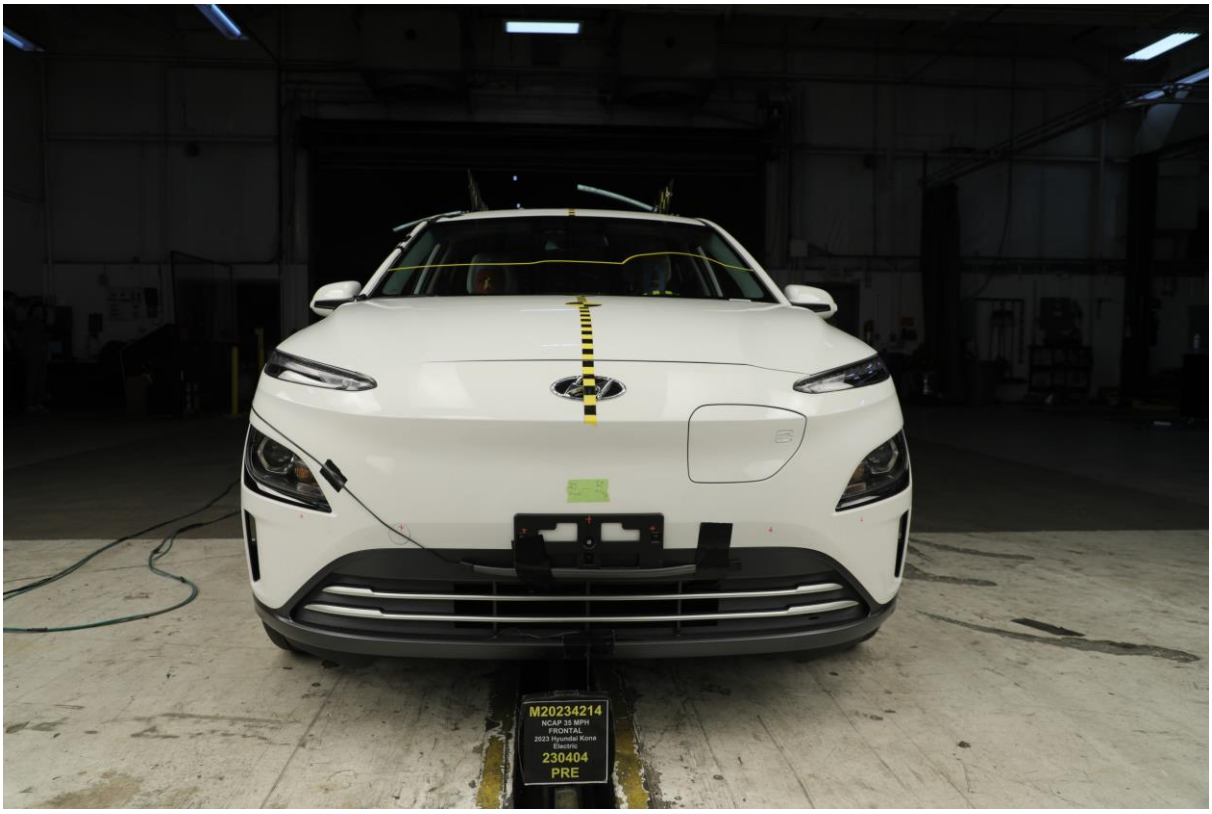


005 Tire Placard

Intentionally Left Blank

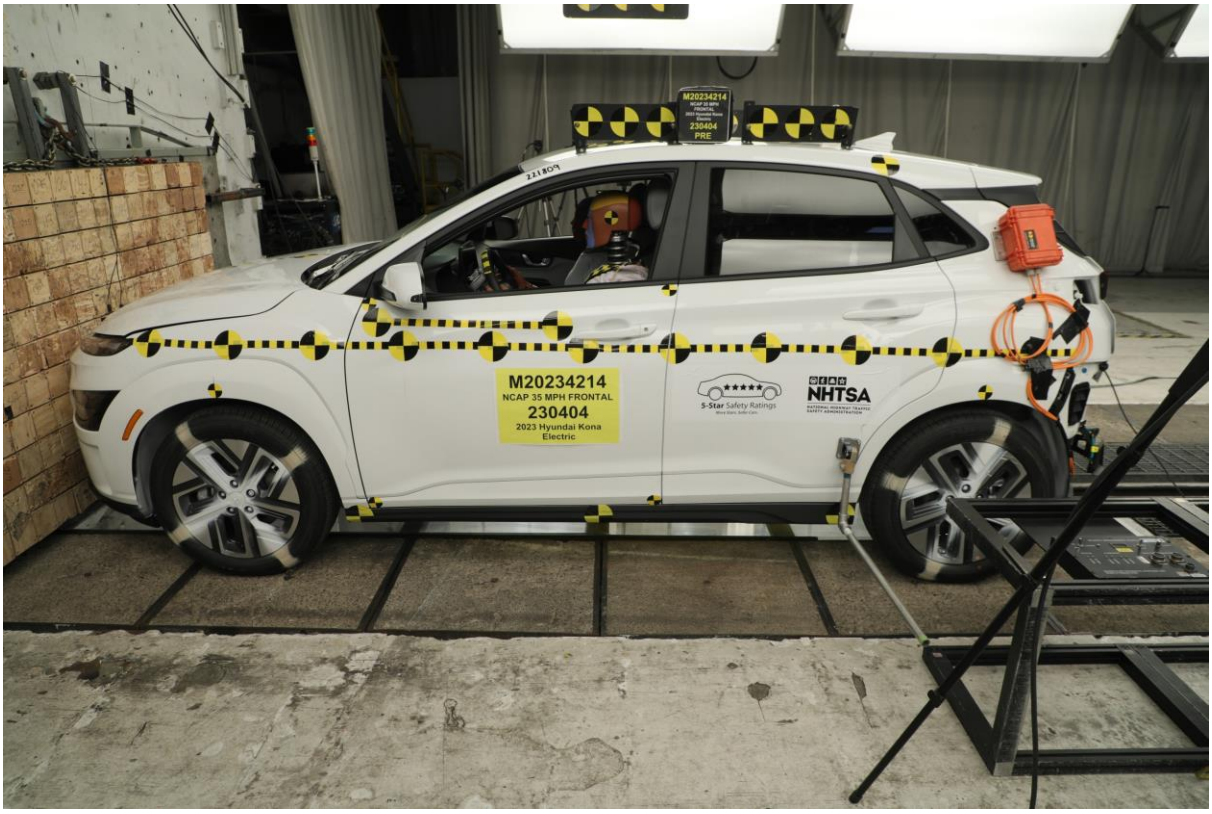
006 2023 Hyundai Kona Electric Frontal As Delivered

007 Left Rear 3-4 View, as Received



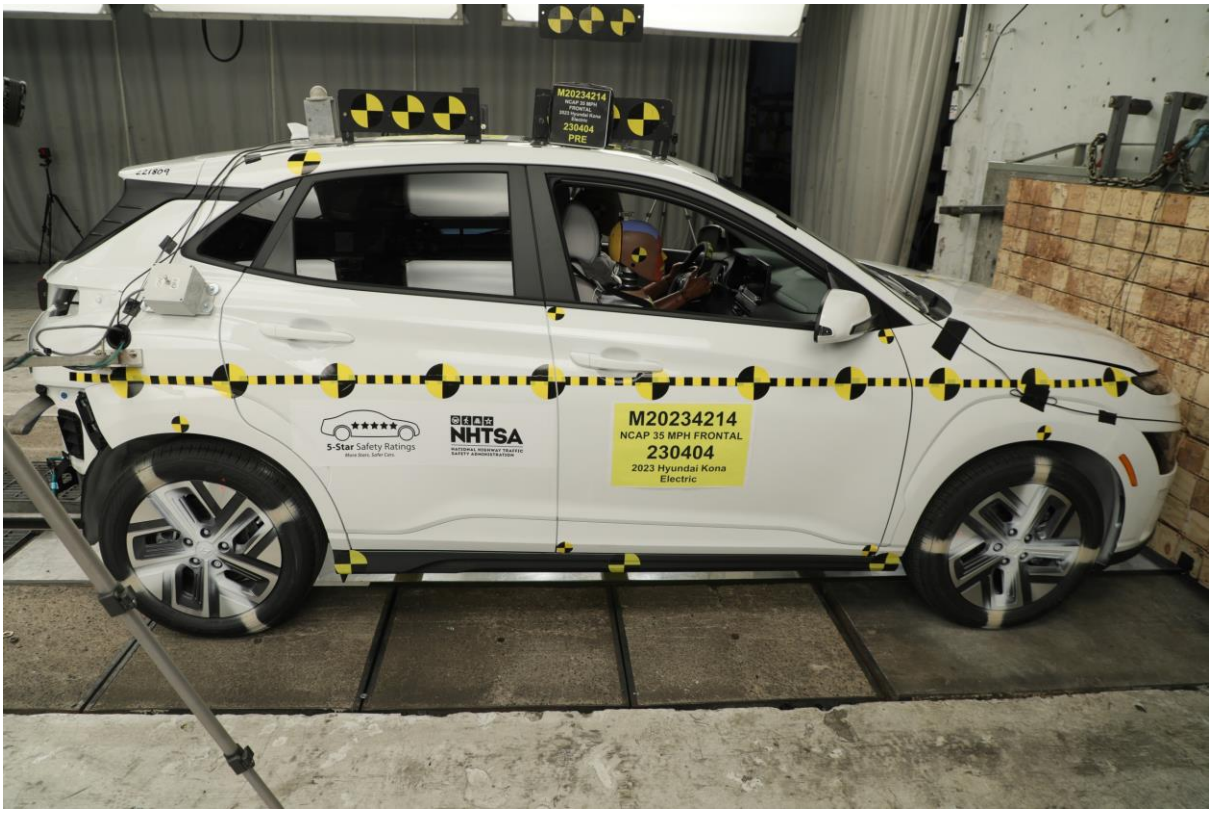
008 Pre-Test Front View of Test Vehicle

009 Post-Test Front View of Test Vehicle

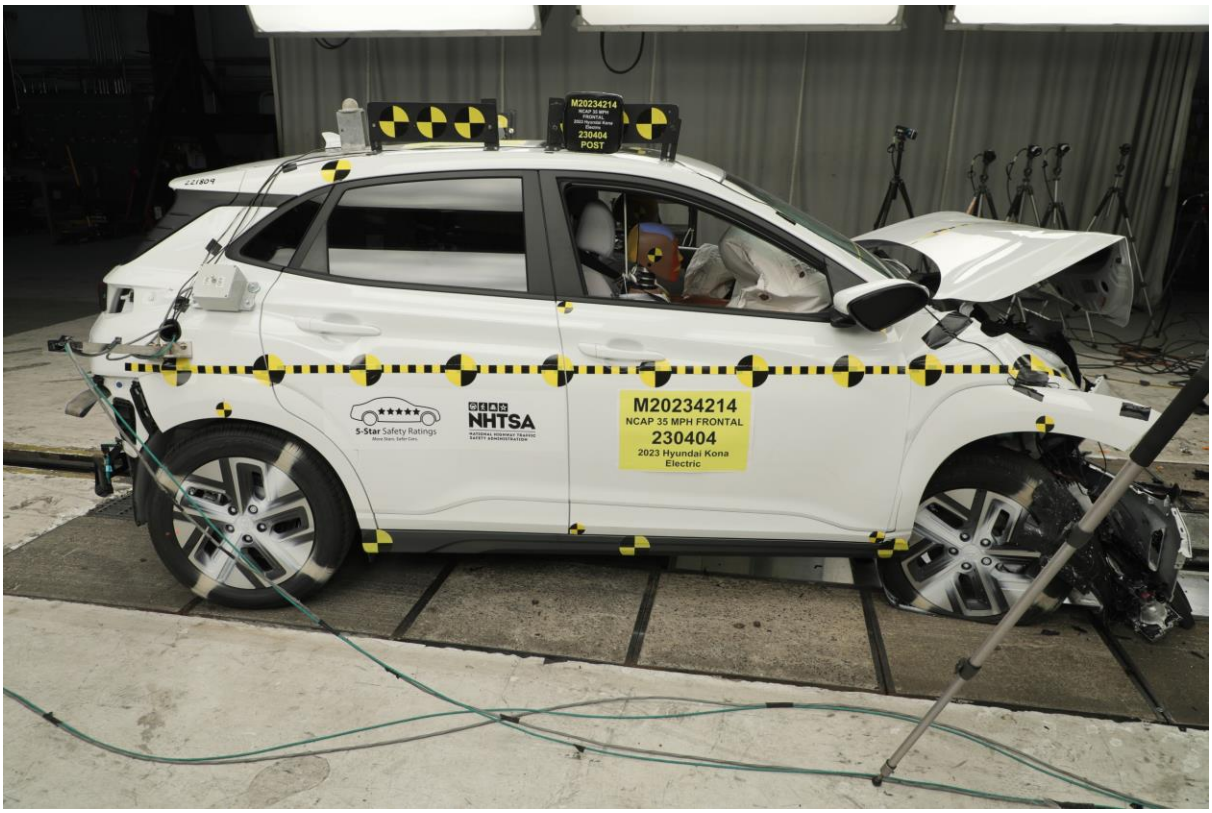


010 Pre-Test Left View of Test Vehicle

011 Post-Test Left View of Test Vehicle



012 Pre-Test Right View of Test Vehicle



013 Post-Test Right View of Test Vehicle

014 Pre-Test Right Front 3-4 View

015 Post-Test Right Front 3-4 View

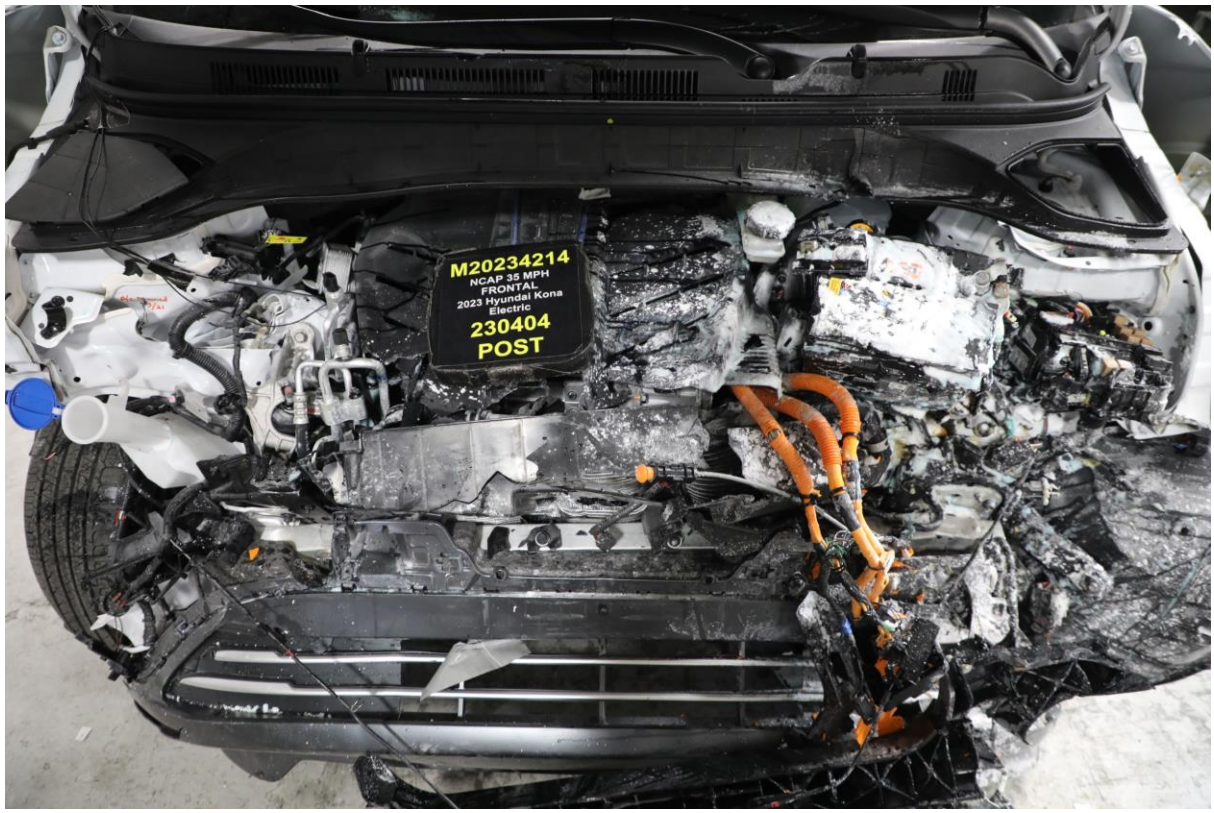
016 Pre-Test Left Rear 3-4 View

017 Post-Test Left Rear 3-4 View

018 Pre-Test Windshield View

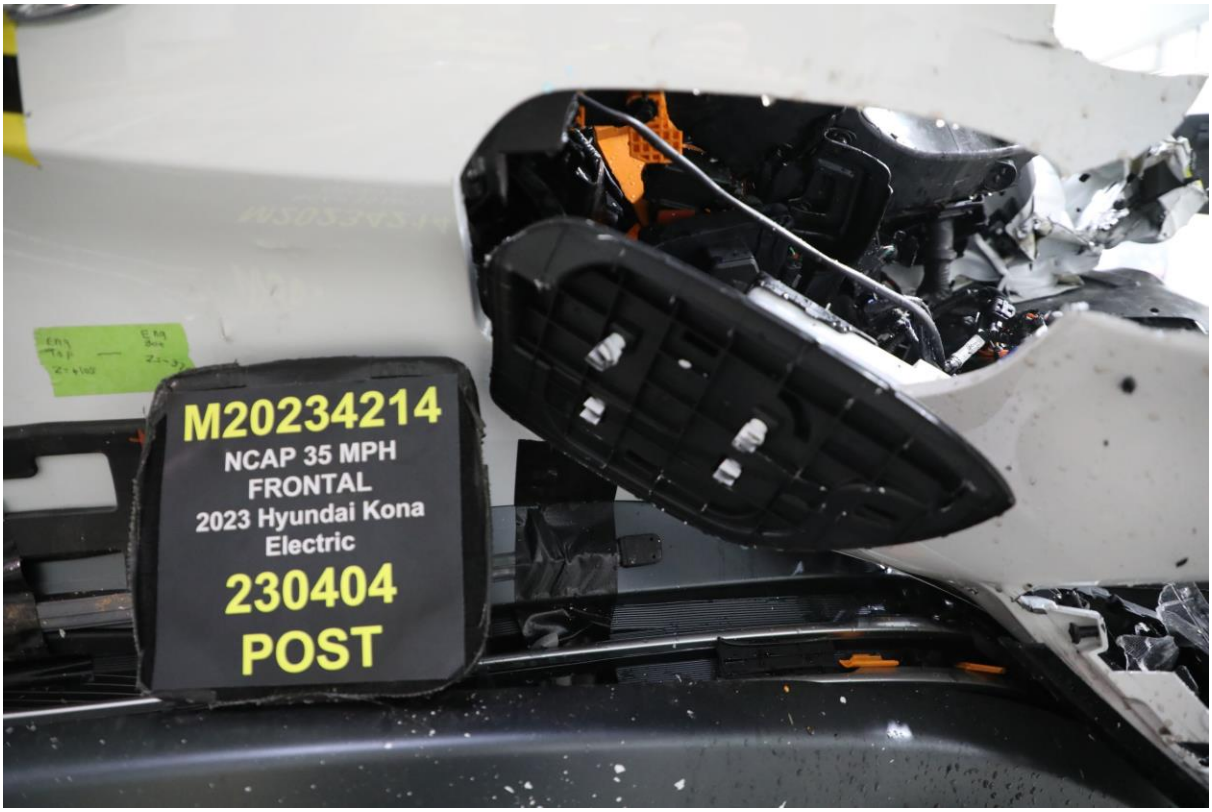
019 Post-Test Windshield View

020 Pre-Test Engine Compartment View



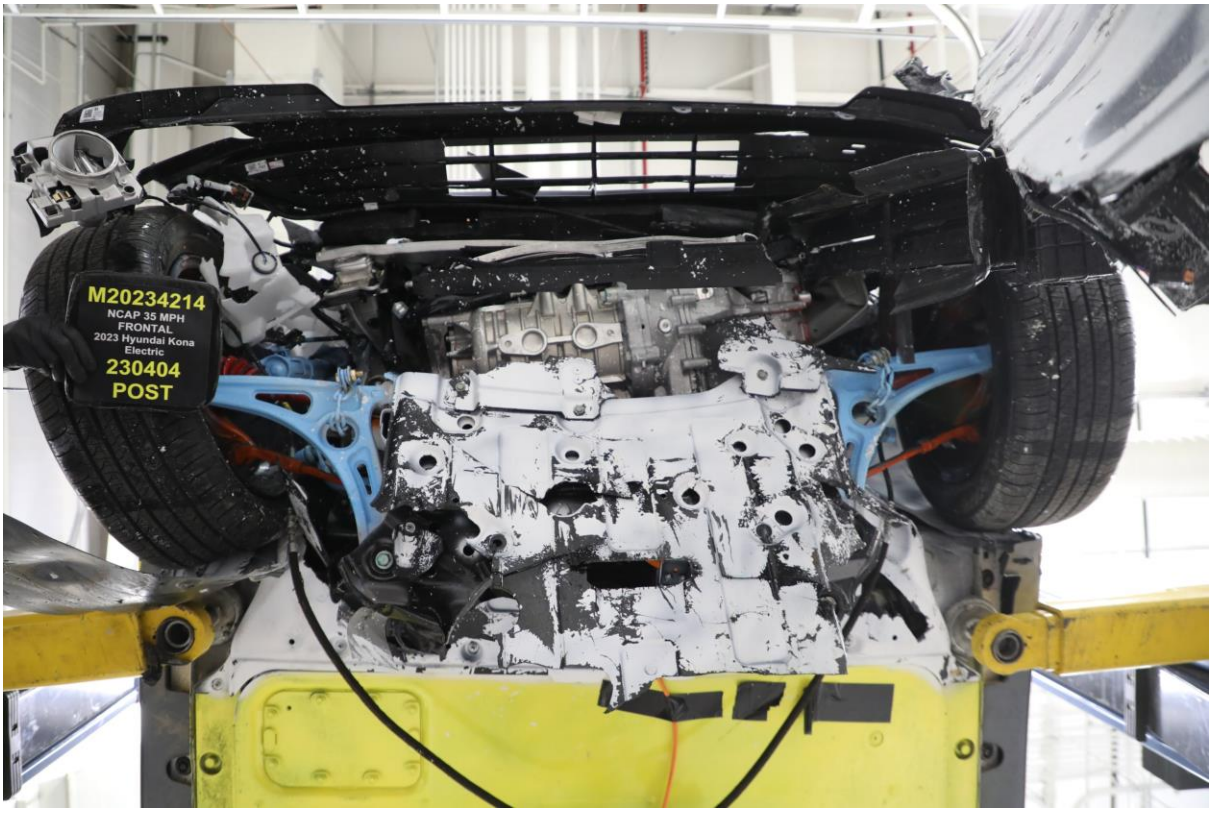
021 Post-Test Engine Compartment View

022 Pre-Test Fuel Filler Cap View

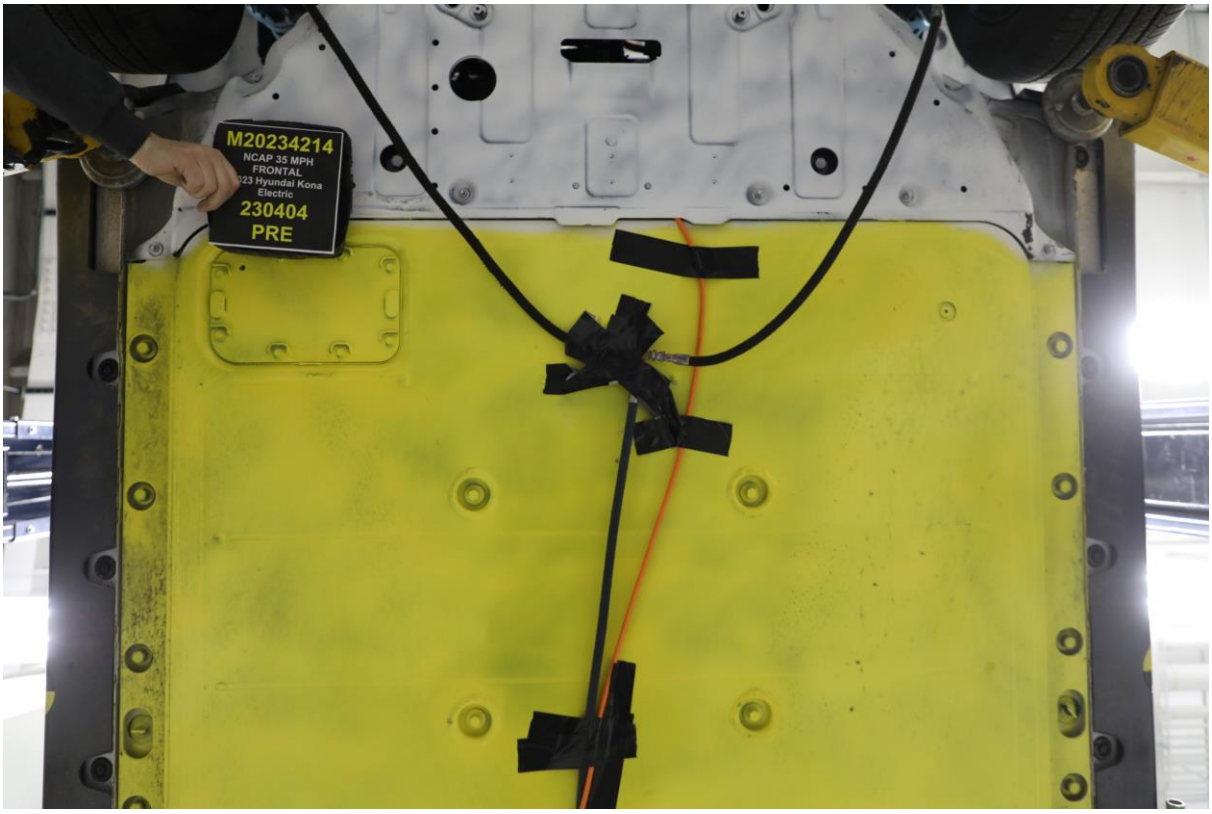


023 Post-Test Fuel Filler Cap View

024 Pre-Test Front Underbody View



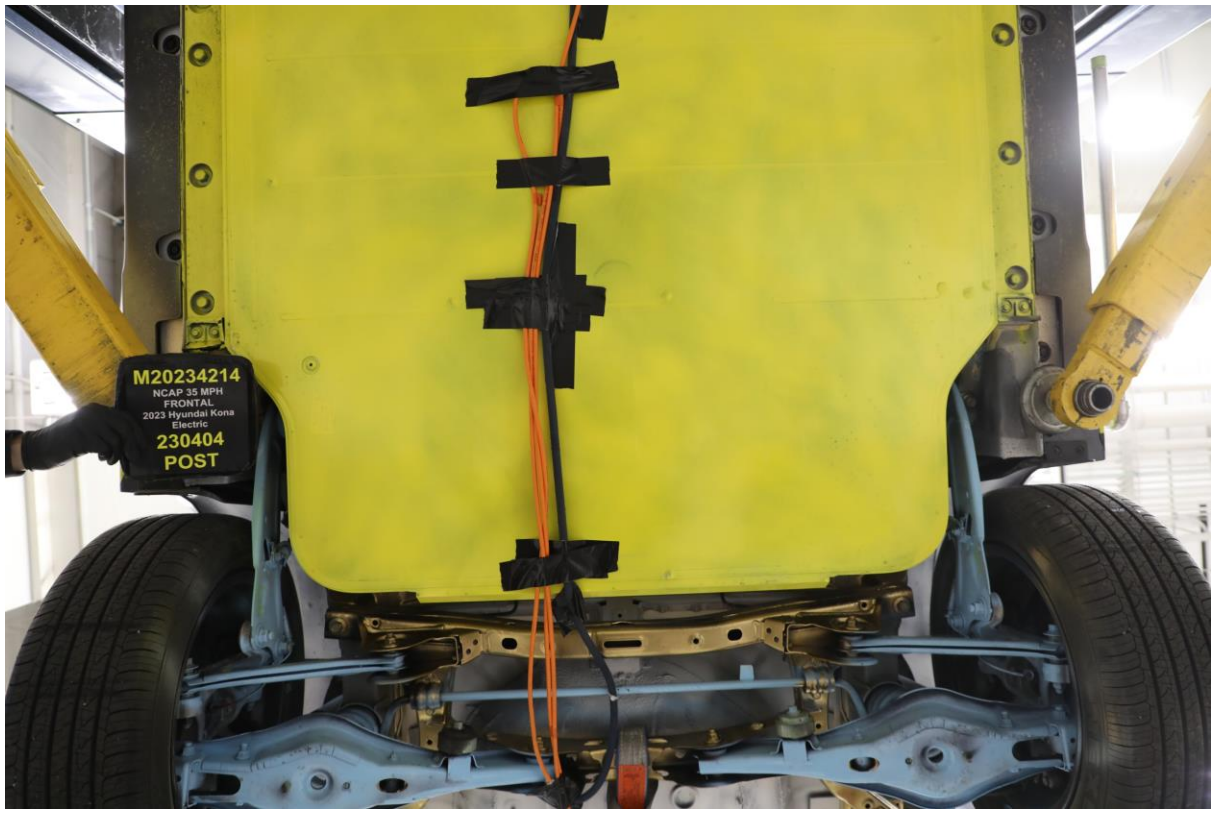
025 Post-Test Front Underbody View



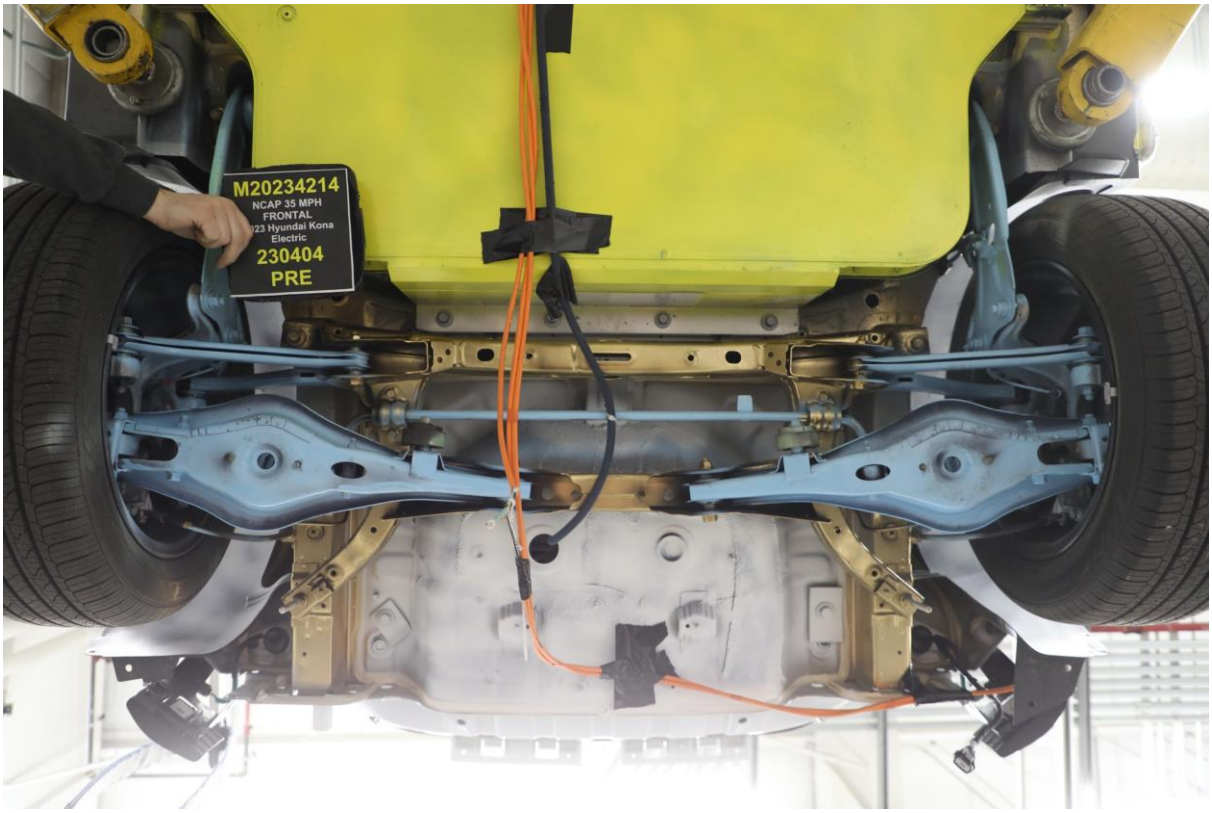
025a Pre-Test Mid Front Underbody View

025b Post-Test Mid Front Underbody View

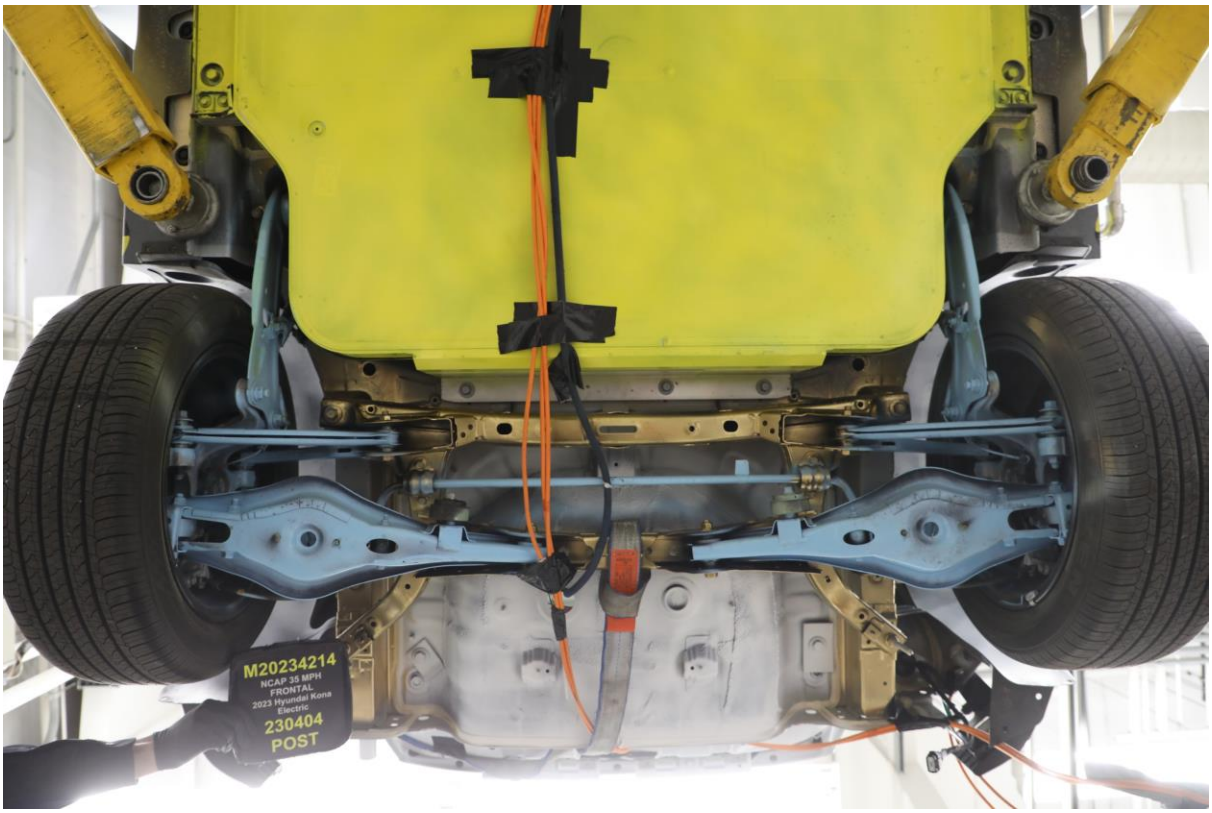
025c Pre-Test Mid Rear Underbody View



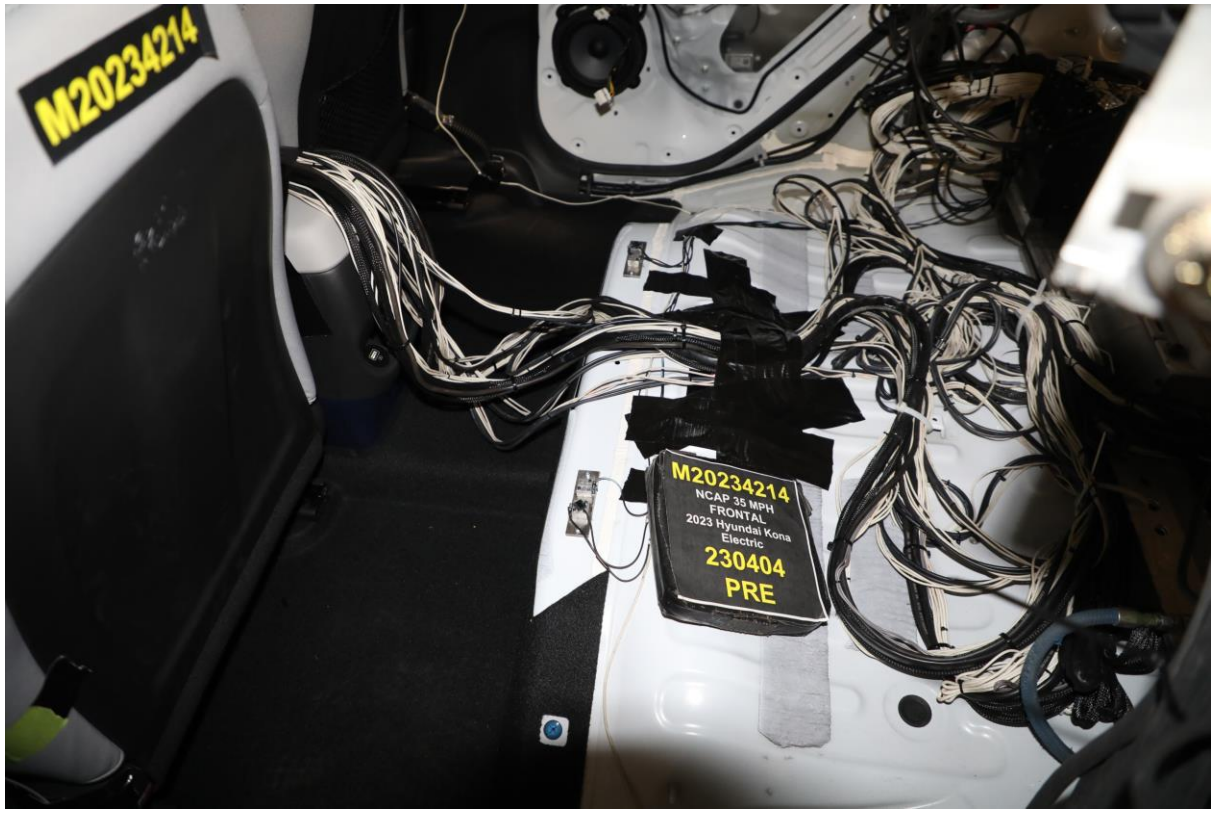
025d Post-Test Mid Rear Underbody View



026 Pre-Test Rear Underbody View

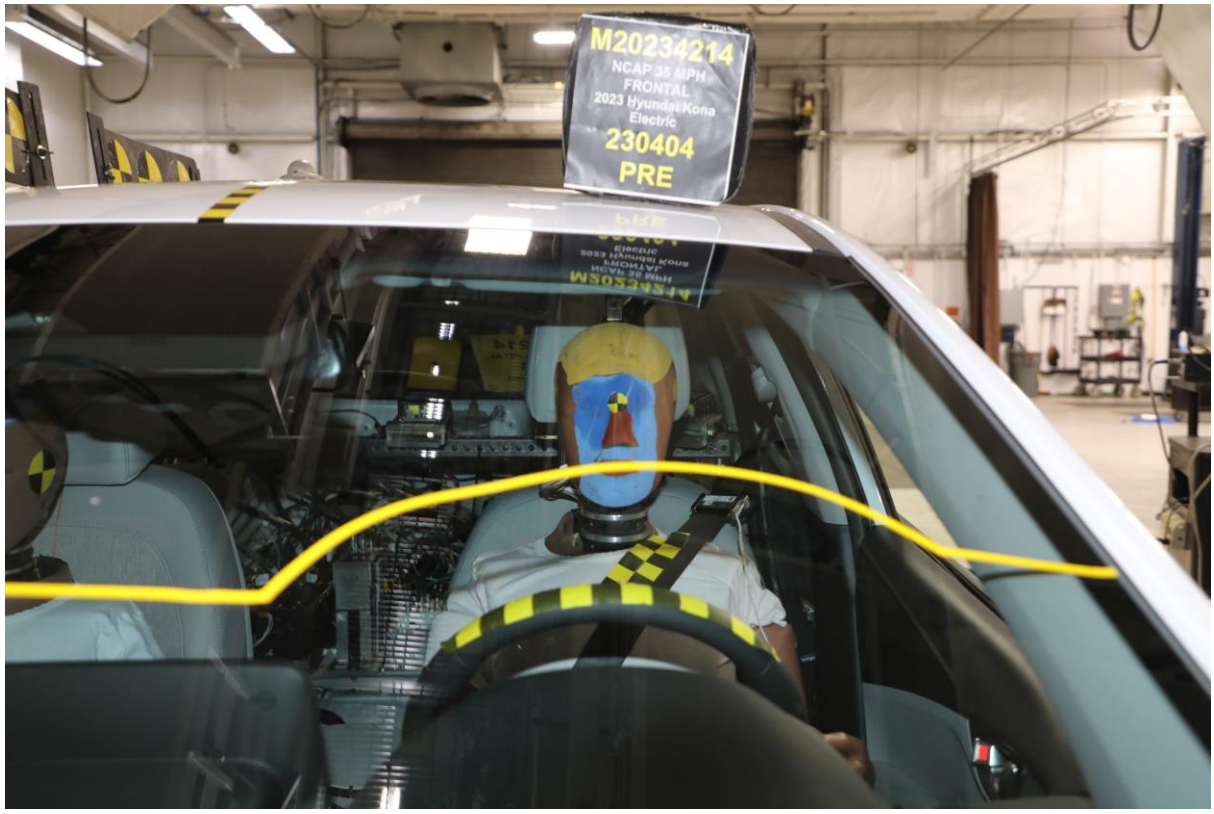


027 Post-Test Rear Underbody View



028 Pre-Test Dummy Cable Routing

029 Post-Test Dummy Cable Routing



030 Pre-Test Driver Dummy Front View

031 Post-Test Driver Dummy Front View

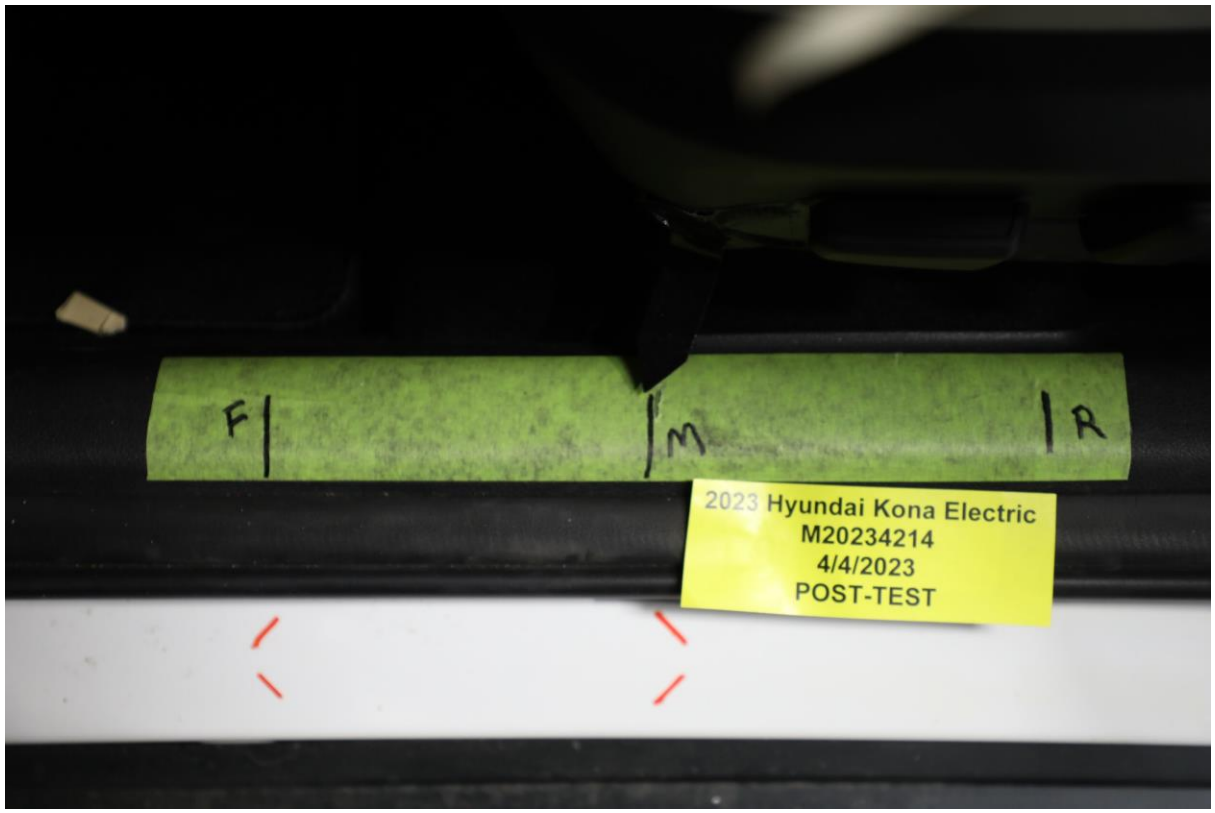
032 Pre-Test Driver Dummy Window View

033 Post-Test Driver Dummy Window View

034 Pre-Test Driver Dummy and Vehicle Interior View

035 Post-Test Driver Dummy and Vehicle Interior View

036 Pre-Test Driver's Seat Fore-Aft Markings

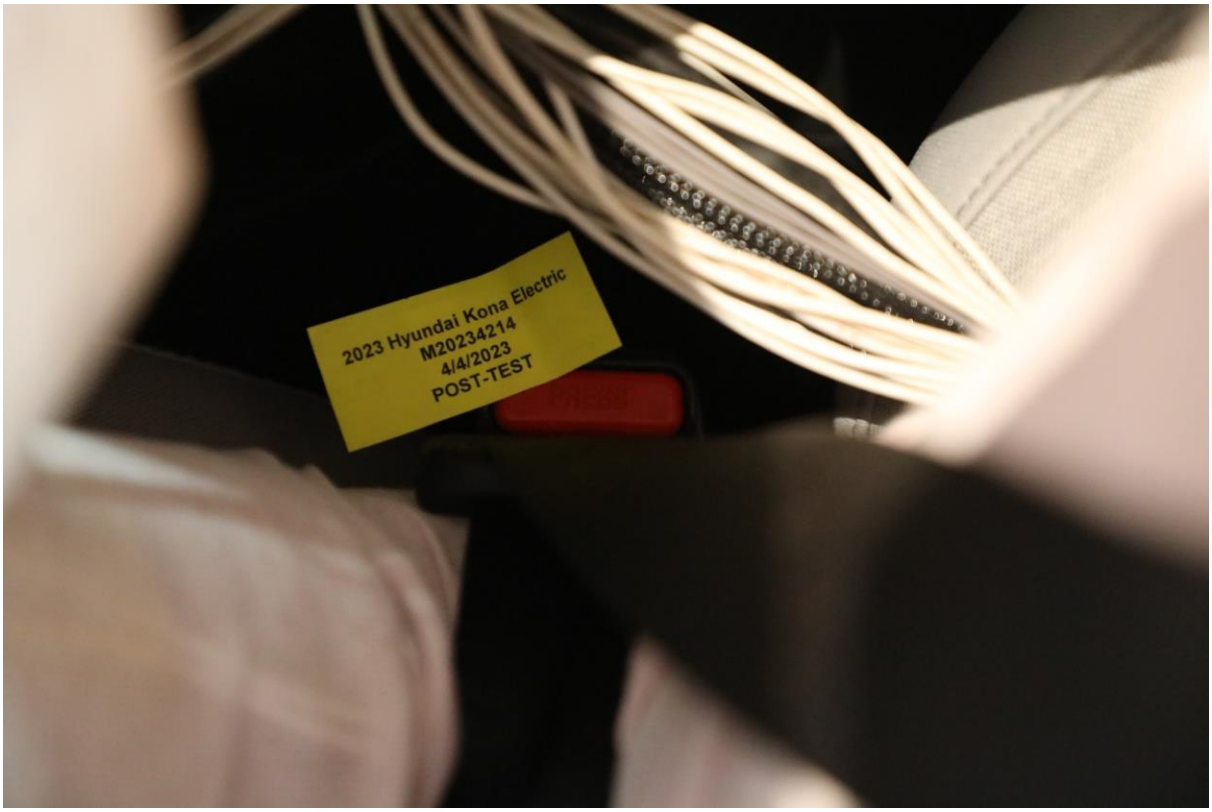


037 Post-Test Driver's Seat Fore-Aft Markings

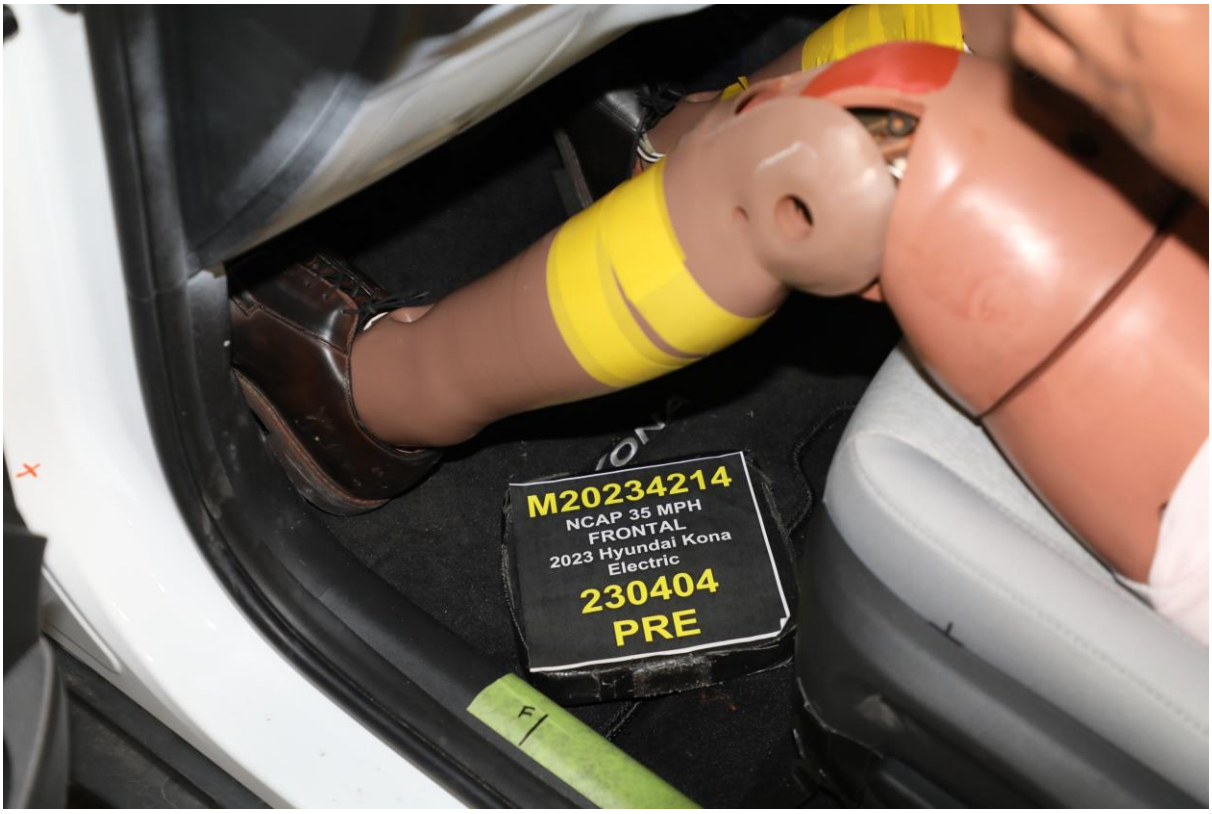
038 Pre-Test View of Belt Anchorage for Driver Dummy

039 Post-Test View of Belt Anchorage for Driver Dummy

040 Pre-Test View of Belt Buckle and Latch Plate for Driver Dummy



041 Post-Test View of Belt Buckle and Latch Plate for Driver Dummy



042 Pre-Test Driver Dummy Feet

043 Post-Test Driver Dummy Feet

044 Pre-Test Driver's Side Knee Bolster

045 Post-Test Driver's Side Knee Bolster

046 Pre-Test Driver's Side Floorpan

047 Post-Test Driver's Side Floorpan

048 Post-Test Driver Dummy Face

049 Post-Test Driver Dummy Contact with Airbag

050 Post-Test Driver Dummy Contact with Headrest

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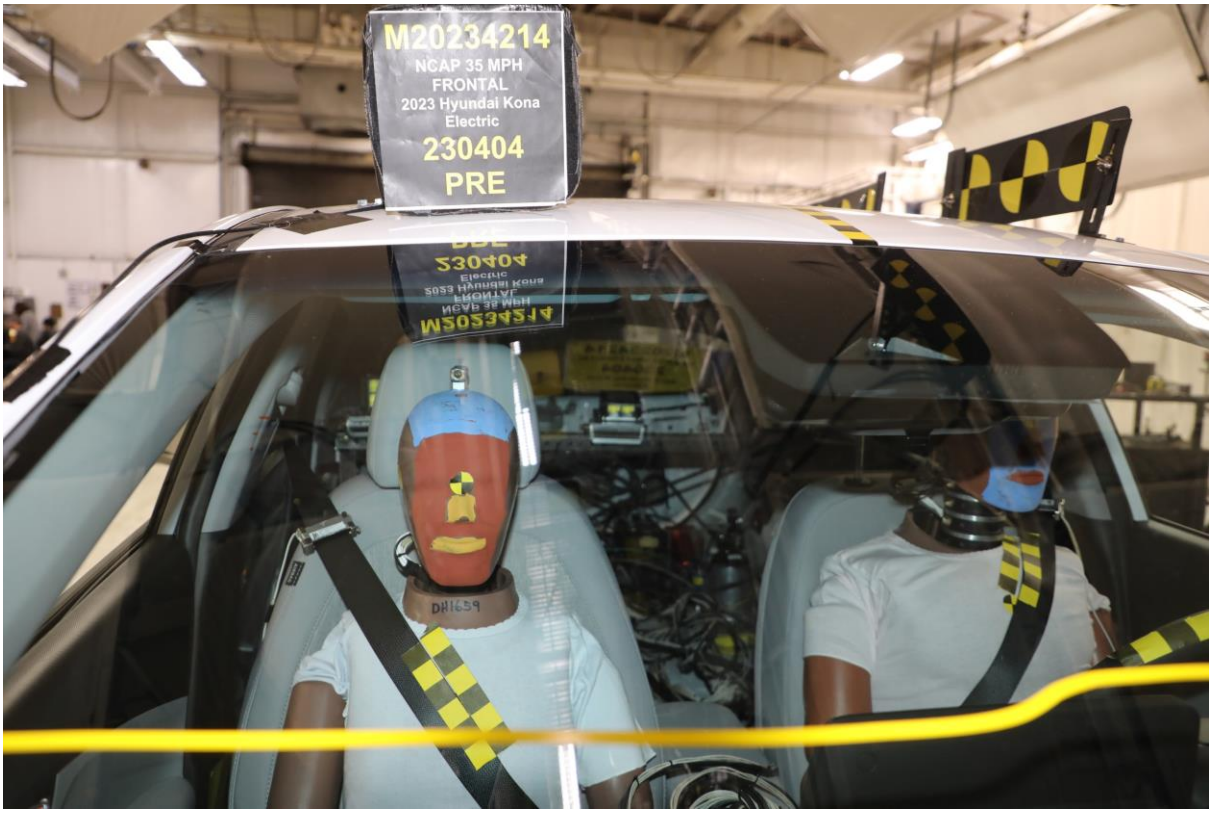
051 Pre-Test View of the Steering Wheel

052 Post-Test View of the Steering Wheel



53 Pre-Test Passenger Dummy Front View

054 Post-Test Passenger Dummy Front View

055 Pre-Test Passenger Dummy Window View

056 Post-Test Passenger Dummy Window View

057 Pre-Test Passenger Dummy and Vehicle Interior View

058 Post-Test Passenger Dummy and Vehicle Interior View

059 Pre-Test Passenger's Seat Fore-Aft Markings

060 Post-Test Passenger's Seat Fore-Aft Markings

061 Pre-Test View of Belt Anchorage for Passenger Dummy

062 Post-Test View of Belt Anchorage for Passenger Dummy

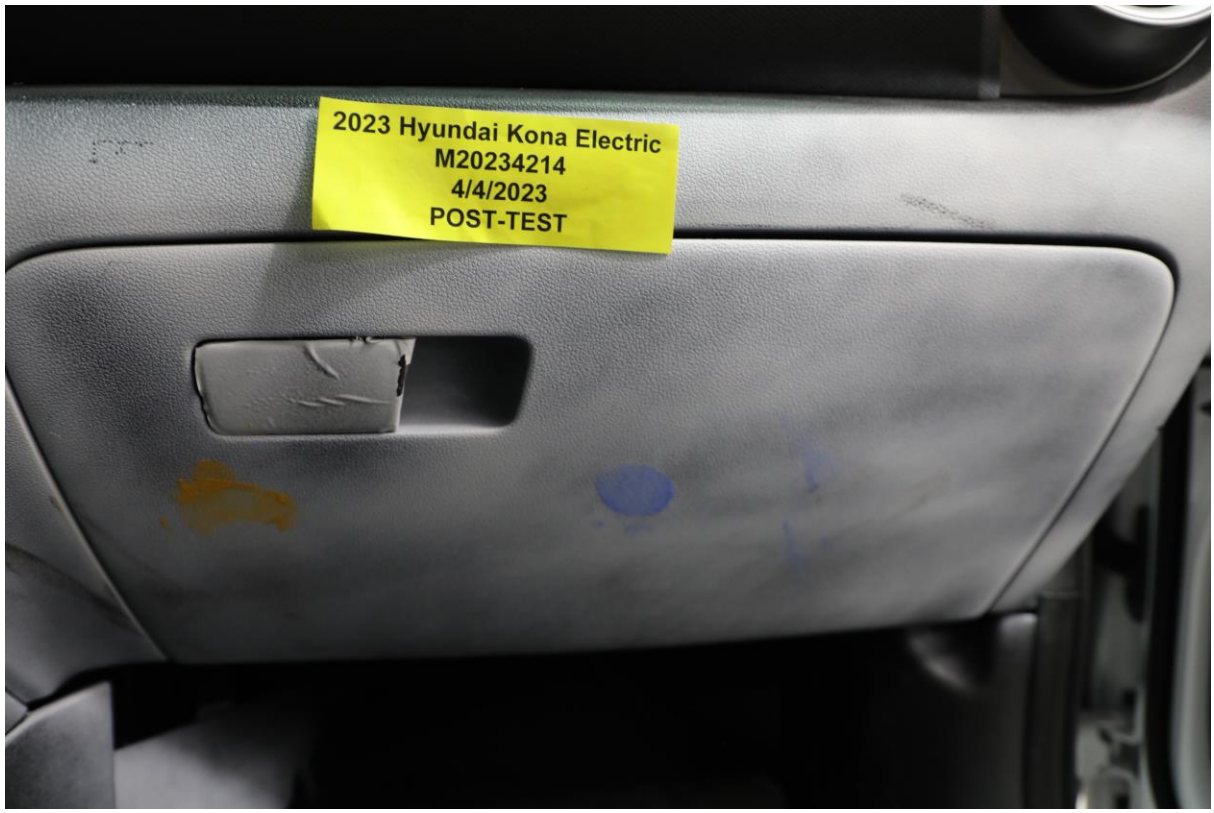
063 Pre-Test View of Belt Buckle and Latch Plate for Passenger Dummy

064 Post-Test View of Belt Buckle and Latch Plate for Passenger Dummy

065 Pre-Test Passenger Dummy Feet

066 Post-Test Passenger Dummy Feet

067 Pre-Test Passenger's Side Knee Bolster

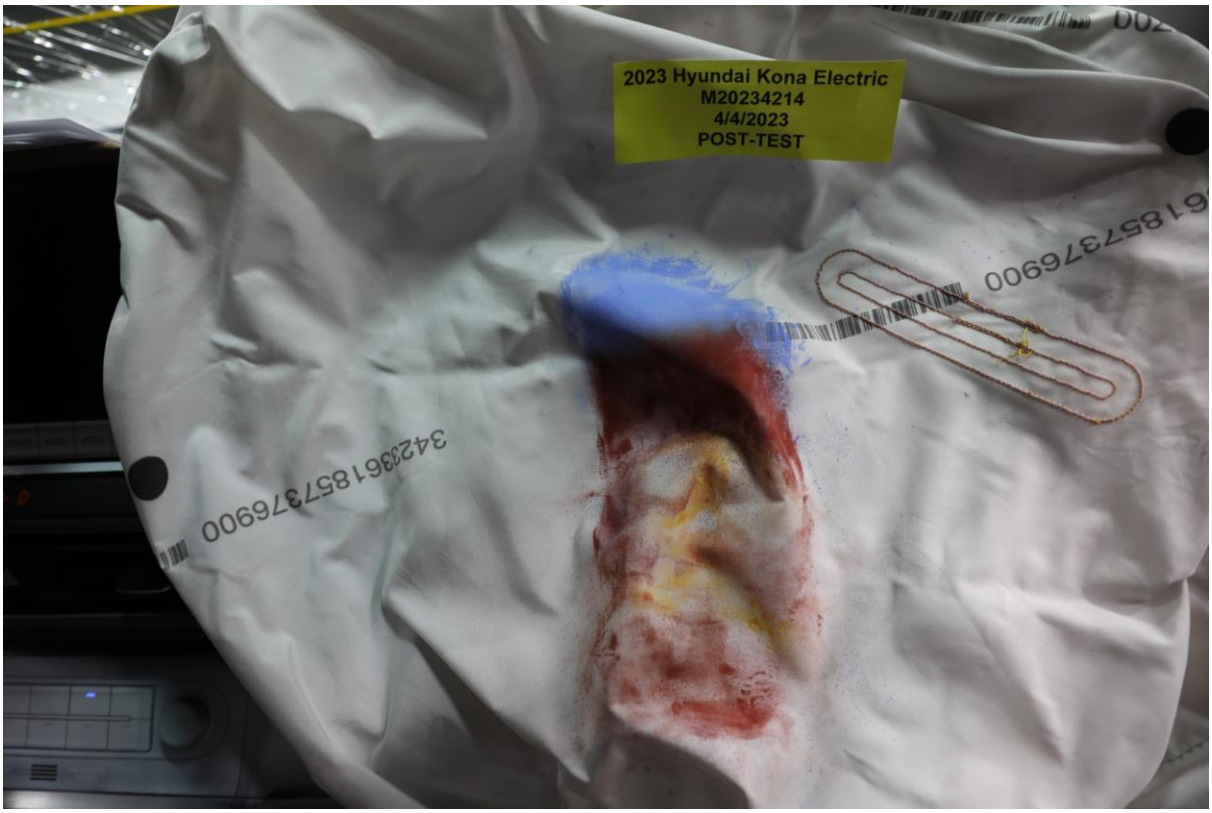


068 Post-Test Passenger's Side Knee Bolster

069 Pre-Test Passenger's Side Floorpan

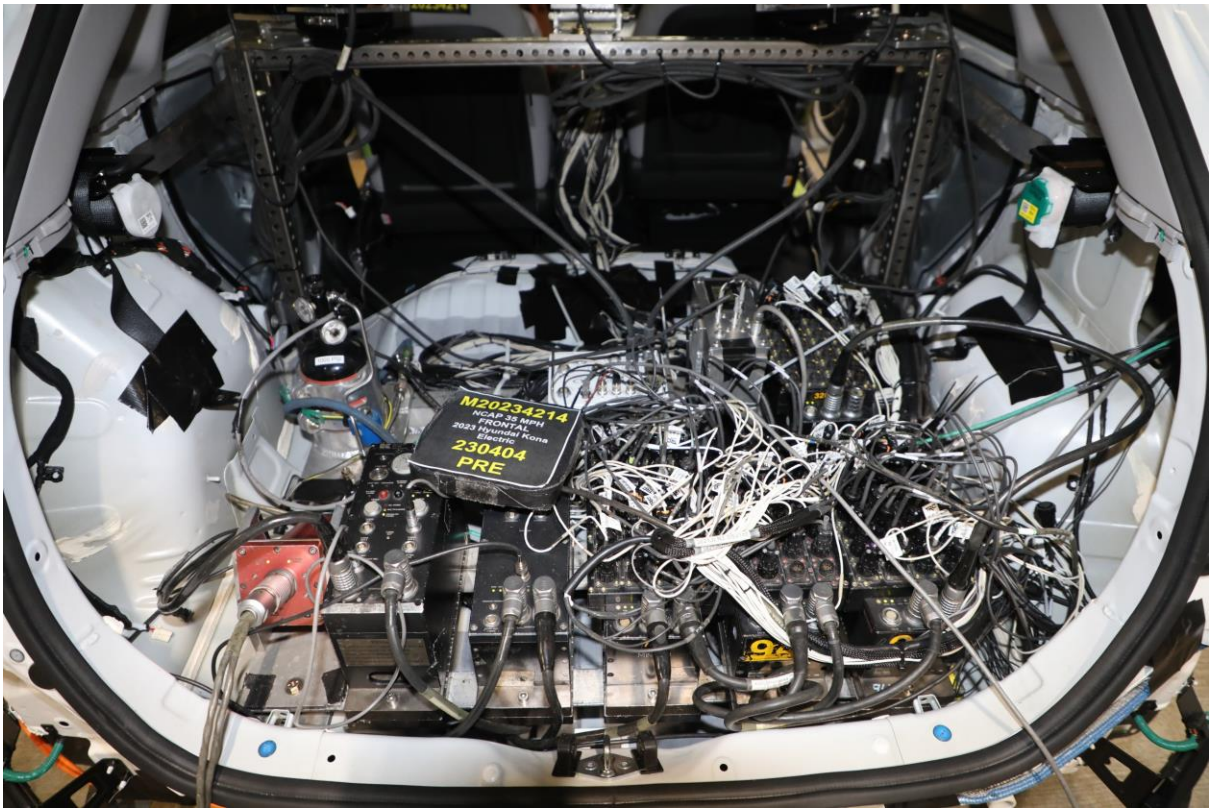
070 Post-Test Passenger's Side Floorpan

071 Post-Test Passenger Dummy Face

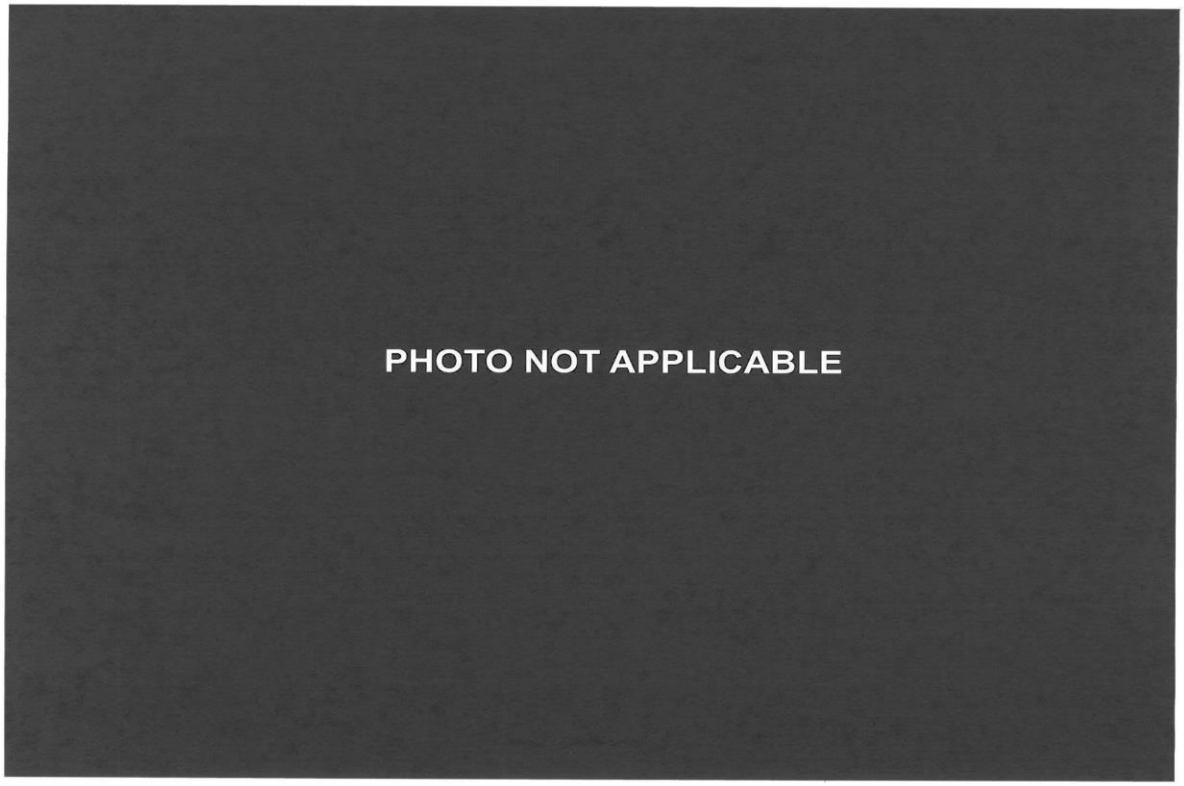


072 Post-Test Passenger Dummy Contact with Airbag

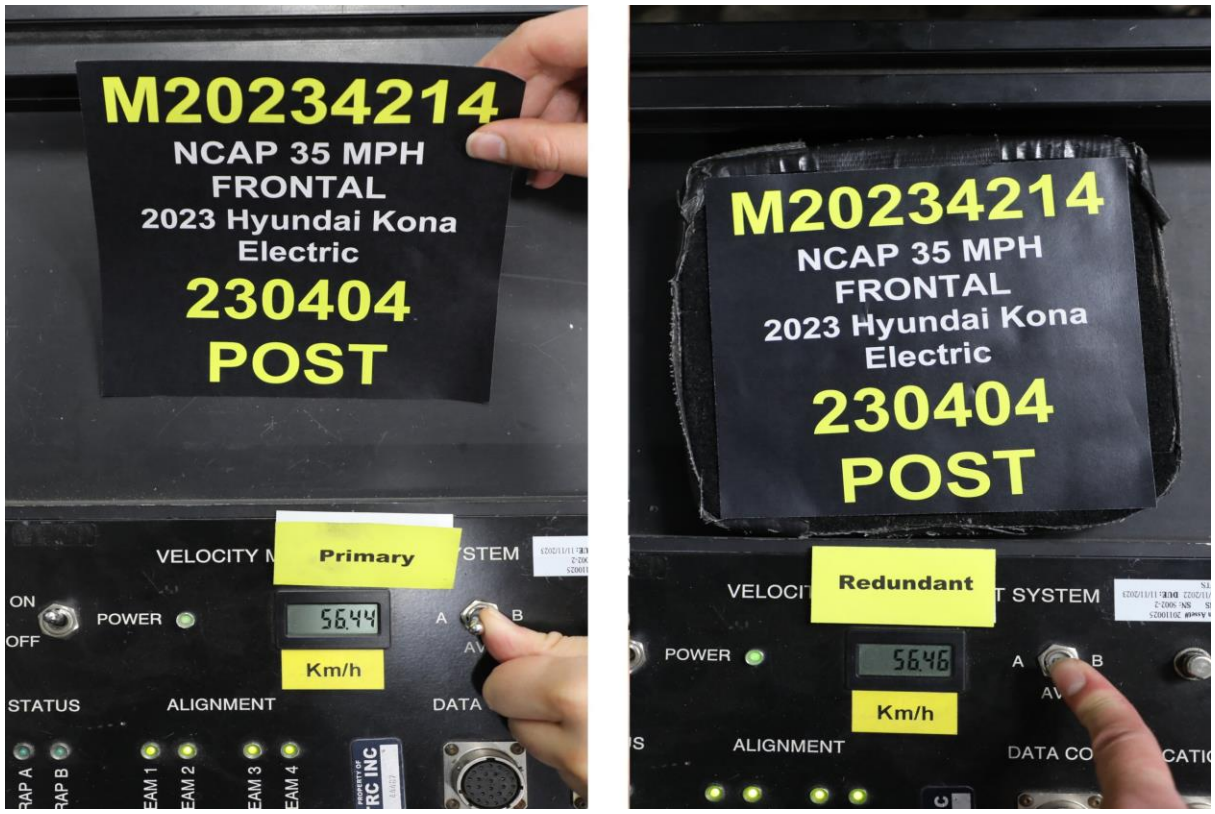
073 Post-Test Passenger Dummy Contact with Headrest



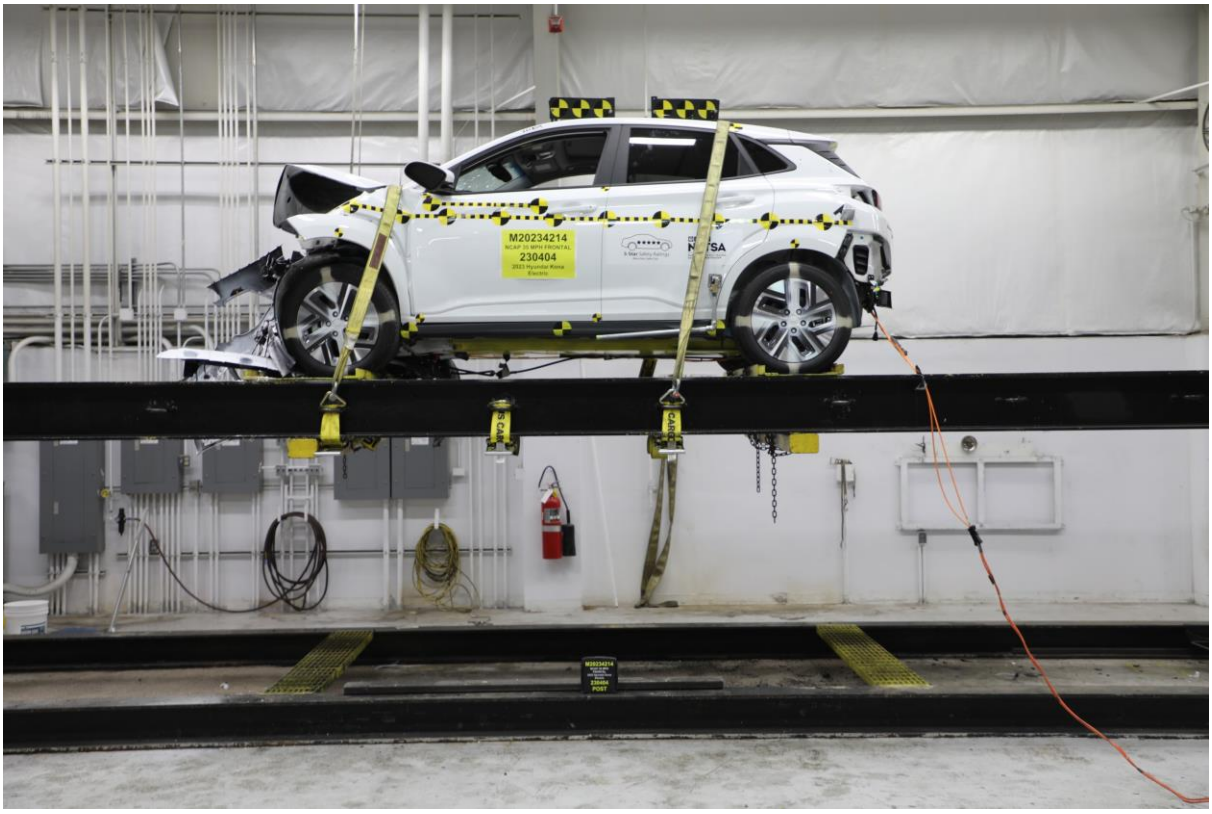
074 Photograph of Ballast Installed in Vehicle



075 Post-Test Stoddard Spillage Location View

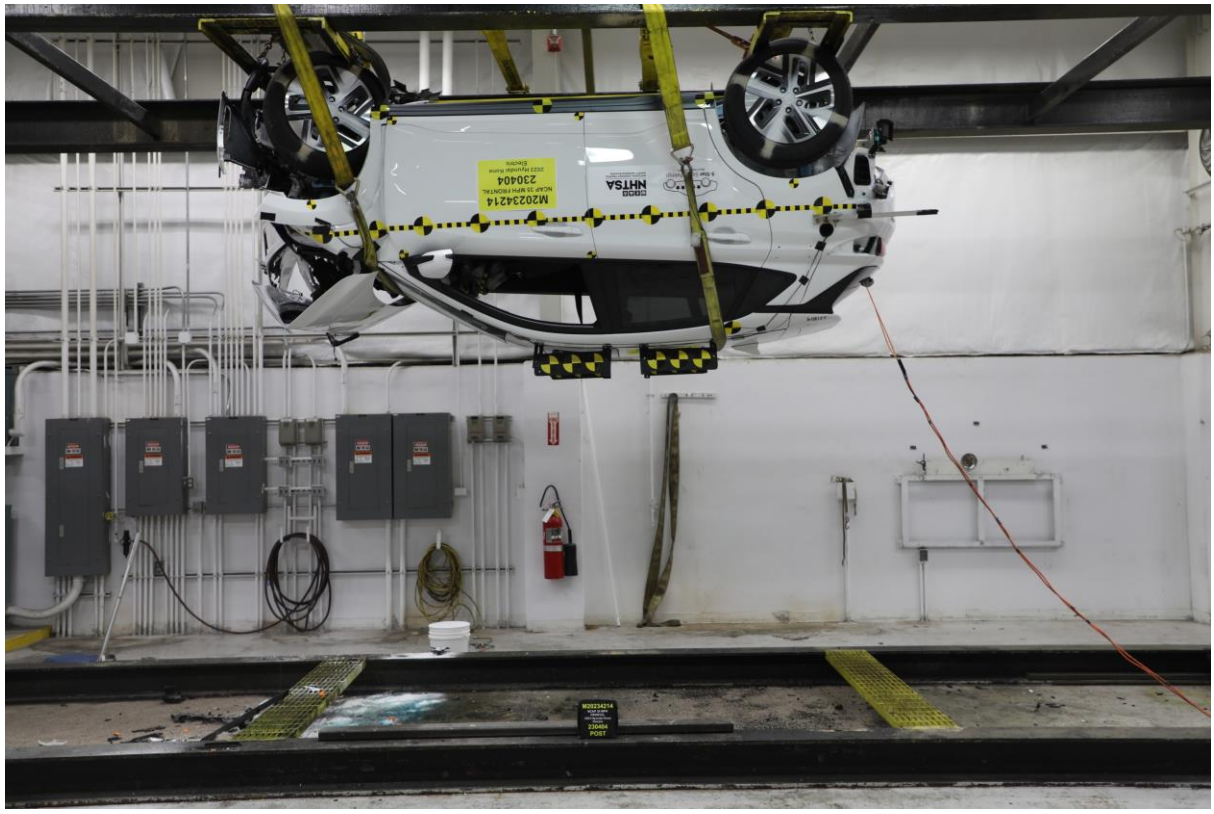


076 Post-Test Speed Trap Read out

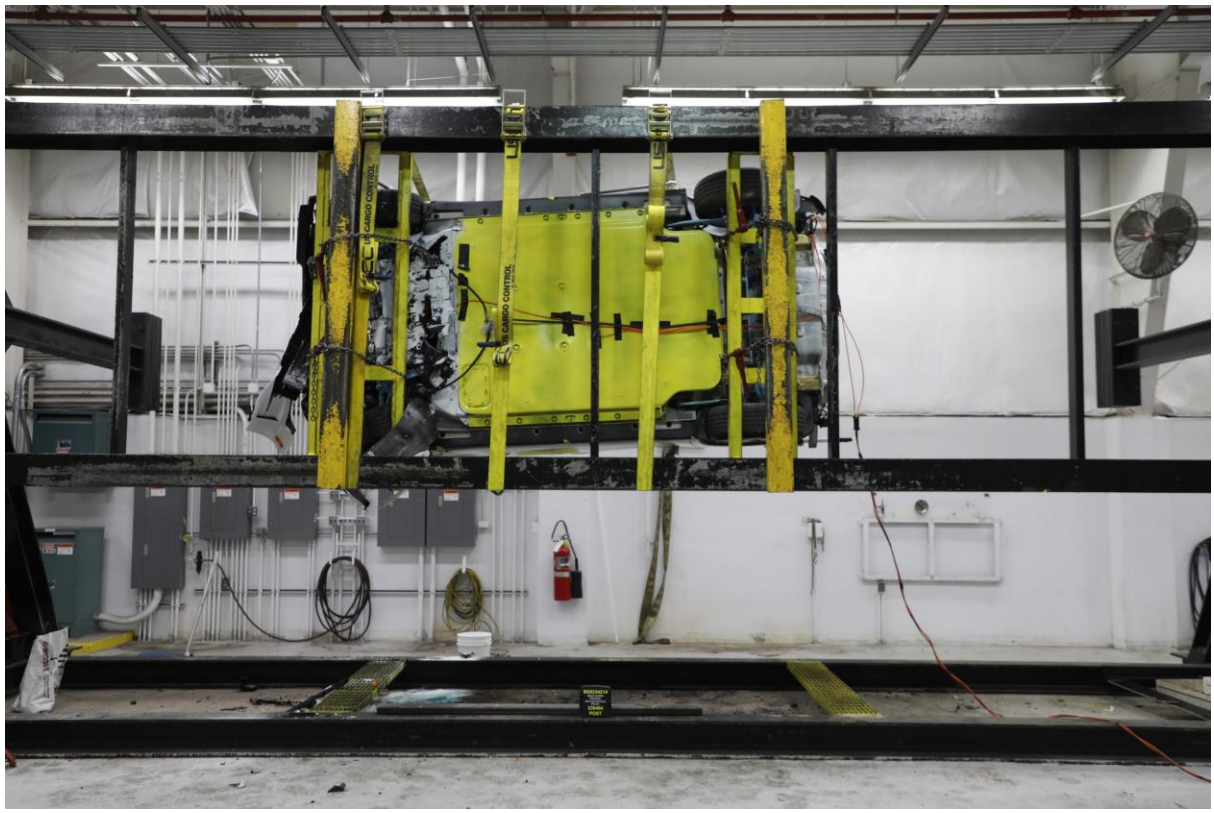


077 Vehicle at 0º on Static Rollover Device

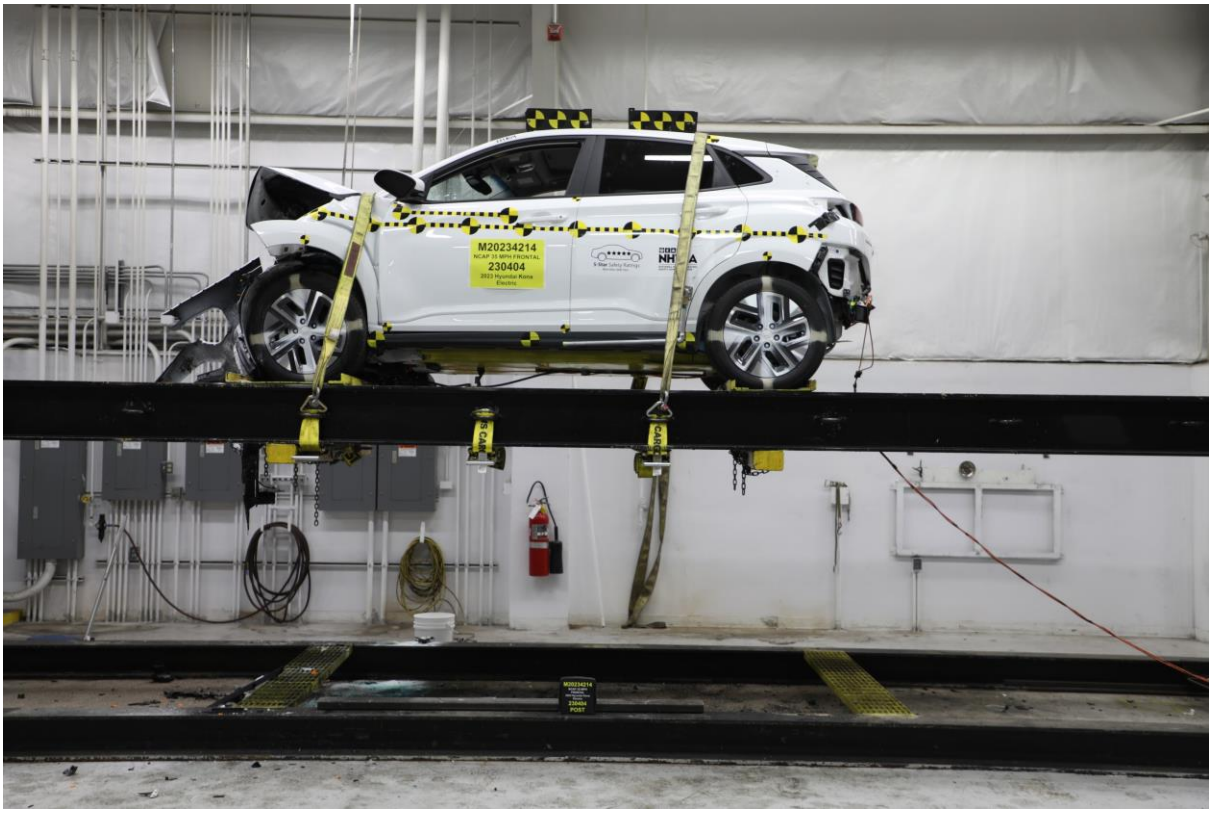
078 Vehicle at 90º on Static Rollover Device



079 Vehicle at 180º on Static Rollover Device

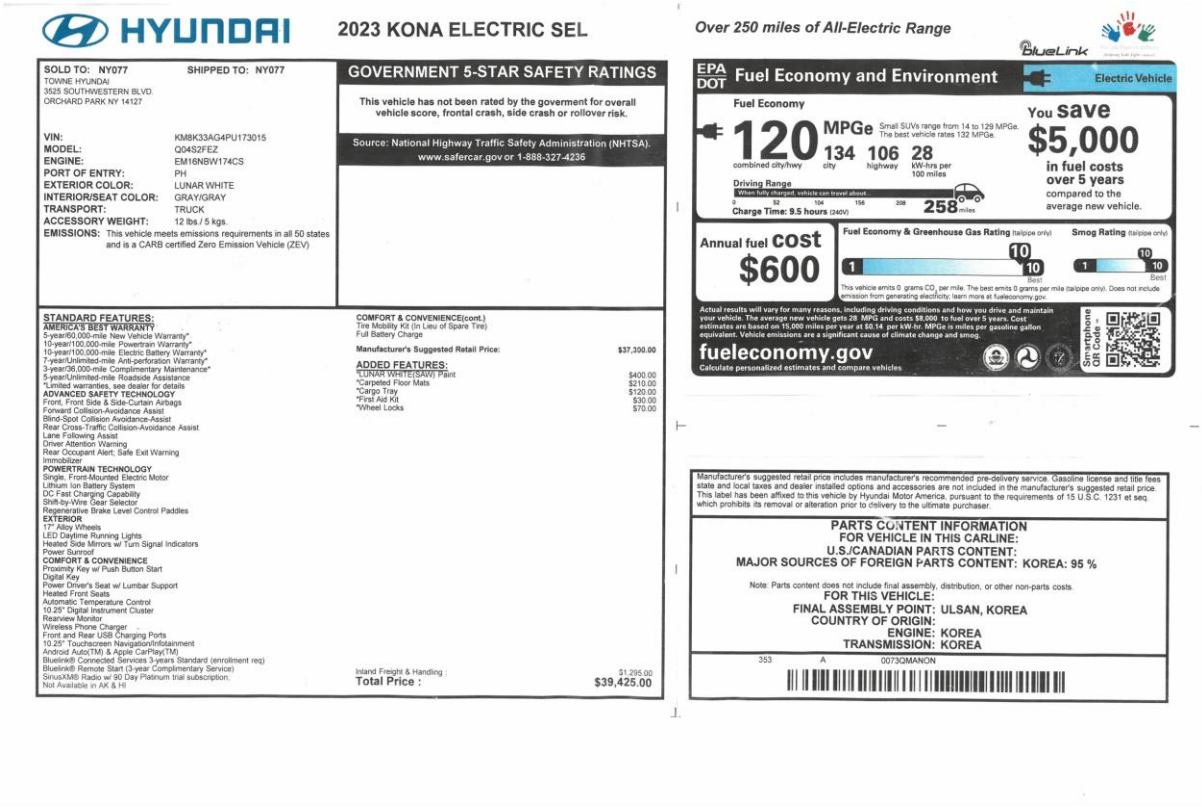


080 Vehicle at 270º on Static Rollover Device



081 Vehicle at 360º on Static Rollover Device

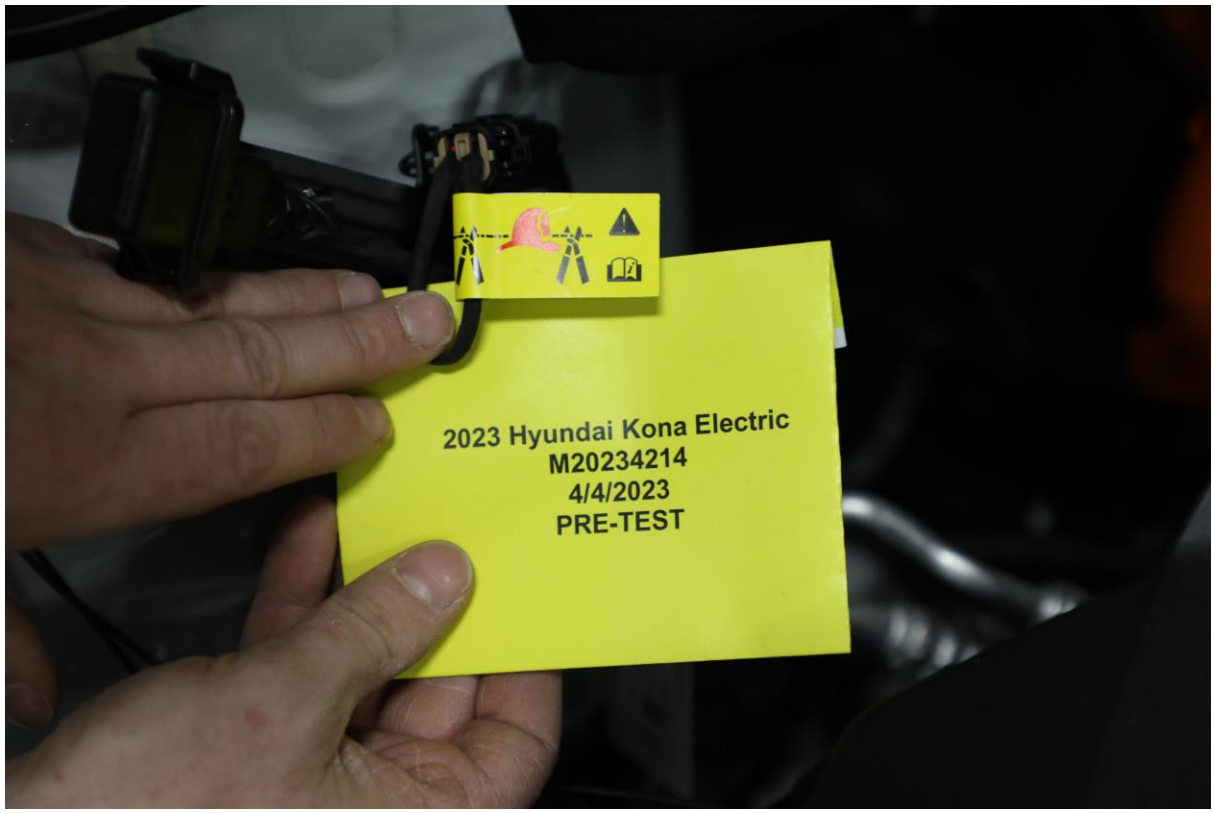
082 2023 Hyundai Kona Electric Frontal Impact Event



083 Monroney Label Photograph

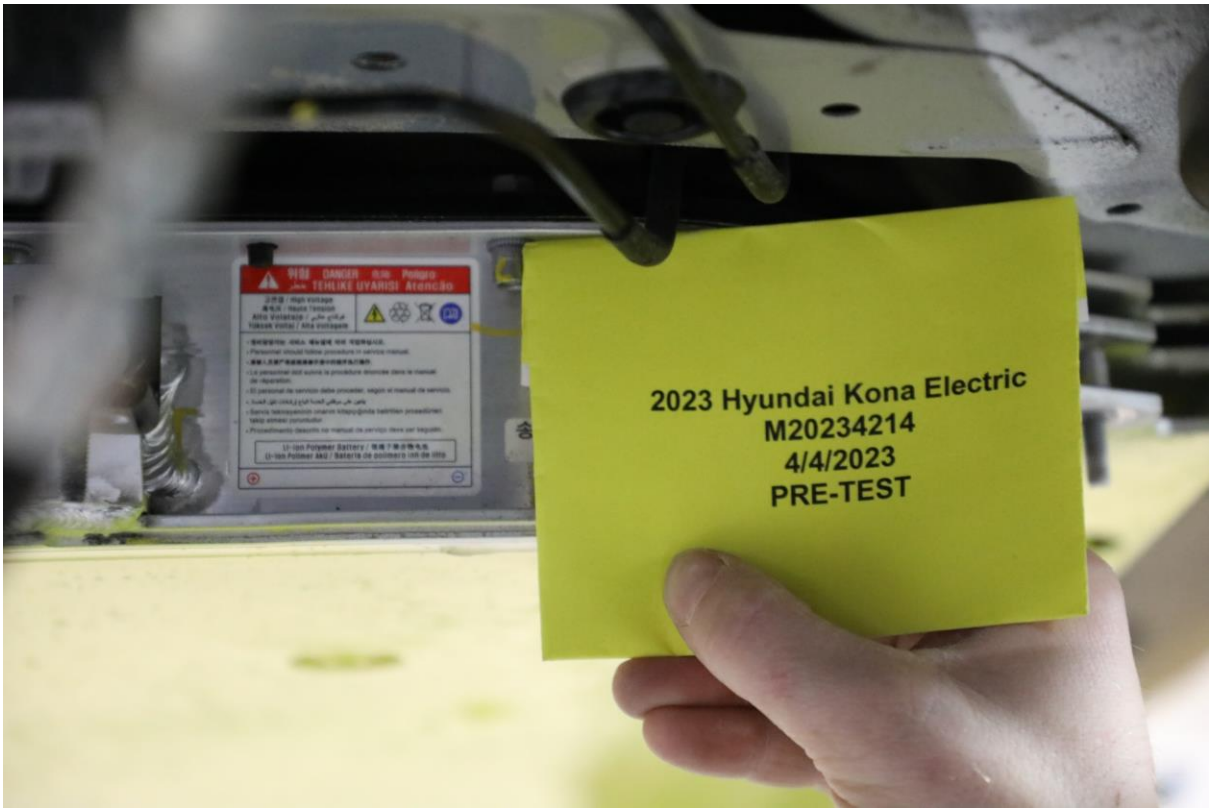
305-01 Auxiliary Power Module Warning Label

305-02 Power Inverter Warning Label



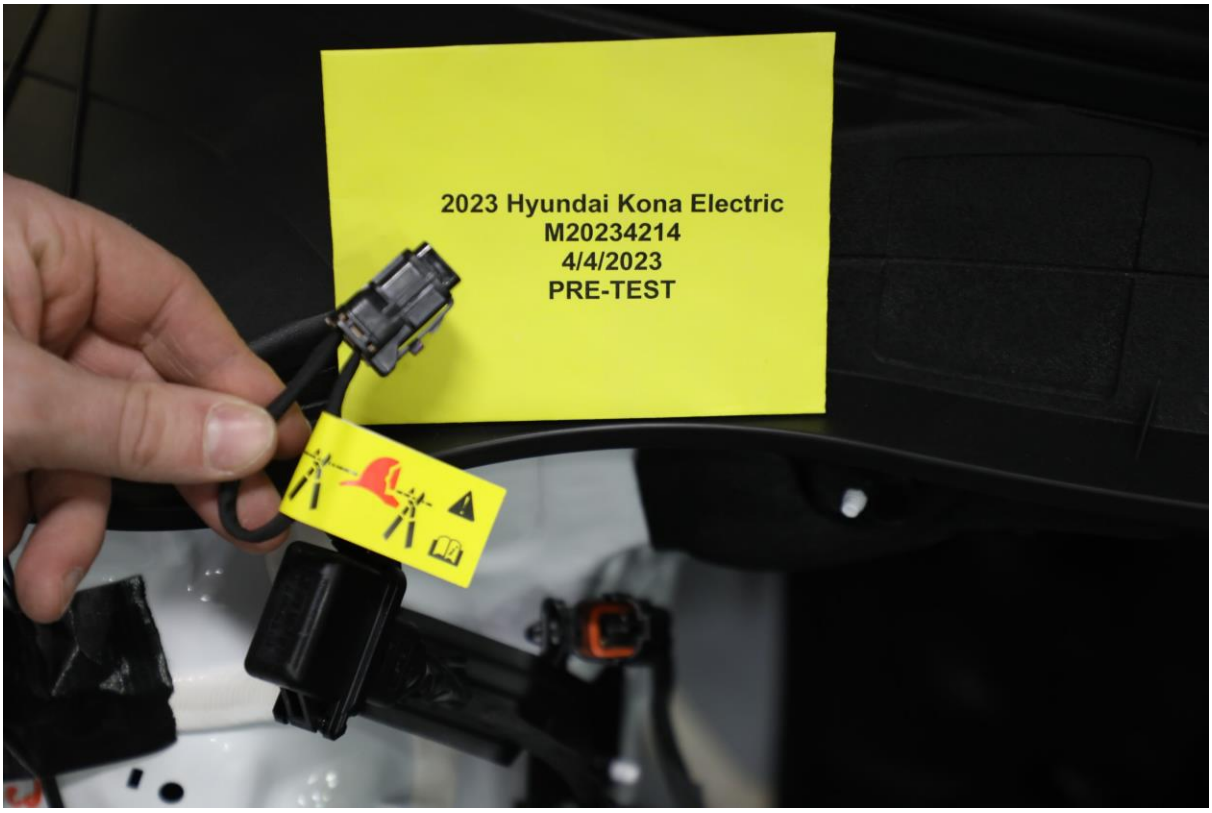
305-03 First Responder Warning Label

305-04 First Responder Warning Location



305-05 Other Vehicle Label(s) Related to Electrical Propulsion System

305-06 Manual High Voltage Service Disconnect in Place

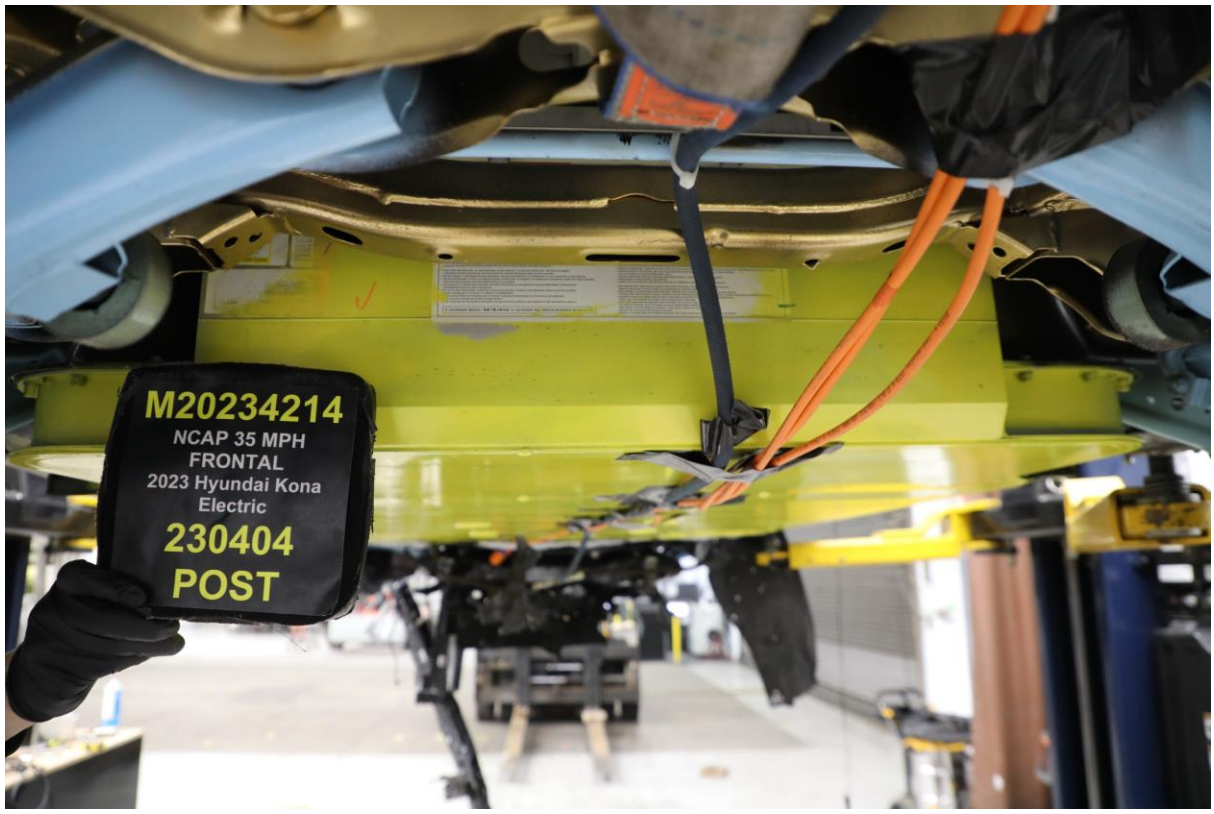


305-07 Manual High Voltage Service Disconnect Removed

305-08 Manual High Voltage Service Disconnect Removed

305-09 Pre-Impact View of Propulsion Battery

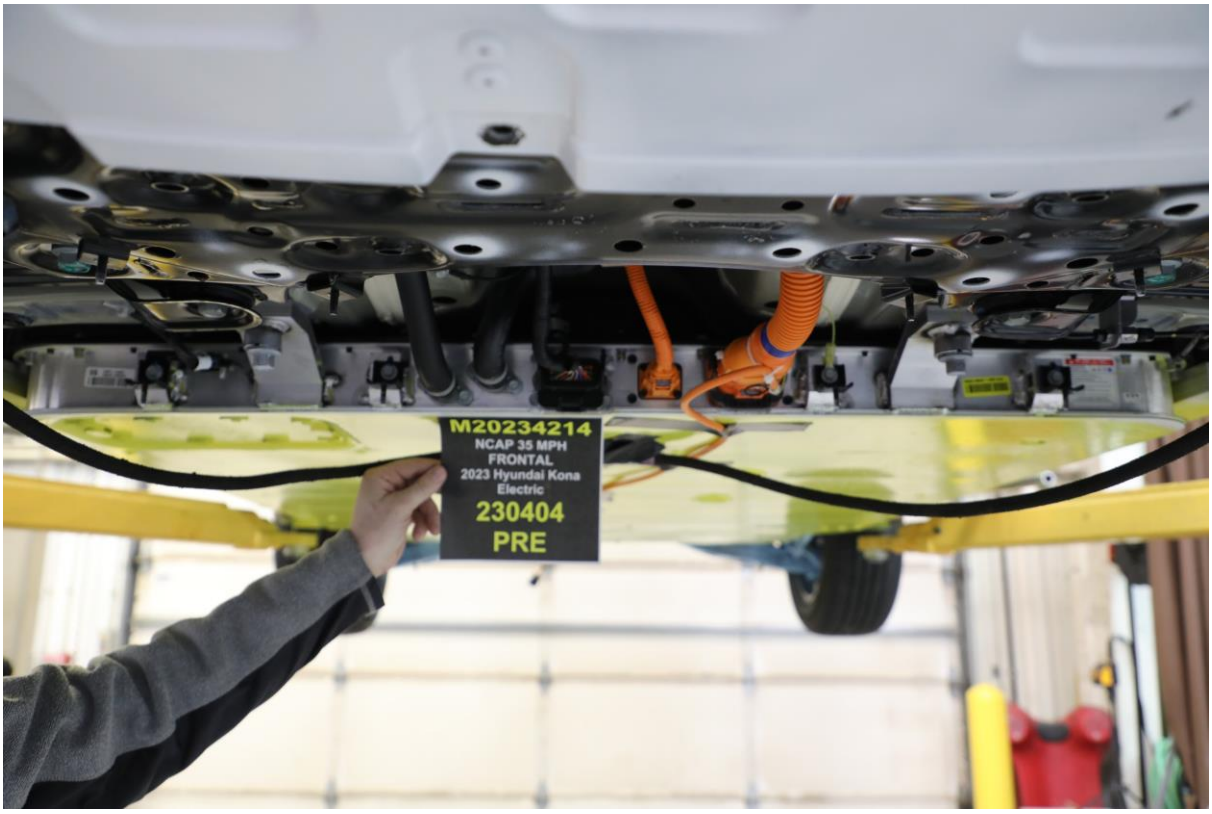
305-10 Post-Impact Front View of Propulsion Battery



305-11 Post-Impact Rear View of Propulsion Battery

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

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



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

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

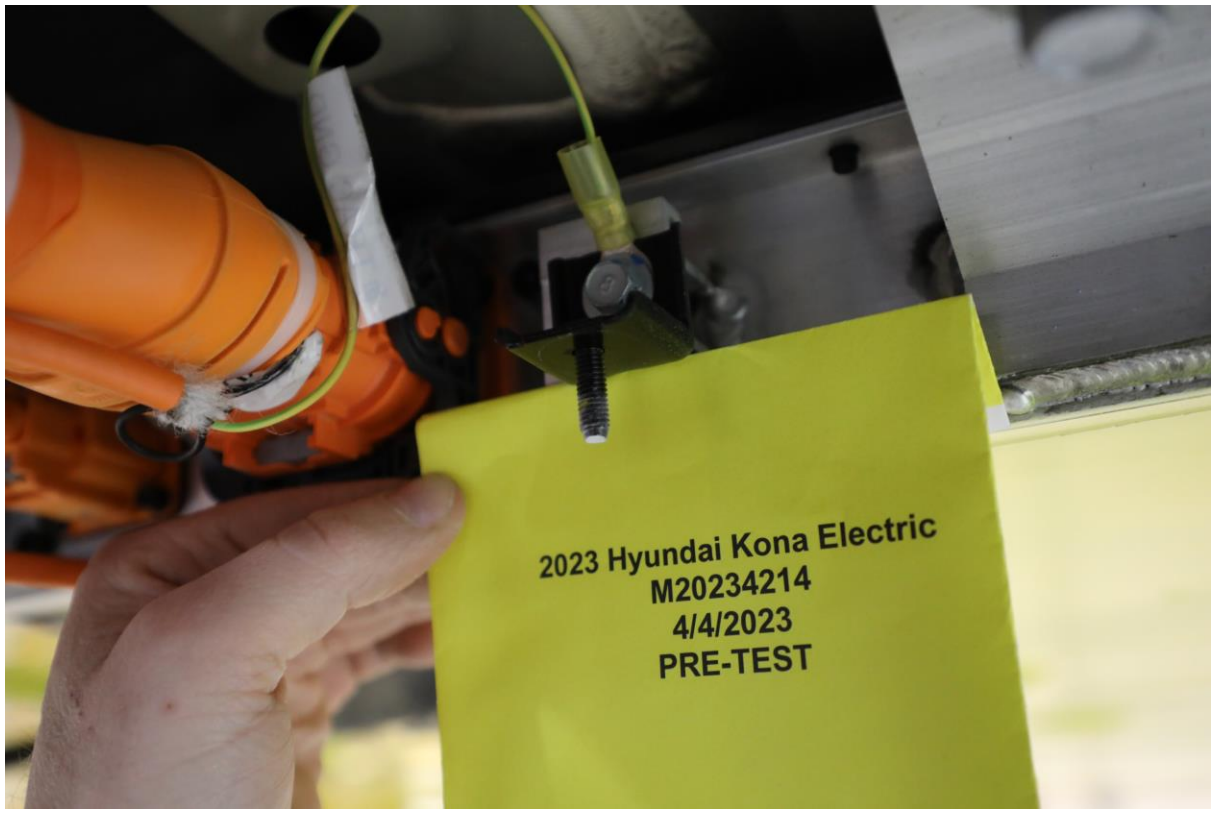
305-16 Pre-Impact View of Electric Propulsion Drive

305-17 Post-Impact View of Electric Propulsion Drive

305-18 Pre-Impact View of High Voltage Interconnect(s)

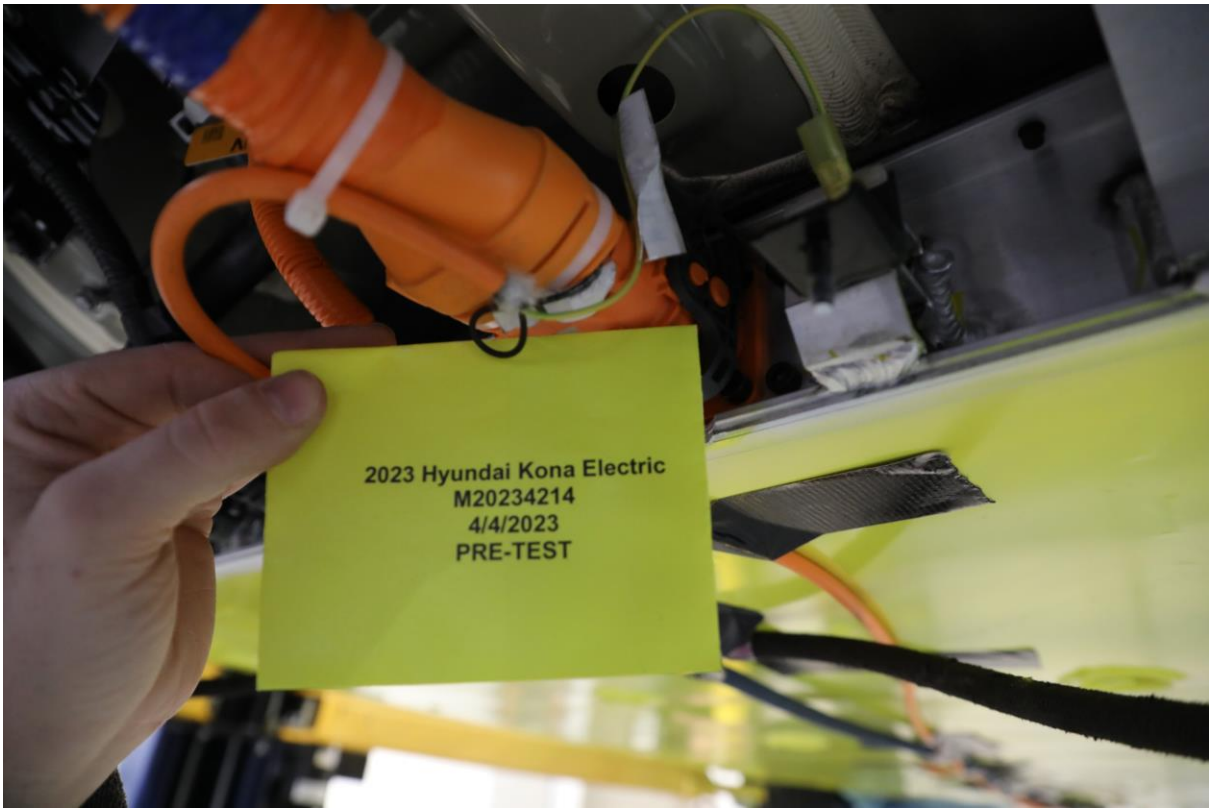
305-19 Pre-Impact View Propulsion Battery Venting System(s)

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



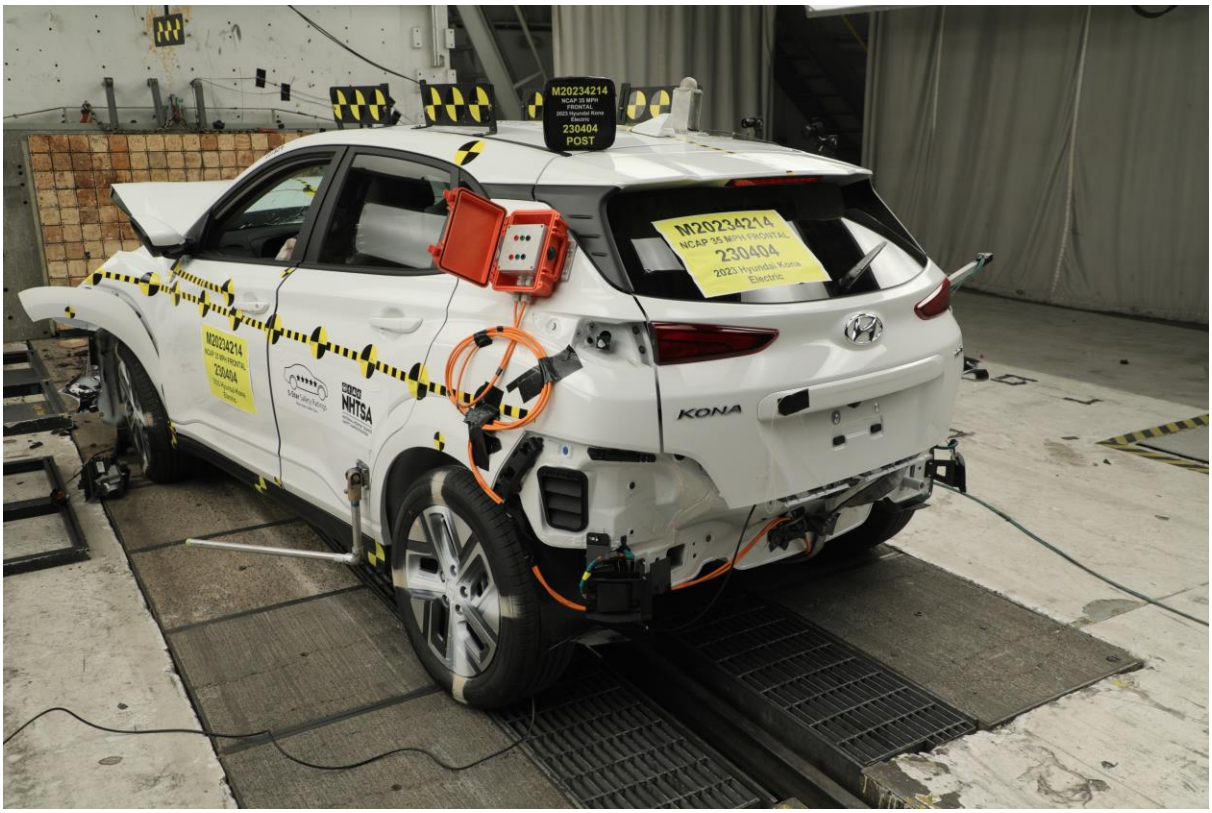
305-21 Pre-Impact View of Ground Lead Attached

305-22 Pre-Impact View of High Voltage Leads Attached

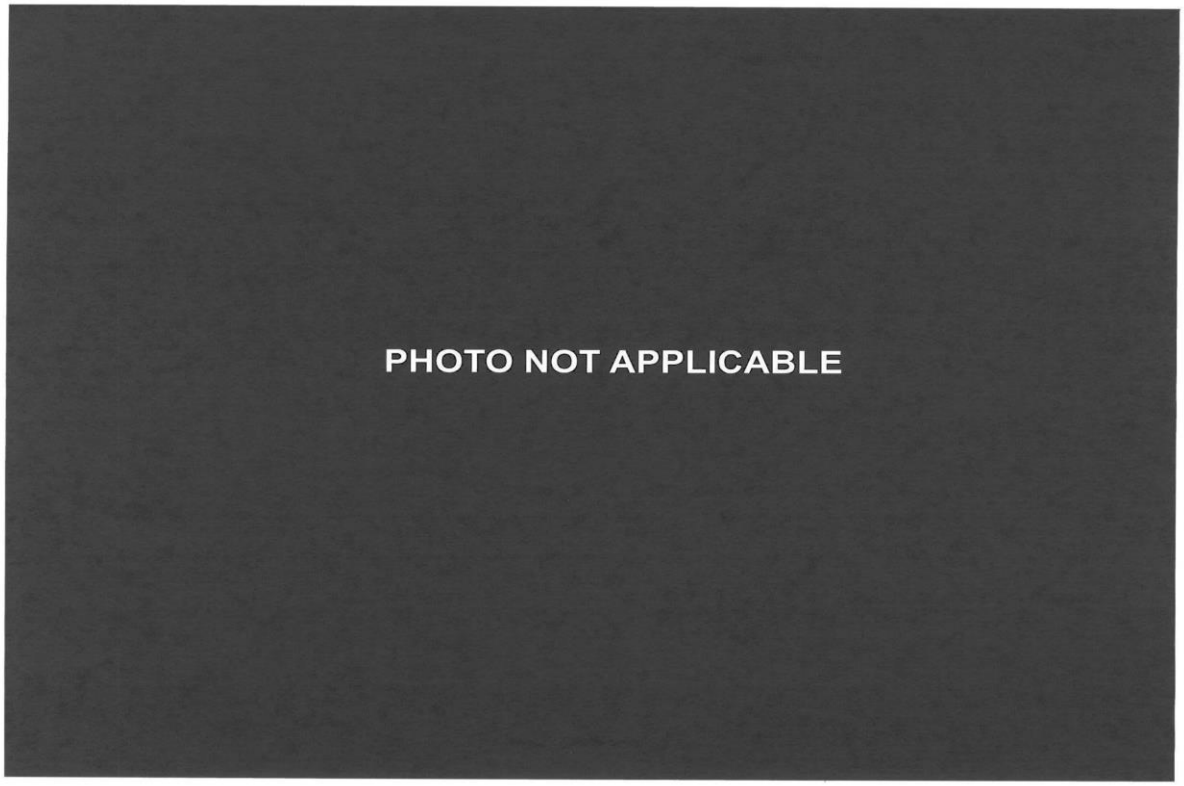


305-23 Pre-Impact Close-Up View of High Voltage Leads Attached

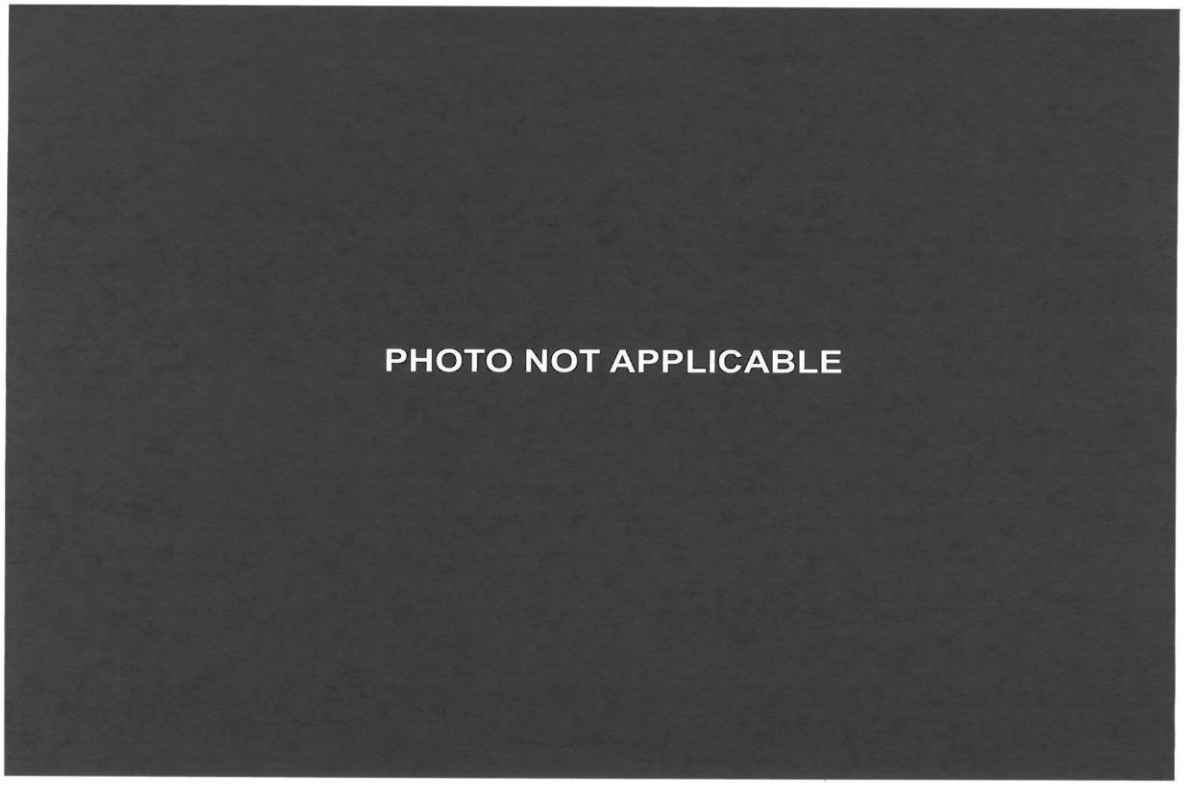
305-24 Pre-Impact View of Installed Test Interface Port



305-25 Post-Impact View of Installed Test Interface Port

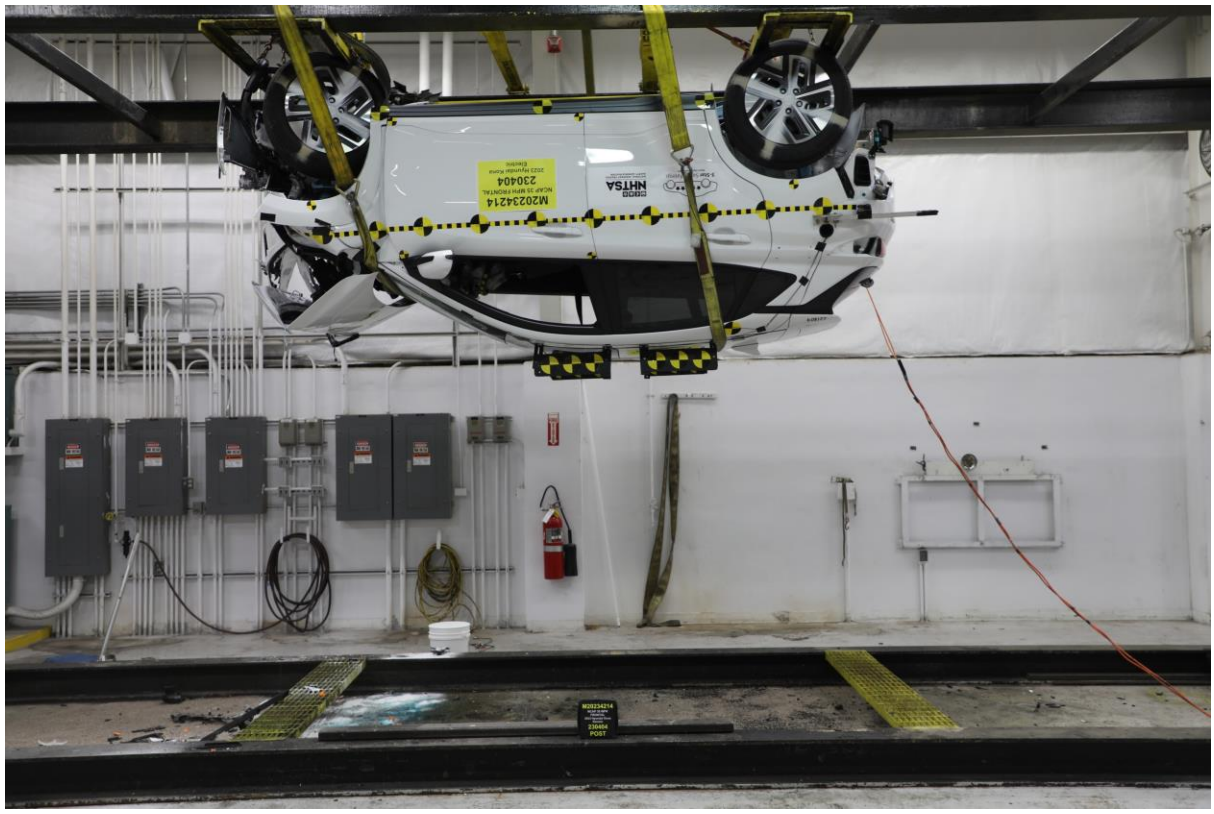


305-26 Pre-Impact View of Other Test Devices

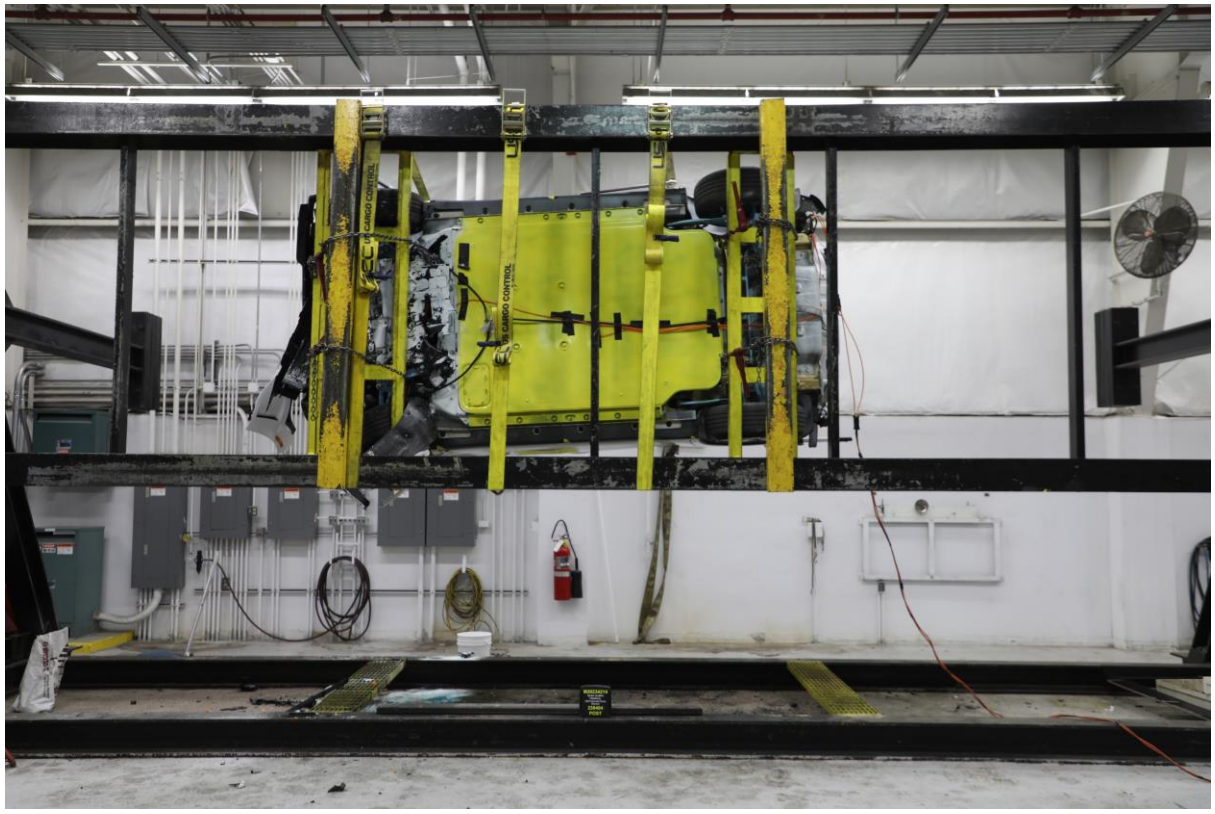


305-27 Post-Impact View of Other Test Devices

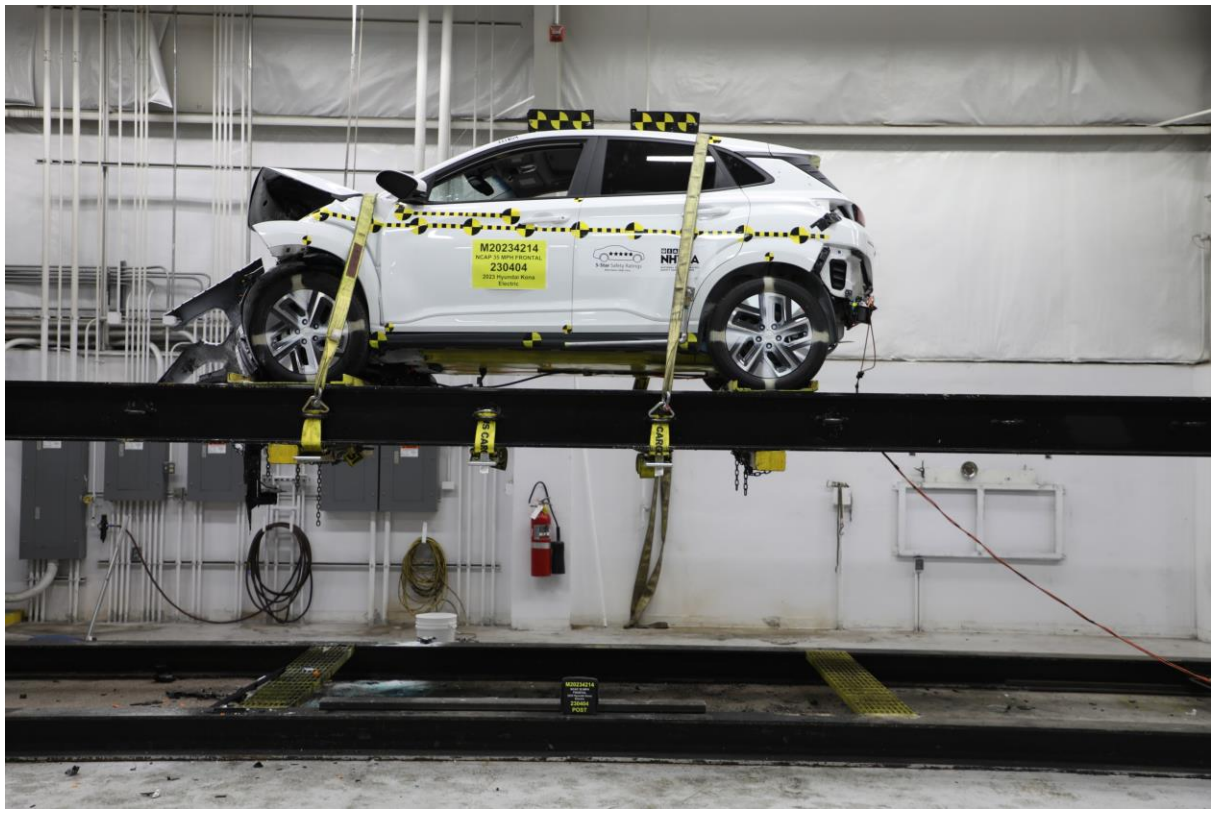
305-28 FMVSS No. 305 Static Rollover at 90°



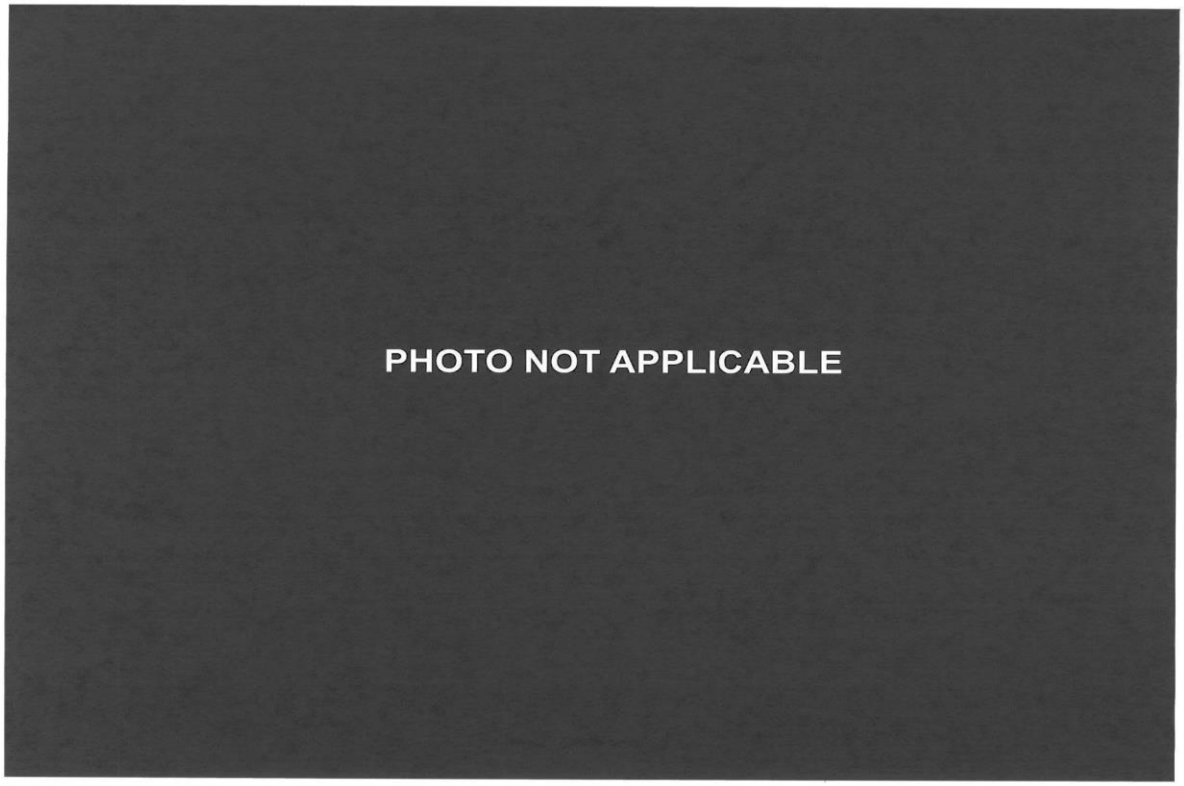
305-29 FMVSS No. 305 Static Rollover at 180°



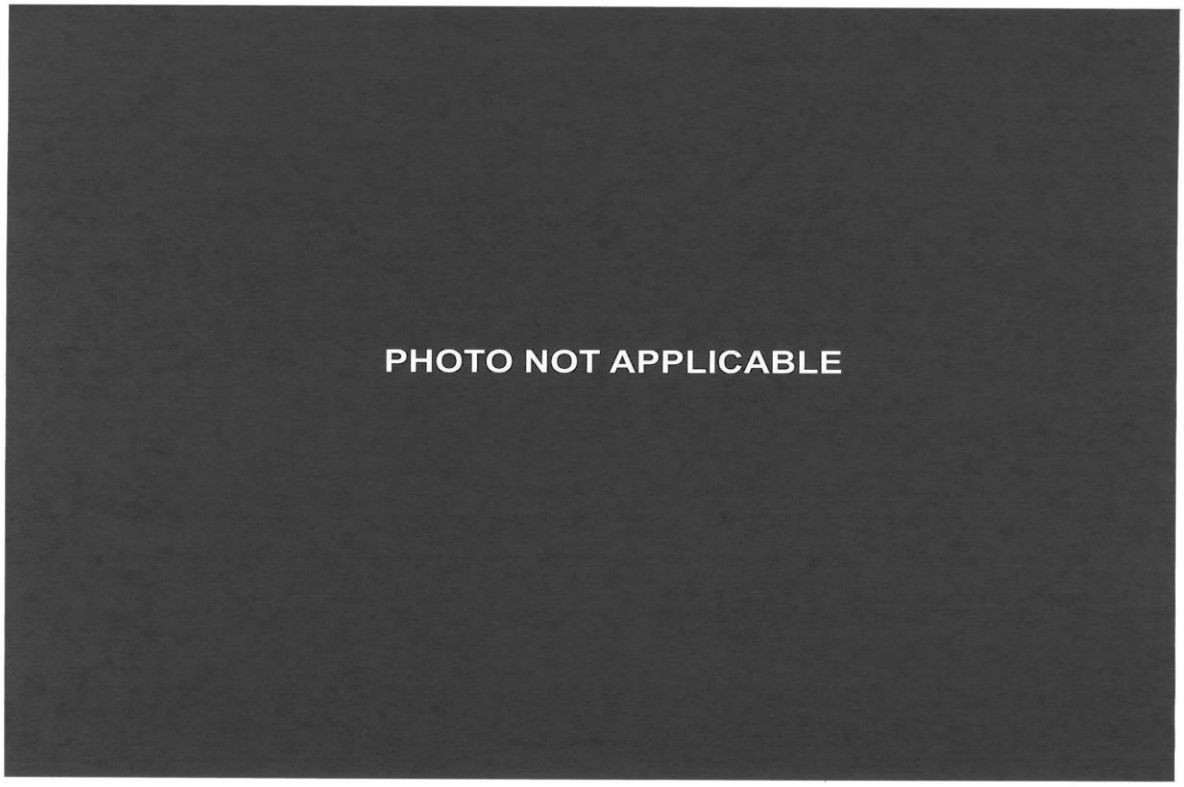
305-30 FMVSS No. 305 Static Rollover at 270°



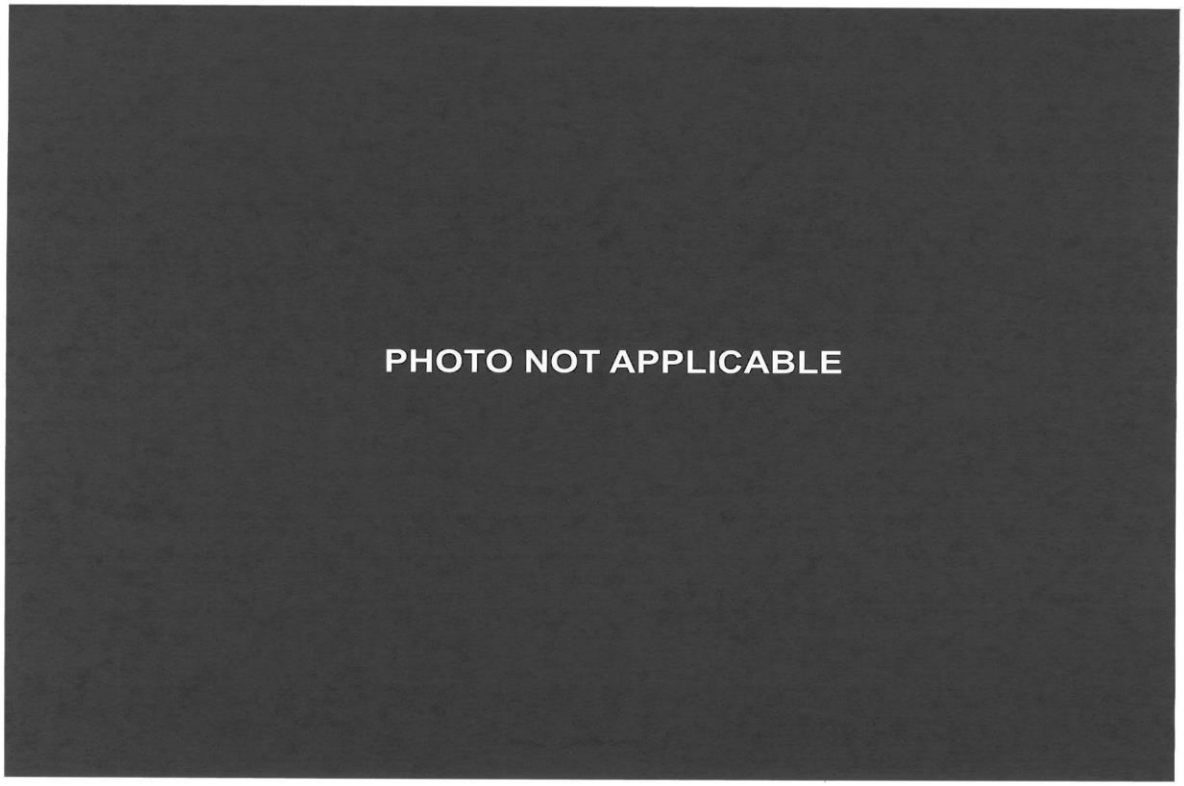
305-31 FMVSS No. 305 Static Rollover at 360°



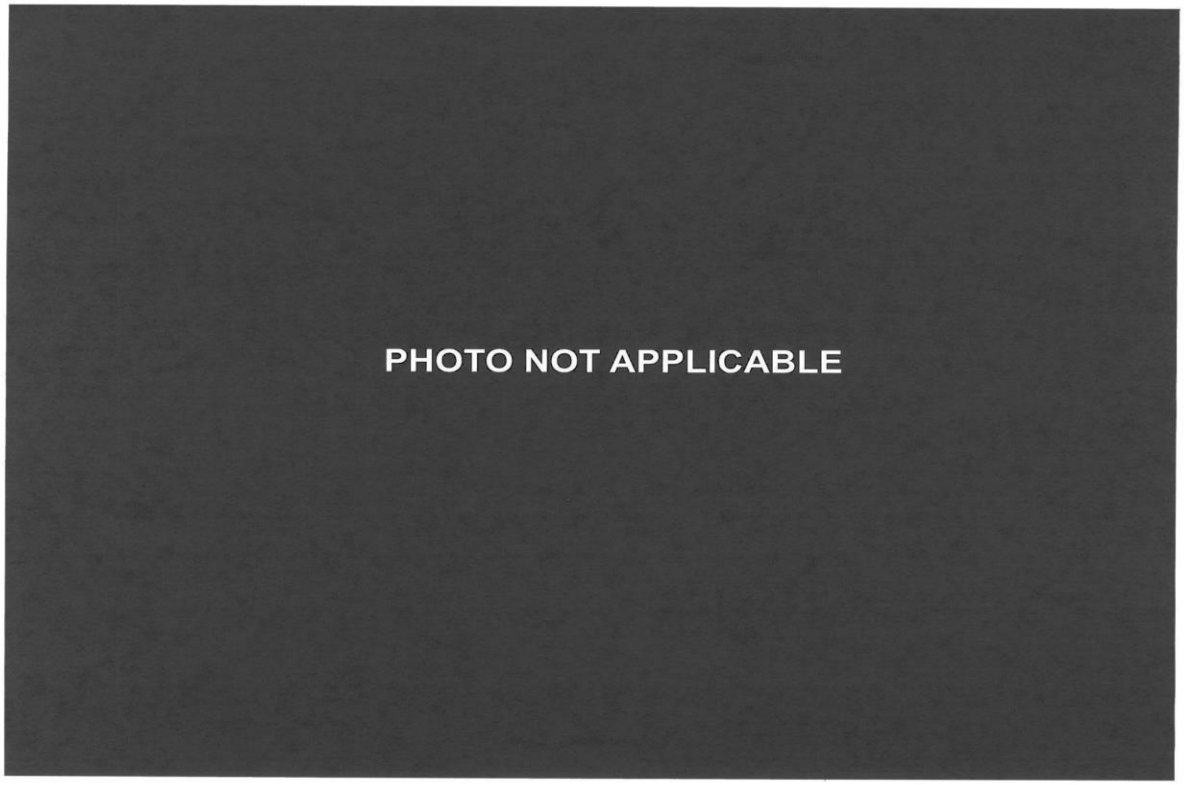
305-32 Pre-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery



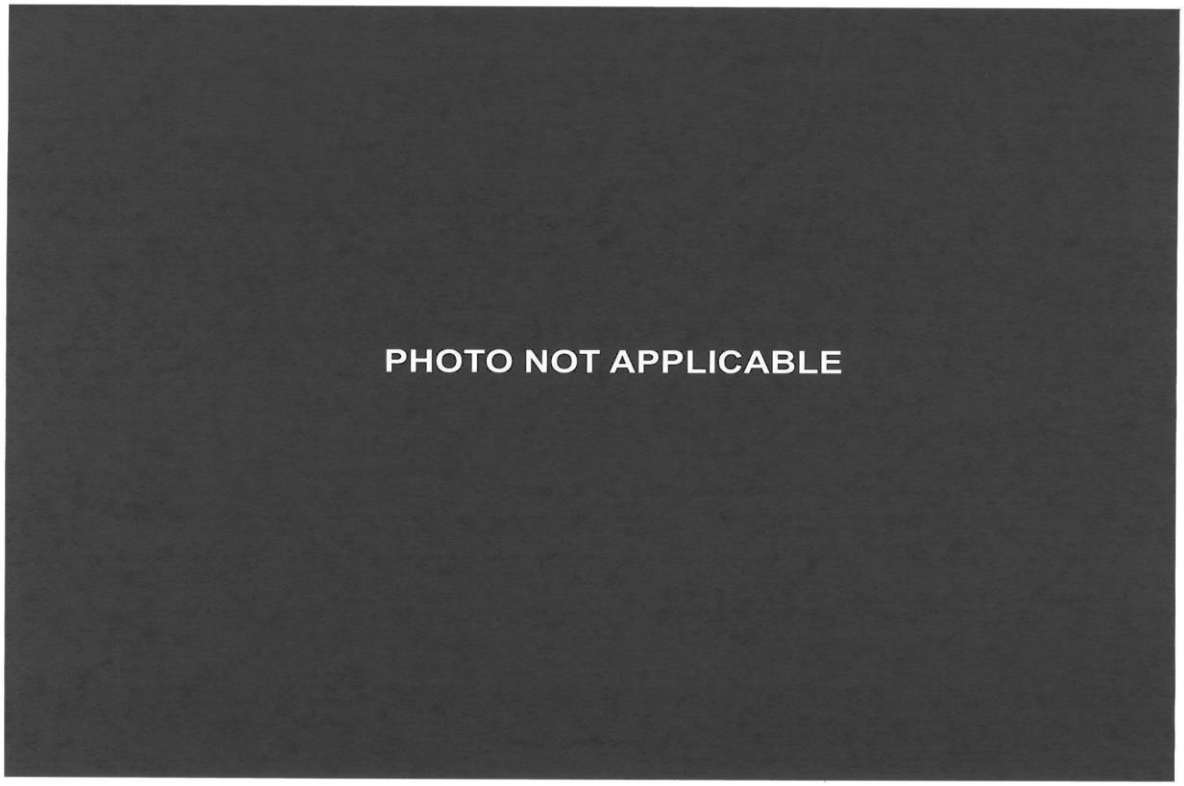
305-33 Post-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery



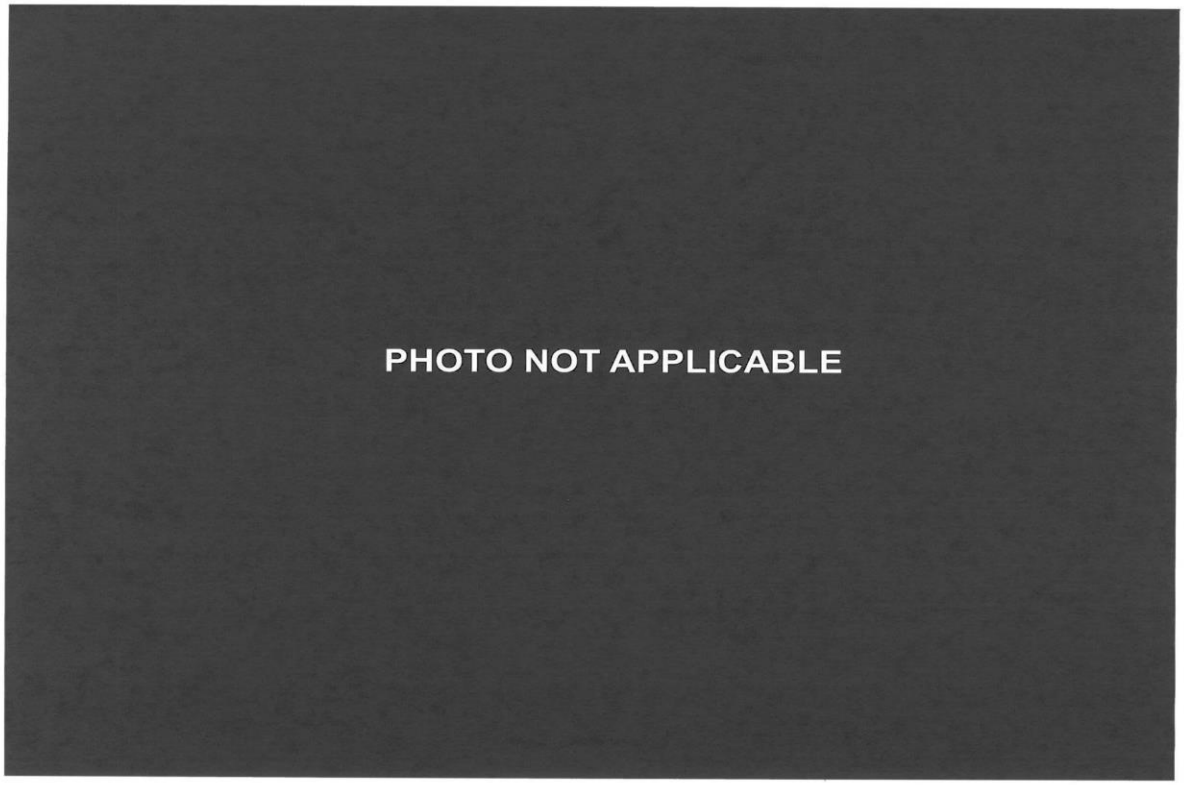
305-34 Post-Impact Propulsion Battery System Mounting and or Intrusion Failure(s)



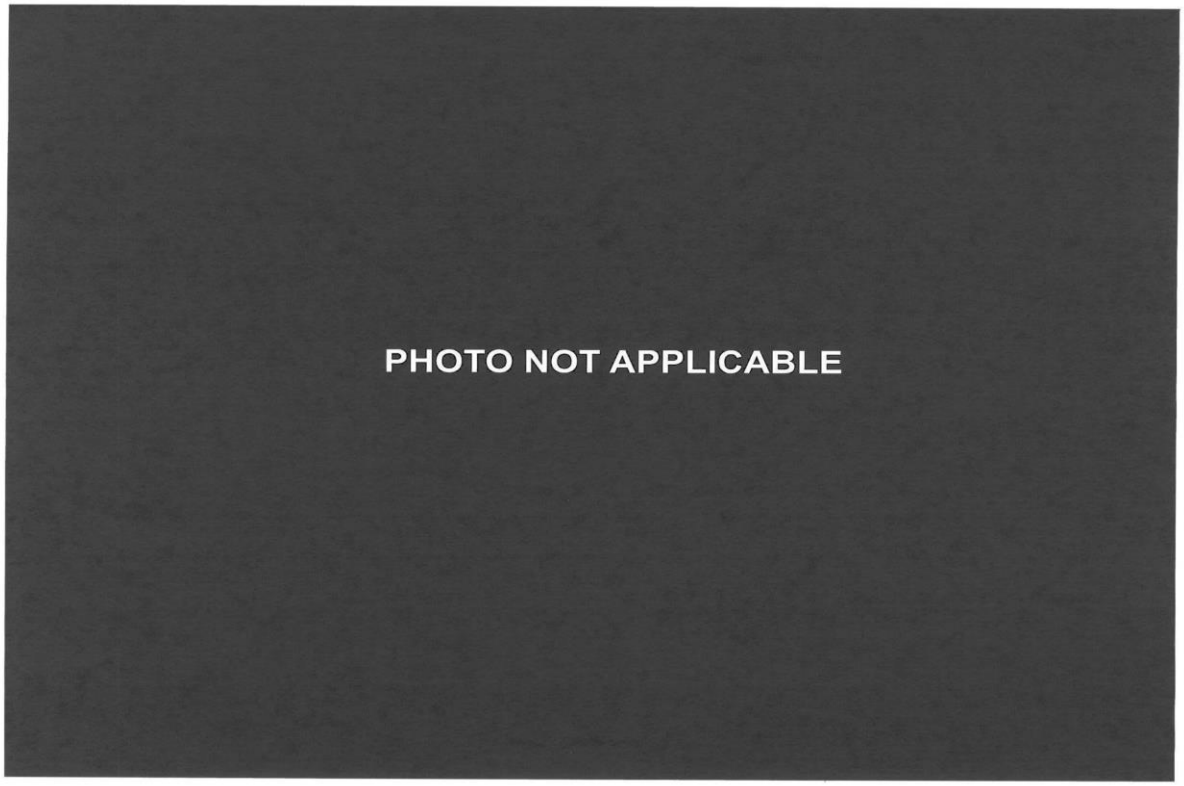
305-35 Post-Impact View of Battery Component Intrusion



305-36 Post-Impact View of Battery Module Movement or Retention Loss



305-37 Post-Impact View of Propulsion Battery Electrolyte Spillage Location



305-38 Post-Test View of Propulsion Battery Electrolyte Spillage Location

APPENDIX B
VEHICLE AND DUMMY RESPONSE DATA PLOTS

TABLE OF DATA PLOTS

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

Driver Head Acceleration X Redundant
Driver Head Acceleration Y Redundant
Driver Head Acceleration Z Redundant
Driver Upper Neck Force Y
Driver Upper Neck Moment X
Driver Upper Neck Moment Z
Driver Chest X Acceleration Redundant
Driver Chest Y Acceleration Redundant
Driver Chest Z Acceleration Redundant
Driver Pelvis X
Driver Pelvis Y
Driver Pelvis Z
Driver Left Femur Redundant
Driver Right Femur Redundant
Driver Left Upper Tibia Moment X
Driver Left Upper Tibia Moment Y
Driver Left Upper Tibia Force Z
Driver Left Lower Tibia Moment X
Driver Left Lower Tibia Moment Y
Driver Left Lower Tibia Force Z
Driver Right Upper Tibia Moment X
Driver Right Upper Tibia Moment Y
Driver Right Upper Tibia Force Z
Driver Right Lower Tibia Moment X
Driver Right Lower Tibia Moment Y
Driver Right Lower Tibia Force Z
Driver Left Foot Fore Z
Driver Left Foot Aft X
Driver Left Foot Aft Z
Driver Right Foot Fore Z
Driver Right Foot Aft X
Driver Right Foot Aft Z

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

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

NHTSA

Test Date: 04/04/2023

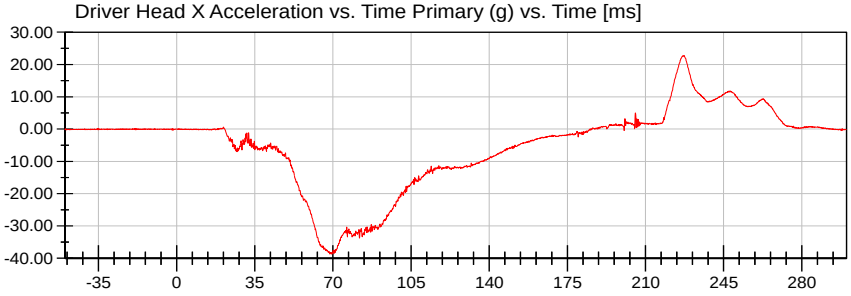
Test Lab: CTF

Position #1 Hybrid III Mid-Sized Adult Male Dummy (037)

Test Number: 230404 (M20234214)

Position #2 Hybrid III Small Adult Female (DH1659)

Driver Head X Acceleration vs. Time Primary (g) vs. Time [ms]



<Max>

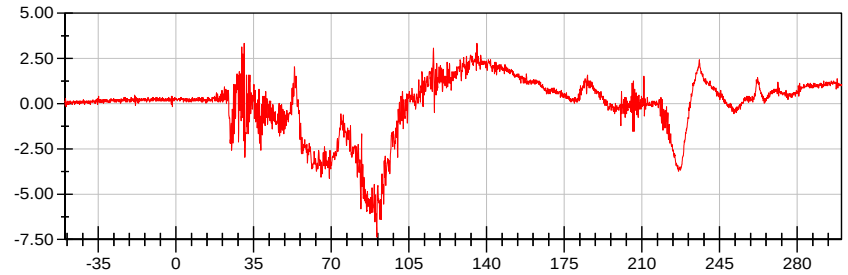
22.72 g at 226.80 ms

<Min>

-38.68 g at 68.56 ms

CFC_1000

Driver Head Y Acceleration vs. Time Primary (g) vs. Time [ms]



<Max>

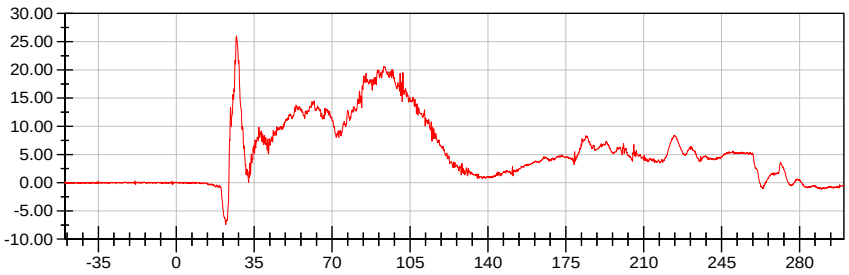
3.33 g at 30.80 ms

<Min>

-7.37 g at 90.48 ms

CFC_1000

Driver Head Z Acceleration vs. Time Primary (g) vs. Time [ms]



<Max>

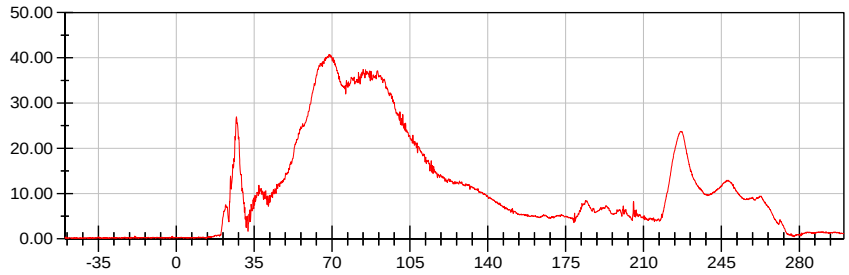
26.04 g at 27.04 ms

<Min>

-7.41 g at 22.24 ms

CFC_1000

Driver Head Resultant Acceleration vs. Time Primary (g) vs. Time [ms]



<Max>

40.75 g at 69.04 ms

<Min>

0.05 g at -48.48 ms

CFC_1000

NHTSA

Test Date: 04/04/2023

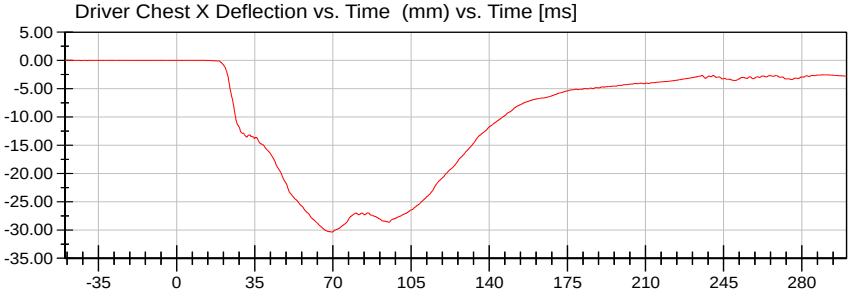
Test Lab: CTF

Position #1 Hybrid III Mid-Sized Adult Male Dummy (037)

Test Number: 230404 (M20234214)

Position #2 Hybrid III Small Adult Female (DH1659)

Driver Chest X Deflection vs. Time (mm) vs. Time [ms]



<Max>

0.01 mm at 8.48 ms

<Min>

-30.36 mm at 69.68 ms

CFC_600

NHTSA

Test Date: 04/04/2023

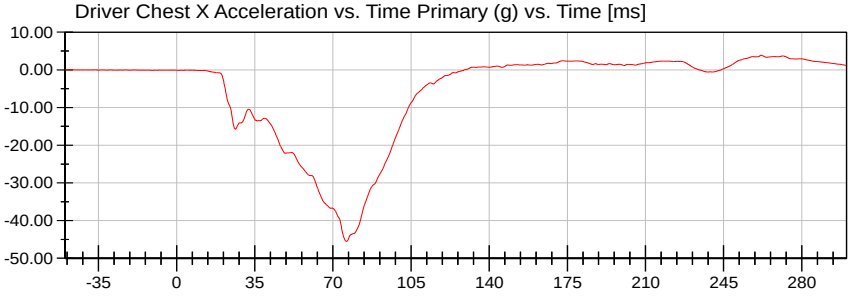
Test Lab: CTF

Position #1 Hybrid III Mid-Sized Adult Male Dummy (037)

Test Number: 230404 (M20234214)

Position #2 Hybrid III Small Adult Female (DH1659)

Driver Chest X Acceleration vs. Time Primary (g) vs. Time [ms]



<Max>

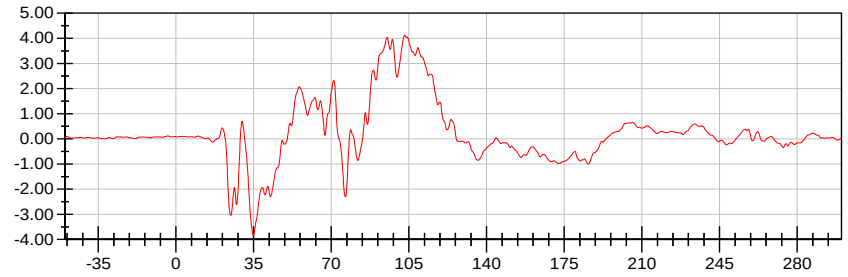
3.87 g at 261.84 ms

<Min>

-45.50 g at 76.08 ms

CFC_180

Driver Chest Y Acceleration vs. Time Primary (g) vs. Time [ms]



<Max>

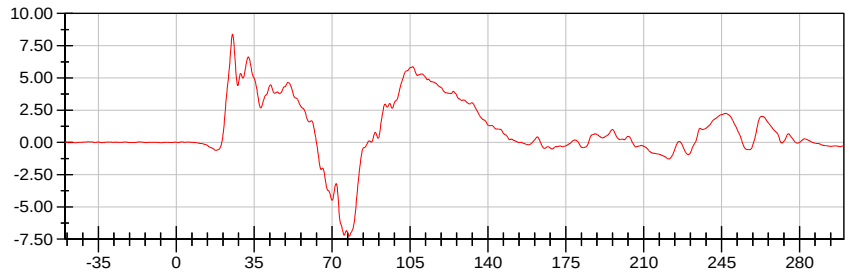
4.13 g at 103.20 ms

<Min>

-3.83 g at 34.88 ms

CFC_180

Driver Chest Z Acceleration vs. Time Primary (g) vs. Time [ms]



<Max>

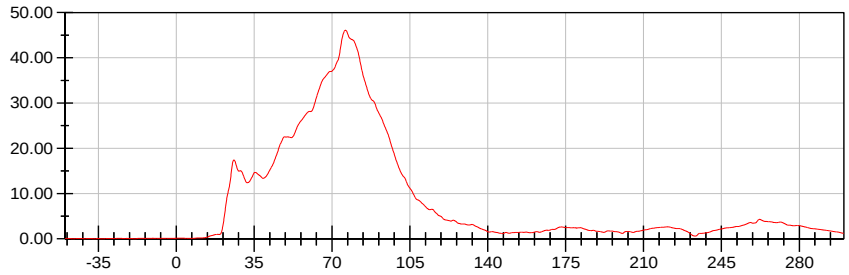
8.39 g at 25.28 ms

<Min>

-7.27 g at 77.68 ms

CFC_180

Driver Chest Resultant Acceleration vs. Time Primary (g) vs. Time [ms]



<Max>

46.08 g at 76.00 ms

<Min>

0.02 g at -18.64 ms

CFC_180

NHTSA

Test Date: 04/04/2023

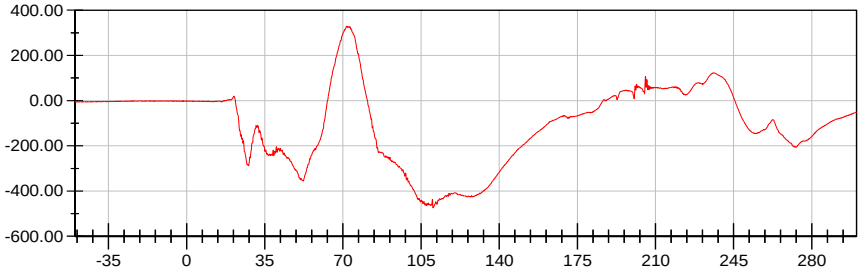
Test Lab: CTF

Position #1 Hybrid III Mid-Sized Adult Male Dummy (037)

Test Number: 230404 (M20234214)

Position #2 Hybrid III Small Adult Female (DH1659)

Driver Upper Neck Force X vs. Time (N) vs. Time [ms]



<Max>

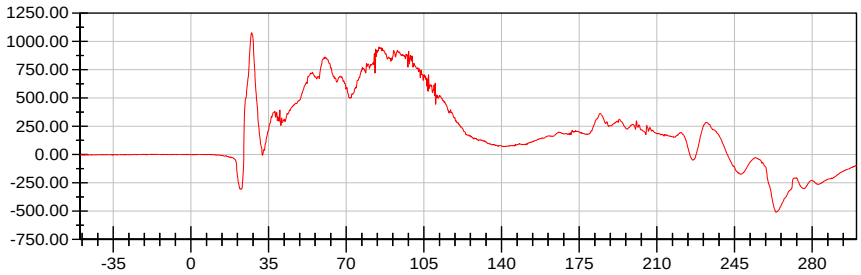
329.18 N at 71.60 ms

<Min>

-474.36 N at 110.40 ms

CFC_1000

Driver Upper Neck Force Z vs. Time (N) vs. Time [ms]



<Max>

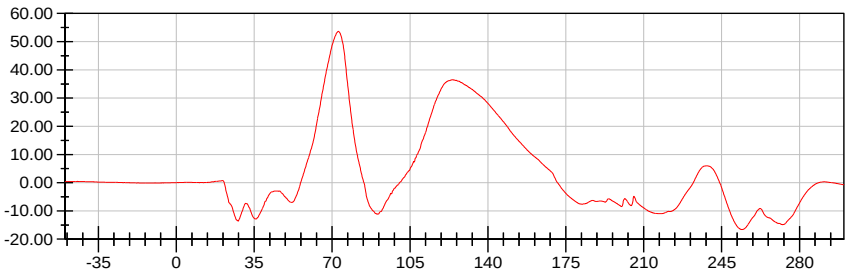
1,076.50 N at 27.36 ms

<Min>

-508.52 N at 263.76 ms

CFC_1000

Driver Upper Neck Moment Y vs. Time (Nm) vs. Time [ms]



<Max>

53.65 Nm at 72.80 ms

<Min>

-16.57 Nm at 254.24 ms

CFC_600

2023 Hyundai Kona Electric NCAP 35 mph Frontal Impact

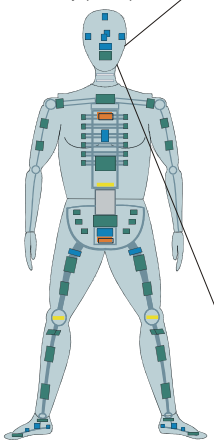
Neck Injury Predictor (NIJ)

Date: 04/04/2023
Time: 14:34

Customer: NHTSA
Test Number: M20234214

TRC Inc. Test Lab: CTF
Test Number: 230404

Test Orientation = Frontal
Fzc(Tension) = 6806
Fzc(Compression) = 6160
Myc(Extension) = 135
Myc(Flexion) = 310



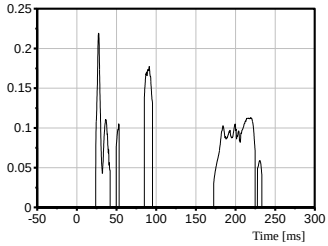
Dummy:HIII 50th Male
Seating Position:
Driver

NIJ Source Code: (Fz/Fzc)+(My/Myc)

11TMONUP00H3MOYX

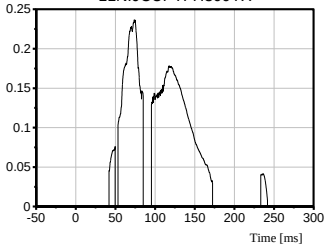
11NECKUP00H3FOZA

11NIJCUPTEH300YX



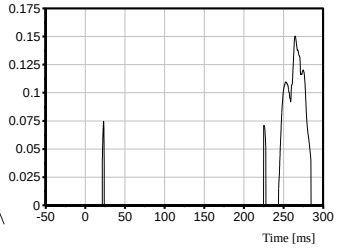
Max [NTE] 0.2192 at 27.52 ms

11NIJCUPTFH300YX



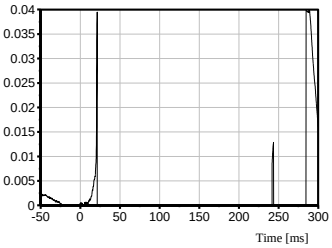
Max [NTF] 0.2367 at 73.92 ms

11NIJCUPCEH300YX



Max [NCE] 0.1503 at 264.80 ms

11NIJCUPCFH300YX



Max [NCF] 0.0399 at 284.64 ms

NHTSA

Test Date: 04/04/2023

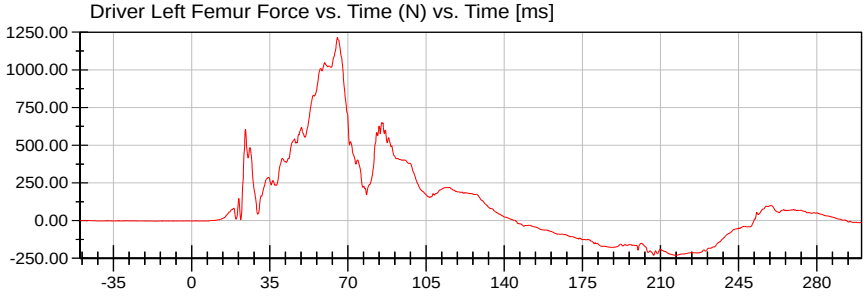
Test Lab: CTF

Position #1 Hybrid III Mid-Sized Adult Male Dummy (037)

Test Number: 230404 (M20234214)

Position #2 Hybrid III Small Adult Female (DH1659)

Driver Left Femur Force vs. Time (N) vs. Time [ms]



<Max>

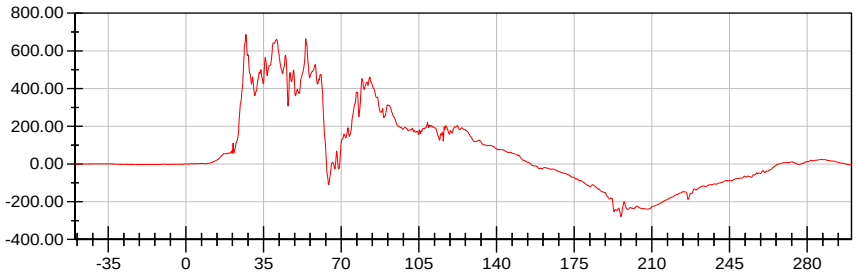
1,214.52 N at 65.28 ms

<Min>

-230.28 N at 216.96 ms

CFC_600

Driver Right Femur Force vs. Time (N) vs. Time [ms]



<Max>

687.06 N at 27.04 ms

<Min>

-279.02 N at 196.16 ms

CFC_600

NHTSA

Test Date: 04/04/2023

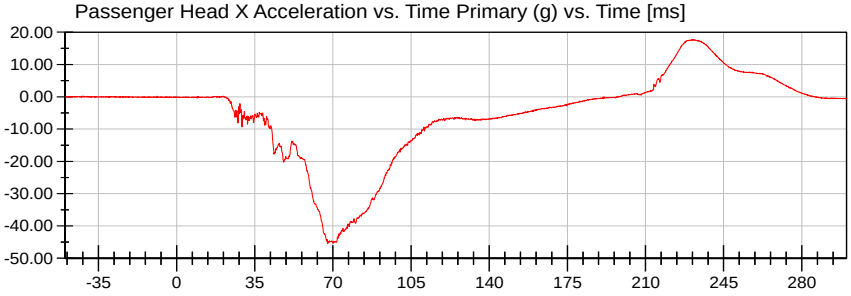
Test Lab: CTF

Position #1 Hybrid III Mid-Sized Adult Male Dummy (037)

Test Number: 230404 (M20234214)

Position #2 Hybrid III Small Adult Female (DH1659)

Passenger Head X Acceleration vs. Time Primary (g) vs. Time [ms]



<Max>

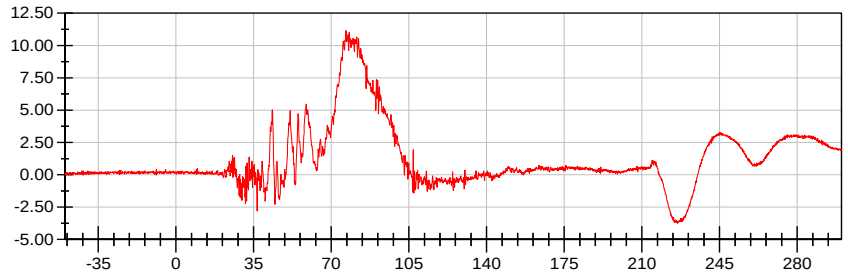
17.67 g at 230.80 ms

<Min>

-45.43 g at 67.68 ms

CFC_1000

Passenger Head Y Acceleration vs. Time Primary (g) vs. Time [ms]



<Max>

11.16 g at 76.64 ms

<Min>

-3.75 g at 226.08 ms

CFC_1000

Passenger Head Z Acceleration vs. Time Primary (g) vs. Time [ms]

<Max>

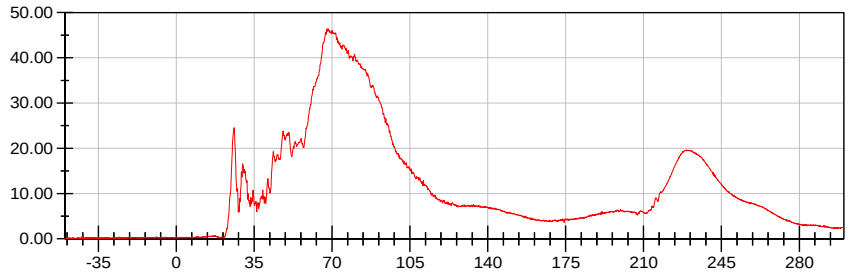
23.77 g at 26.00 ms

<Min>

-0.94 g at 149.52 ms

CFC_1000

Passenger Head Resultant Acceleration vs. Time Primary (g) vs. Time [ms]



<Max>

46.43 g at 68.16 ms

<Min>

0.04 g at -48.32 ms

CFC_1000

NHTSA

Test Date: 04/04/2023

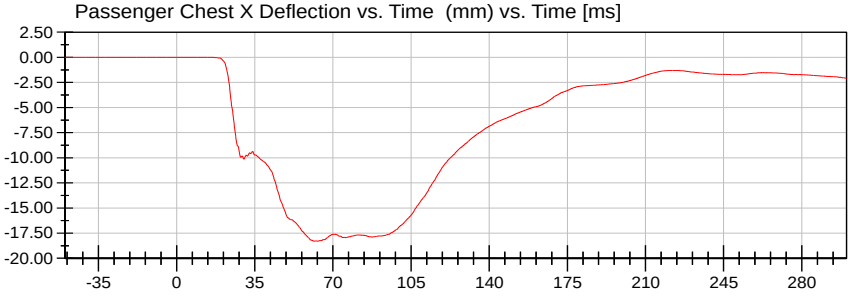
Test Lab: CTF

Position #1 Hybrid III Mid-Sized Adult Male Dummy (037)

Test Number: 230404 (M20234214)

Position #2 Hybrid III Small Adult Female (DH1659)

Passenger Chest X Deflection vs. Time (mm) vs. Time [ms]



<Max>

0.01 mm at -9.28 ms

<Min>

-18.30 mm at 63.28 ms

CFC_600

NHTSA

Test Date: 04/04/2023

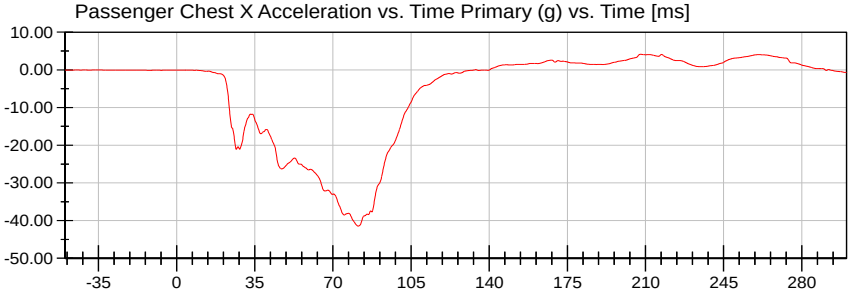
Test Lab: CTF

Position #1 Hybrid III Mid-Sized Adult Male Dummy (037)

Test Number: 230404 (M20234214)

Position #2 Hybrid III Small Adult Female (DH1659)

Passenger Chest X Acceleration vs. Time Primary (g) vs. Time [ms]



<Max>

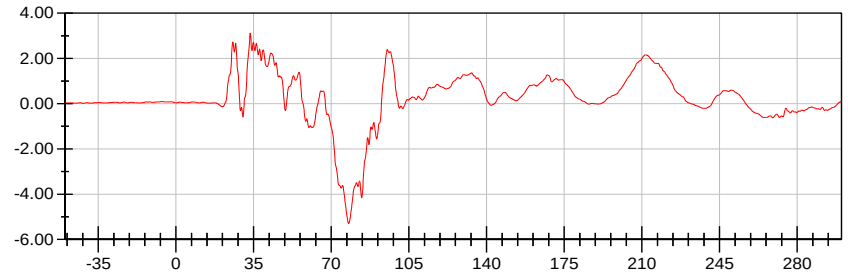
4.13 g at 207.84 ms

<Min>

-41.48 g at 81.28 ms

CFC_180

Passenger Chest Y Acceleration vs. Time Primary (g) vs. Time [ms]



<Max>

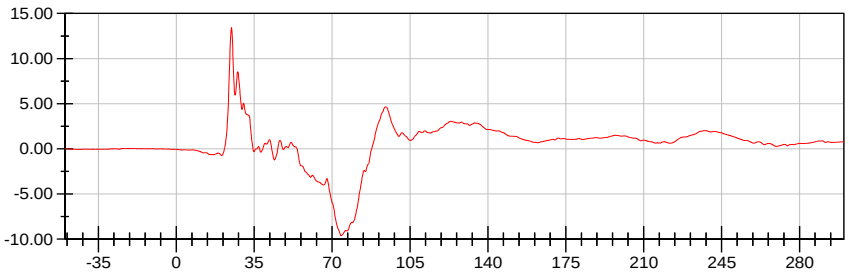
3.12 g at 33.52 ms

<Min>

-5.30 g at 77.84 ms

CFC_180

Passenger Chest Z Acceleration vs. Time Primary (g) vs. Time [ms]



<Max>

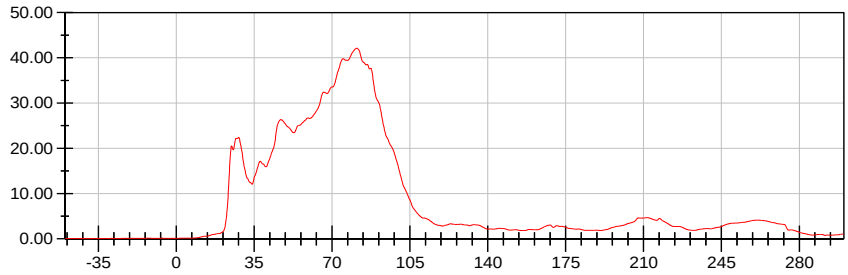
13.43 g at 24.80 ms

<Min>

-9.62 g at 74.08 ms

CFC_180

Passenger Chest Resultant Acceleration vs. Time Primary (g) vs. Time [ms]



<Max>

42.14 g at 81.20 ms

<Min>

0.05 g at -41.52 ms

CFC_180

NHTSA

Test Date: 04/04/2023

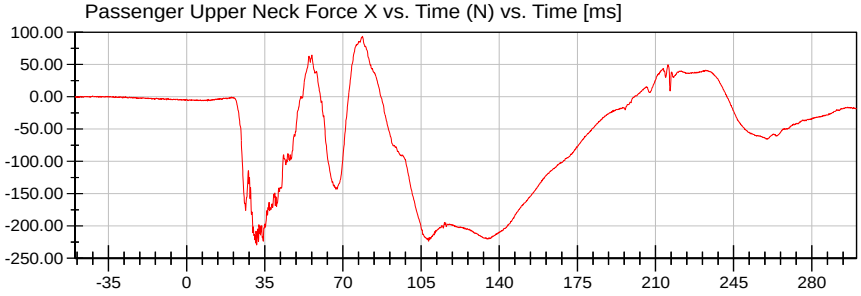
Test Lab: CTF

Position #1 Hybrid III Mid-Sized Adult Male Dummy (037)

Test Number: 230404 (M20234214)

Position #2 Hybrid III Small Adult Female (DH1659)

Passenger Upper Neck Force X vs. Time (N) vs. Time [ms]



<Max>

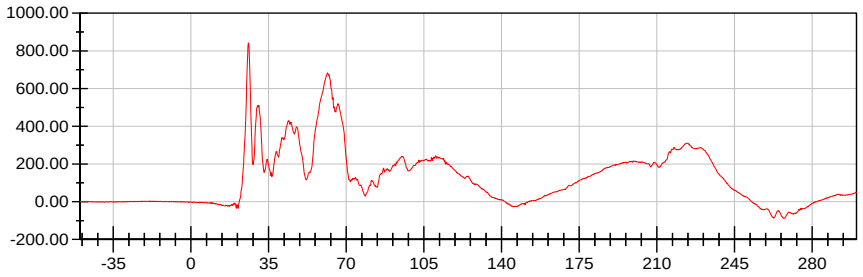
93.57 N at 78.72 ms

<Min>

-229.45 N at 31.36 ms

CFC_1000

Passenger Upper Neck Force Z vs. Time (N) vs. Time [ms]



<Max>

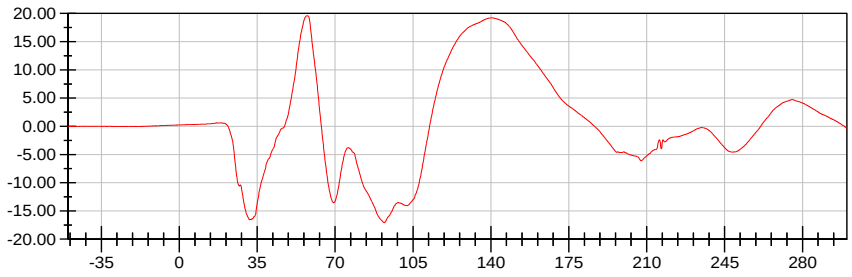
842.03 N at 25.92 ms

<Min>

-88.36 N at 267.36 ms

CFC_1000

Passenger Upper Neck Moment Y vs. Time (Nm) vs. Time [ms]



<Max>

19.59 Nm at 57.36 ms

<Min>

-17.07 Nm at 92.00 ms

CFC_600

2023 Hyundai Kona Electric NCAP 35 mph Frontal Impact

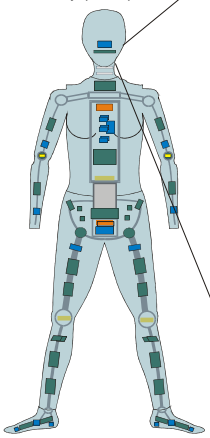
Neck Injury Predictor (NIJ)

Date: 04/04/2023
Time: 14:34

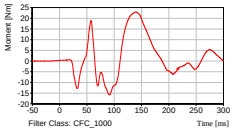
Customer: NHTSA
Test Number: M20234214

TRC Inc. Test Lab: CTF
Test Number: 230404

Test Orientation = Frontal
Fzc(Tension) = 4287
Fzc(Compression) = 3880
Myc(Extension) = 67
Myc(Flexion) = 155

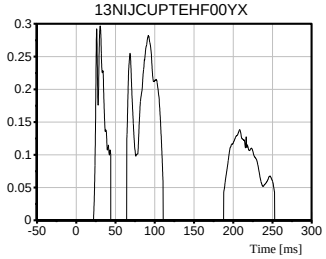


13TMONUP00HFMOYX



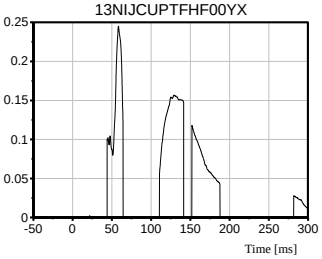
13NECKUP00HFFOZA

13NIJCUPTEHF00YX



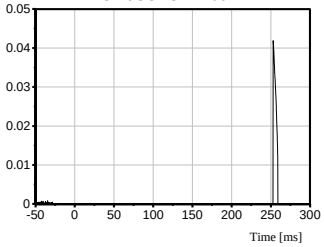
Max [NTE] 0.2967 at 30.64 ms

13NIJCUPTFHF00YX



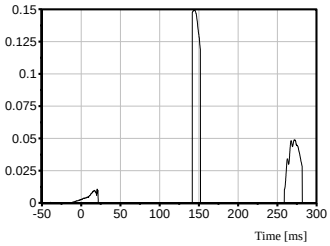
Max [NTF] 0.2452 at 58.48 ms

13NIJCUPCEHF00YX



Max [NCE] 0.0419 at 252.88 ms

13NIJCUPCFHF00YX



Max [NCF] 0.1495 at 144.64 ms

Dummy:HIII 5th Female
Seating Position:
Right Front Passenger

NIJ Source Code: (Fz/Fzc)+(My/Myc)

NHTSA

Test Date: 04/04/2023

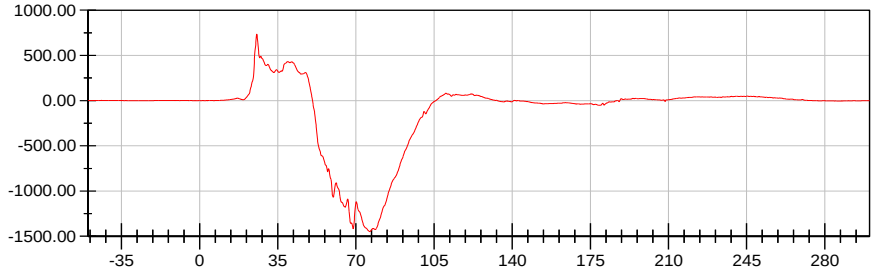
Test Lab: CTF

Position #1 Hybrid III Mid-Sized Adult Male Dummy (037)

Test Number: 230404 (M20234214)

Position #2 Hybrid III Small Adult Female (DH1659)

Passenger Left Femur Force vs. Time (N) vs. Time [ms]



<Max>

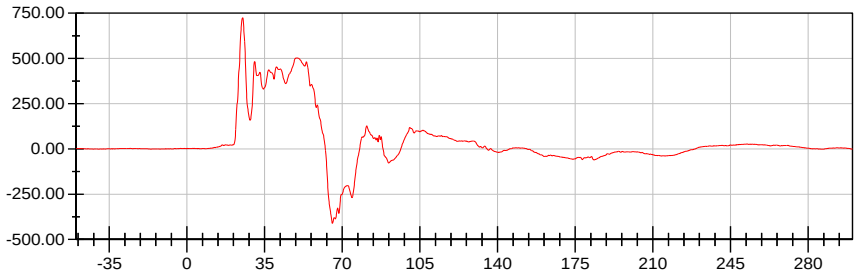
735.68 N at 25.60 ms

<Min>

-1,448.08 N at 76.16 ms

CFC_600

Passenger Right Femur Force vs. Time (N) vs. Time [ms]



<Max>

724.29 N at 25.20 ms

<Min>

-411.01 N at 65.60 ms

CFC_600

APPENDIX C
DUMMY CALIBRATION AND PERFORMANCE VERIFICATION

Pre-Test Calibration Sheets

Driver S/N 037

Transportation Research Center Inc.
572E HIII 50th Male Dummy
External Dimensions
Serial No. 037
Calibration No. 83

Symbol	Description	Specification	Results	Pass
		mm	mm	
A	Total Sitting Height	878.8 - 889.0	880	Yes
B	Shoulder Pivot Height	505.5 - 520.7	510	Yes
C	H-Point Height	83.8 - 88.9	86	Yes
D	H-Point From Seatback	134.6 - 139.7	137	Yes
E	Shoulder Pivot From Backline	83.8 - 94.0	90	Yes
F	Thigh Clearance	139.7 - 154.9	150	Yes
G	Back Of Elbow To Wrist Pivot	289.6 - 304.8	295	Yes
H	Skull Cap To Backline	40.6 - 45.7	45	Yes
I	Shoulder-Elbow Length	330.2 - 345.4	337	Yes
J	Elbow Rest Height	190.5 - 210.8	198	Yes
K	Buttock Knee Length	579.1 - 604.5	601	Yes
L	Popliteal Height	429.3 - 454.7	440	Yes
M	Knee Pivot Height	485.1 - 500.4	494	Yes
N	Buttock Popliteal Length	452.1 - 477.5	470	Yes
O	Chest Depth	213.4 - 228.6	223	Yes
P	Foot Length	251.5 - 266.7	264	Yes
V	Shoulder Breadth	421.6 - 436.9	425	Yes
W	Foot Breadth	91.4 - 106.7	96	Yes
Y	Chest Circumference	970.3 - 1000.8	992	Yes
Z	Waist Circumference	835.7 - 866.1	865	Yes
AA	Location For Chest Circumference	429.3 - 434.3	432	Yes
BB	Location For Waist Circumference	226.1 - 231.1	229	Yes

Transportation Research Center Inc.

Front Head Drop
HIII 50th Serial No. 037 Certification No. 83-1
Test Date: 3/1/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.1 °C	Yes
Relative Humidity	10 - 70 %	37 %	Yes
Peak Head Resultant Acceleration	225 - 275 g	232.6 g	Yes
Peak Head Lateral Acceleration	(-15) - 15 g	4.4 g	Yes
Is Acceleration Curve Unimodal within 10% of Peak?	< 10 %	1.39 %	Yes

Test meets specifications.

Condition: Used

Comments:
Head Skin S/N: N/A

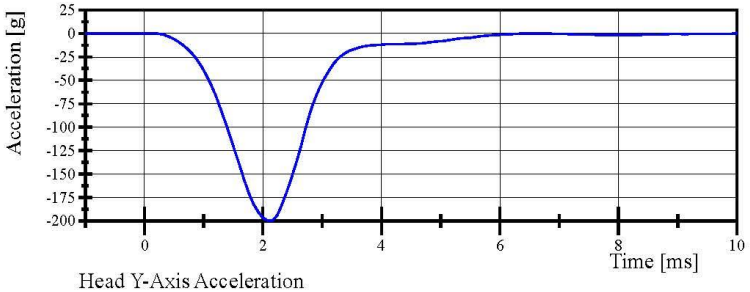
Specification Source: CFR49 Part 572 Subpart E with Polarity in accordance with J211

03.01.2023 10:04:04 612

Transportation Research Center Inc.

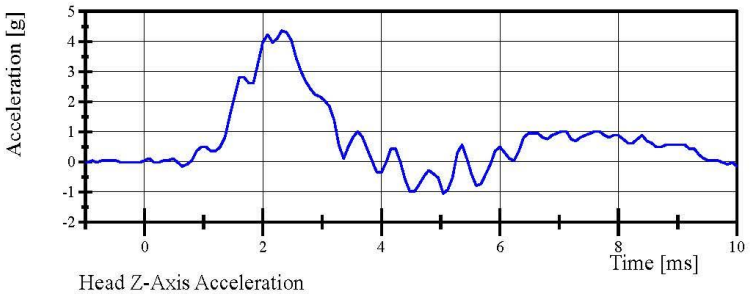
Front Head Drop
HIII 50th Serial No. 037 Certification No. 83-1
Test Date: 3/1/2023

Head X-Axis Acceleration



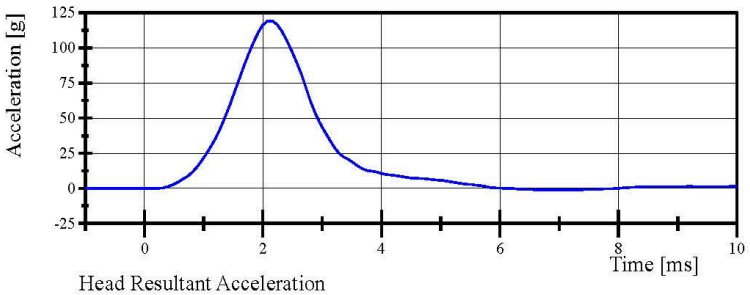
Filter Class: CFC_1000
Max: 0.1 g at -1.0 ms
Min: -199.7 g at 2.1 ms

Head Y-Axis Acceleration



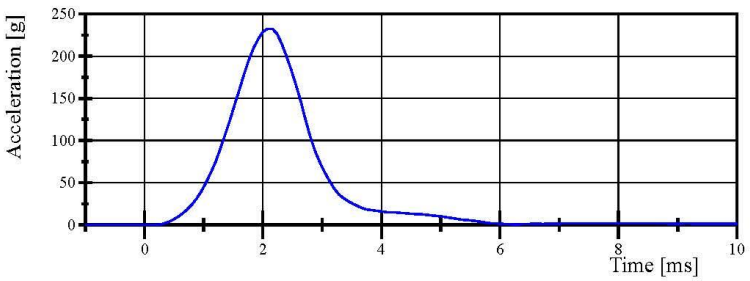
Filter Class: CFC_1000
Max: 4.4 g at 2.3 ms
Min: -1.0 g at 5.0 ms

Head Z-Axis Acceleration



Filter Class: CFC_1000
Max: 119.1 g at 2.1 ms
Min: -1.1 g at 7.0 ms

Head Resultant Acceleration



Filter Class: CFC_1000
Max: 232.6 g at 2.1 ms
Min: 0.0 g at -1.0 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

03.01.2023 10:04:38 612

Transportation Research Center Inc.

Neck Flexion
HIII 50th Serial No. 037 Certification No. 83-1
Test Date: 3/1/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.2 °C	Yes
Relative Humidity	10 - 70 %	35 %	Yes
Pendulum Velocity	6.89 - 7.13 m/s	6.900 m/s	Yes
Pendulum Acceleration Decay Crossing -5g	34 - 42 ms	35.3 ms	Yes
Pendulum Acceleration at 10ms	(-22.5) - (-27.5) g	-25.84 g	Yes
Pendulum Acceleration at 20ms	(-17.6) - (-22.6) g	-20.22 g	Yes
Pendulum Acceleration at 30ms	(-12.5) - (-18.5) g	-17.16 g	Yes
Pendulum Acceleration > 30ms	>= (-29.0) g	-17.16 g	Yes
Total Head D-Plane Rotation			
Peak	(-64) - (-78) °	-67.7 °	Yes
Time of Peak	57 - 64 ms	58.7 ms	Yes
Total Head D-Plane Rotation Decay to 0°	113 - 128 ms	118.2 ms	Yes
Total Neck Occipital Condyles Moment			
Peak	88.1 - 108.4 N·m	98.34 N·m	Yes
Time of Peak	47 - 58 ms	49.8 ms	Yes
Total Neck Occipital Condyles Moment Decay to 0 N·m	97 - 107 ms	97.3 ms	Yes

Test meets specifications.

Condition: Used

Comments:
Neck S/N: 47287

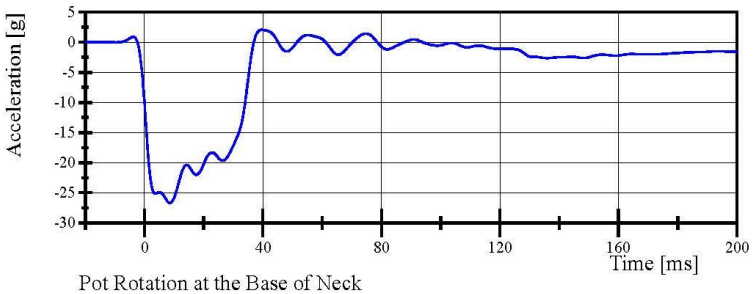
Specification Source: CFR49 Part 572 Subpart E with Polarity in accordance with J211

03.01.2023 10:45:50 1872

Transportation Research Center Inc.

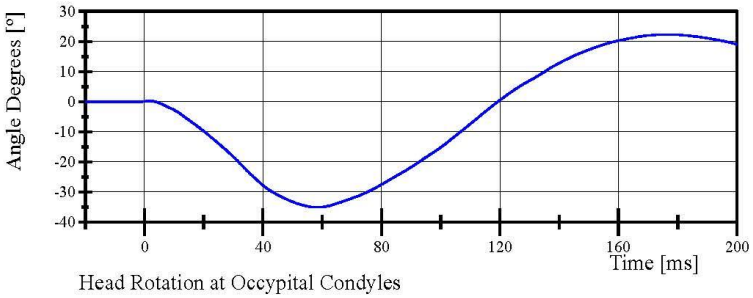
Neck Flexion
HIII 50th Serial No. 037 Certification No. 83-1
Test Date: 3/1/2023

Pendulum Acceleration



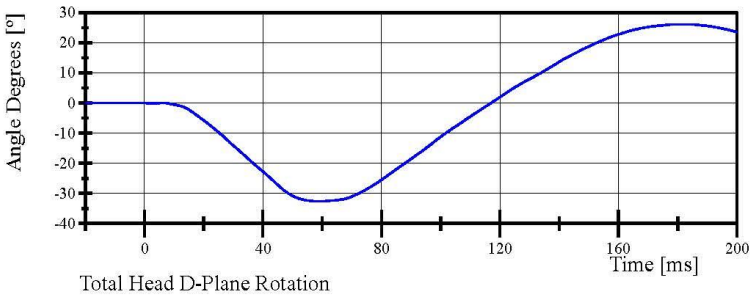
Filter Class: CFC_60
Max: 2.1 g at 39.6 ms
Min: -26.7 g at 8.6 ms

Pot Rotation at the Base of Neck



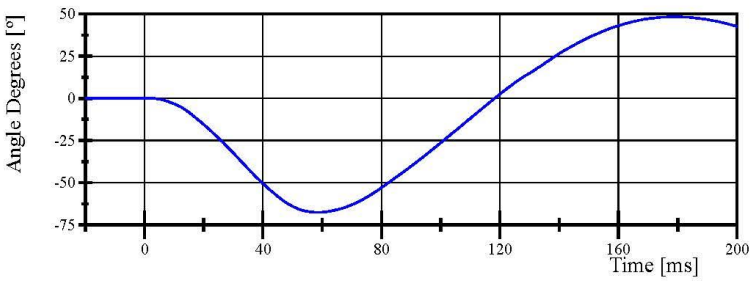
Filter Class: CFC_60
Max: 22.3 ° at 176.8 ms
Min: -35.0 ° at 58.5 ms

Head Rotation at Occypital Condyles



Filter Class: CFC_60
Max: 26.2 ° at 181.7 ms
Min: -32.6 ° at 59.2 ms

Total Head D-Plane Rotation



Filter Class: CFC_60
Max: 48.4 ° at 179.0 ms
Min: -67.7 ° at 58.7 ms

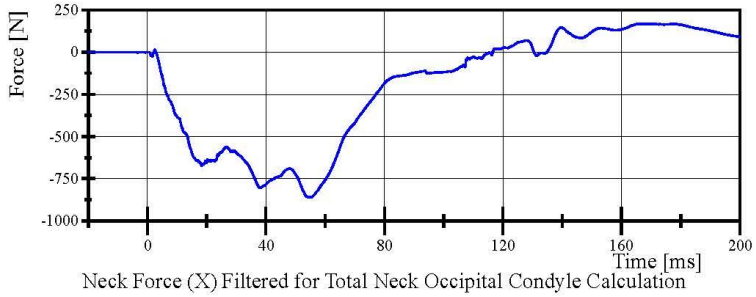
Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

03.01.2023 10:46:13 1872

Transportation Research Center Inc.

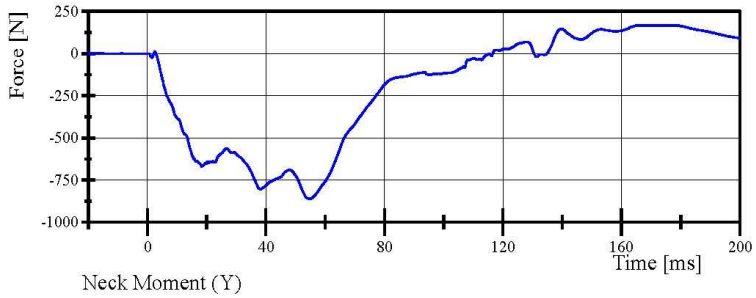
Neck Flexion
HIII 50th Serial No. 037 Certification No. 83-1
Test Date: 3/1/2023

Neck Force (X)



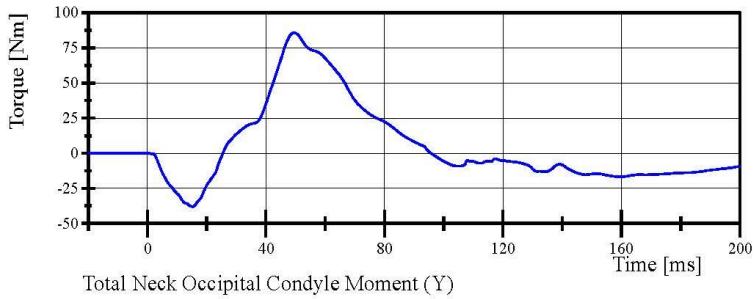
Filter Class: CFC_1000
Max: 168.1 N at 165.9 ms
Min: -860.9 N at 54.8 ms

Neck Force (X) Filtered for Total Neck Occipital Condyle Calculation



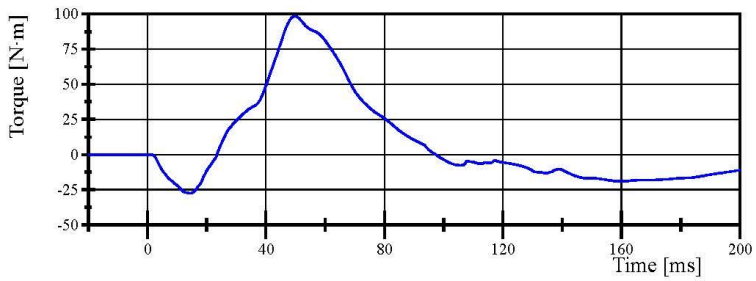
Filter Class: CFC_600
Max: 167.9 N at 166.1 ms
Min: -860.7 N at 55.0 ms

Neck Moment (Y)



Filter Class: CFC_600
Max: 85.7 Nm at 49.6 ms
Min: -38.0 Nm at 15.1 ms

Total Neck Occipital Condyle Moment (Y)



Filter Class: Without_(Constar
Max: 98.3 N·m at 49.8 ms
Min: -27.5 N·m at 14.5 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

03.01.2023 10:46:13 1872

Transportation Research Center Inc.

Neck Extension
HIII 50th Serial No. 037 Certification No. 83-1
Test Date: 3/1/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	20.8 °C	Yes
Relative Humidity	10 - 70 %	35 %	Yes
Pendulum Velocity	(-5.95) - (-6.18) m/s	-5.963 m/s	Yes
Pendulum Acceleration Decay Crossing 5g	38 - 46 ms	39.5 ms	Yes
Pendulum Acceleration at 10ms	17.2 - 21.2 g	20.15 g	Yes
Pendulum Acceleration at 20ms	14.0 - 19.0 g	17.07 g	Yes
Pendulum Acceleration at 30ms	11.0 - 16.0 g	13.56 g	Yes
Pendulum Acceleration > 30ms	<= 22.0 g	13.83 g	Yes
Total Head D-Plane Rotation			
Peak	81 - 106 °	93.0 °	Yes
Time of Peak	72 - 82 ms	77.6 ms	Yes
Total Head D-Plane Rotation Decay to 0°	147 - 174 ms	158.6 ms	Yes
Total Neck Occipital Condyles Moment			
Peak	(-52.9) - (-80) N·m	-65.54 N·m	Yes
Time of Peak	65 - 79 ms	71.2 ms	Yes
Total Neck Occipital Condyles Moment Decay to 0 N·m	120 - 148 ms	142.1 ms	Yes

Test meets specifications.

Condition: Used

Comments:
Neck S/N: 47287

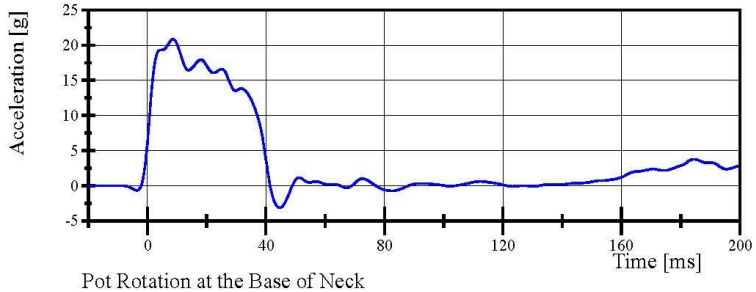
Specification Source: CFR49 Part 572 Subpart E with Polarity in accordance with J211

03.01.2023 11:16:26 2012

Transportation Research Center Inc.

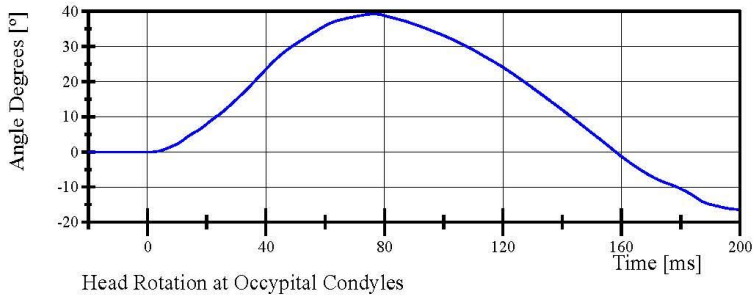
Neck Extension
HIII 50th Serial No. 037 Certification No. 83-1
Test Date: 3/1/2023

Pendulum Acceleration



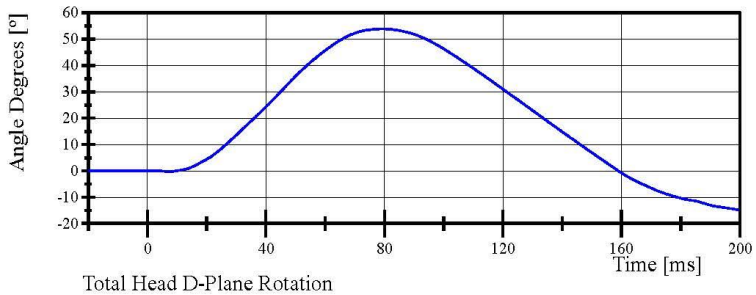
Filter Class: CFC_60
Max: 20.9 g at 8.6 ms
Min: -3.1 g at 44.7 ms

Pot Rotation at the Base of Neck



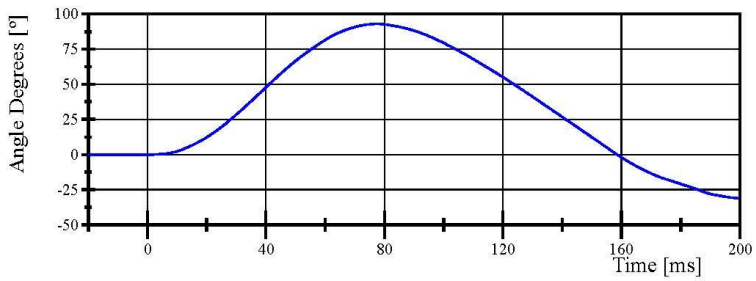
Filter Class: CFC_60
Max: 39.2 ° at 76.2 ms
Min: -16.4 ° at 199.4 ms

Head Rotation at Occypital Condyles



Filter Class: CFC_60
Max: 53.9 ° at 79.4 ms
Min: -14.7 ° at 199.4 ms

Total Head D-Plane Rotation



Filter Class: CFC_60
Max: 93.0 ° at 77.6 ms
Min: -31.1 ° at 199.4 ms

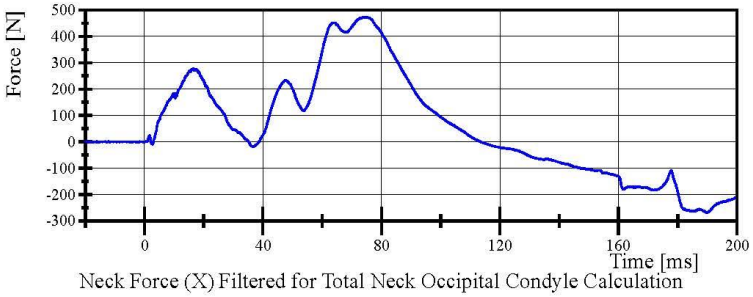
Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

03.01.2023 11:17:08 2012

Transportation Research Center Inc.

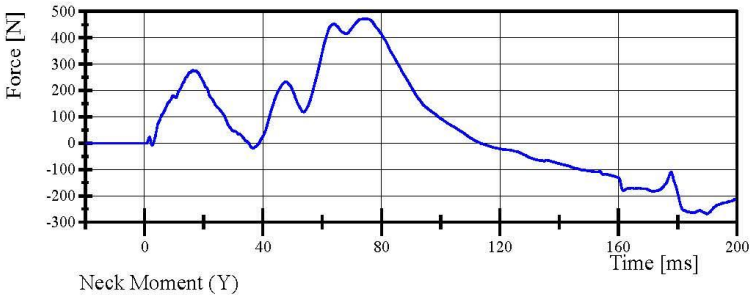
Neck Extension
HIII 50th Serial No. 037 Certification No. 83-1
Test Date: 3/1/2023

Neck Force (X)



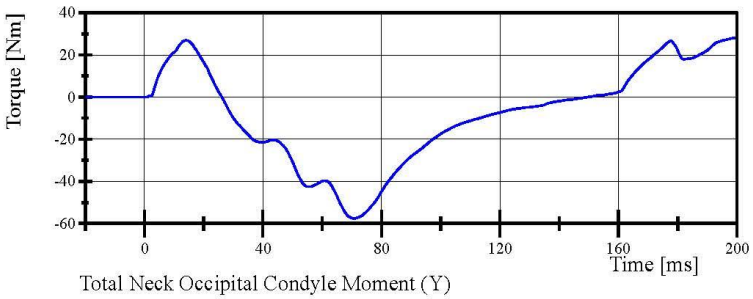
Filter Class: CFC_1000
Max: 473.2 N at 74.4 ms
Min: -269.1 N at 189.8 ms

Neck Force (X) Filtered for Total Neck Occipital Condyle Calculation



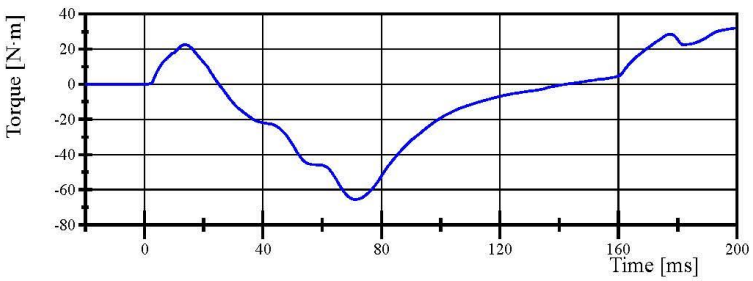
Filter Class: CFC_600
Max: 472.5 N at 74.4 ms
Min: -268.3 N at 189.9 ms

Neck Moment (Y)



Filter Class: CFC_600
Max: 28.1 Nm at 199.4 ms
Min: -57.6 Nm at 70.9 ms

Total Neck Occipital Condyle Moment (Y)



Filter Class: Without_(Constar
Max: 31.9 N·m at 199.4 ms
Min: -65.5 N·m at 71.2 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

03.01.2023 11:17:08 2012

Transportation Research Center Inc.

Front Thorax
HIII 50th Serial No. 037 Certification No. 83-1
Test Date: 3/1/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.0 °C	Yes
Relative Humidity	10 - 70 %	34 %	Yes
Probe Velocity	6.59 - 6.83 m/s	6.605 m/s	Yes
Probe Force Peak	(-5,160) - (-5,894) N	-5,434.5 N	Yes
Maximum Chest Compression	(-63.5) - (-72.6) mm	-66.67 mm	Yes
Internal Hysteresis	69 - 85 %	69.2 %	Yes

Test meets specifications.

Condition: Used

Comments:
Jacket S/N: ER6442
Rib Set S/N: 02033121A

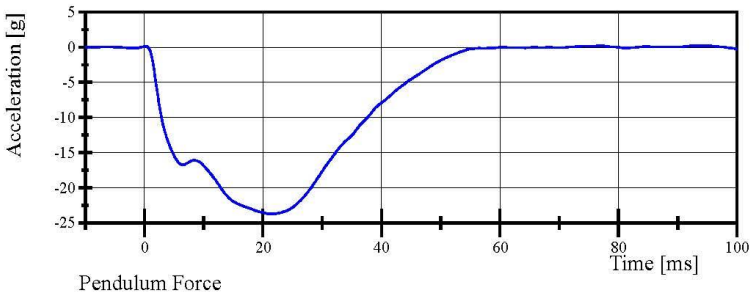
Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

03.01.2023 08:17:13 428

Transportation Research Center Inc.

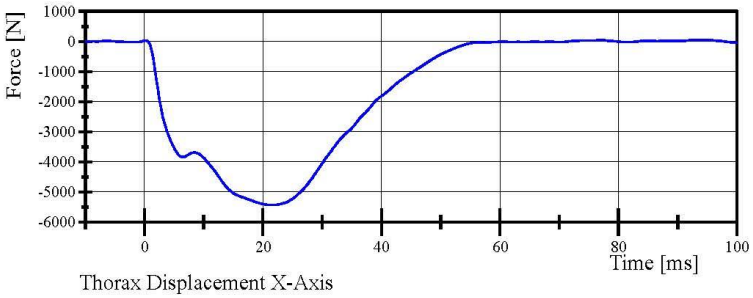
Front Thorax
HIII 50th Serial No. 037 Certification No. 83-1
Test Date: 3/1/2023

Pendulum Acceleration



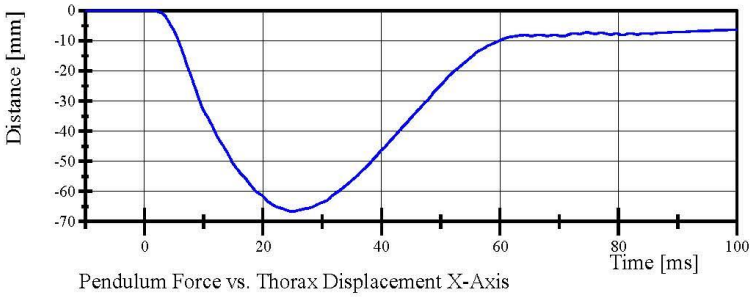
Filter Class: CFC_180
Max: 0.2 g at 93.6 ms
Min: -23.7 g at 21.4 ms

Pendulum Force



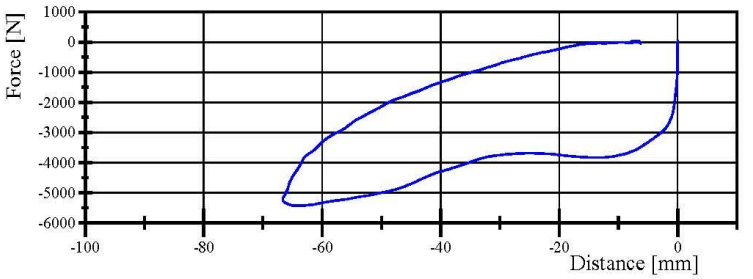
Filter Class: CFC_180
Max: 43.4 N at 93.6 ms
Min: -5,434.5 N at 21.4 ms

Thorax Displacement X-Axis



Filter Class: CFC_600
Max: 0.0 mm at -5.8 ms
Min: -66.7 mm at 25.0 ms

Pendulum Force vs. Thorax Displacement X-Axis



Filter Class: CFC_180
Max: 43.4 N at -6.7 mm
Min: -5,434.5 N at -64.2 mm

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

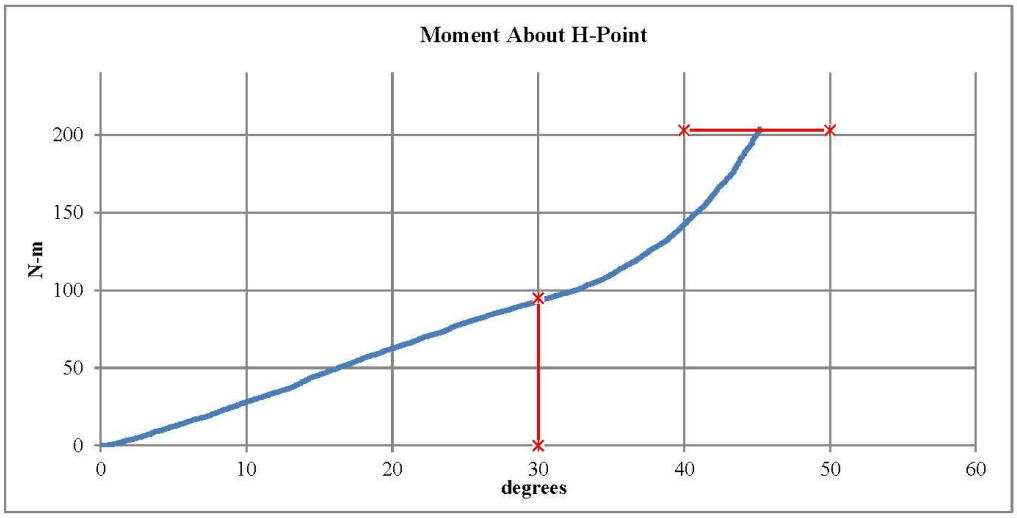
03.01.2023 08:17:51 428

Transportation Research Center Inc.

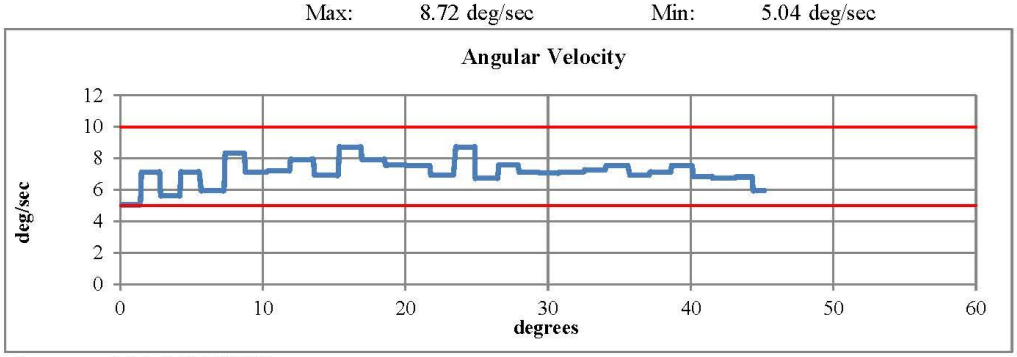
Hybrid III 50th Male Hip Range of Motion

Serial Number:	037	Date:	01-Mar-2023
Side Tested:	Left Hip	Time:	9:04
Test Number:	1		

TEST PARAMETER	SPECIFICATION			TEST RESULTS		
Temperature	18.9	-	25.6	20.9	°C	Pass
Humidity	10	-	70	35	%	Pass
Moment at 30°	0	≤	94.9	93.01	N-m	Pass
Angle at 203 Nm	40	-	50	45.17	deg	Pass
Average Velocity	5	-	10	7.15	deg/sec	Pass



Max: 8.72 deg/sec Min: 5.04 deg/sec



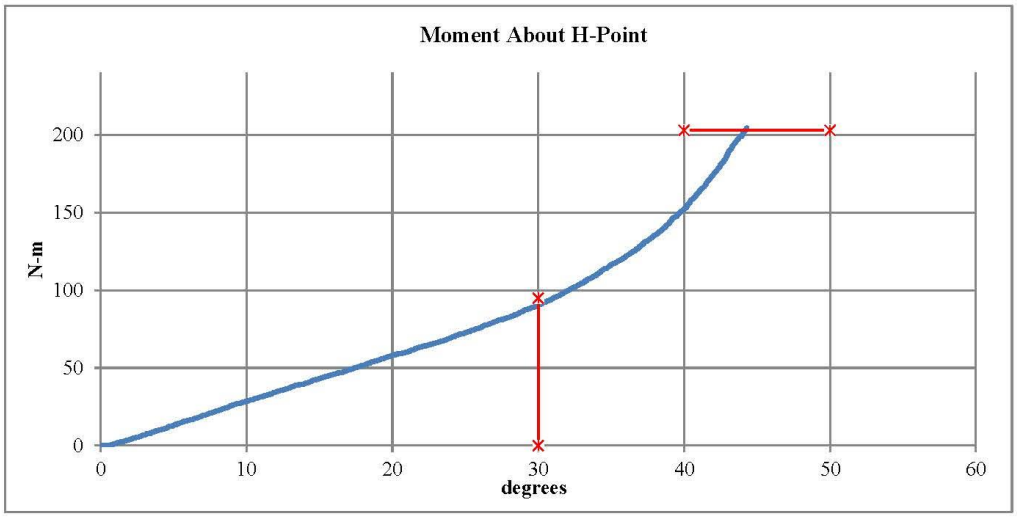
Comments: Pelvis S/N: EU6859

Transportation Research Center Inc.

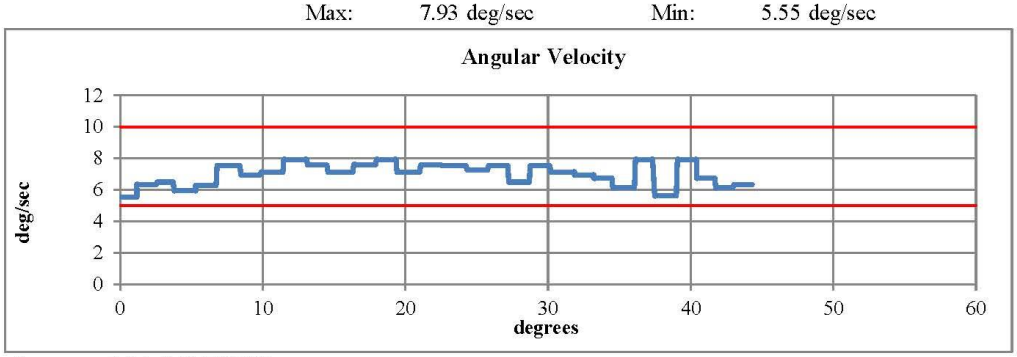
Hybrid III 50th Male Hip Range of Motion

Serial Number:	037	Date:	01-Mar-2023
Side Tested:	Right Hip	Time:	9:59
Test Number:	1		

TEST PARAMETER	SPECIFICATION			TEST RESULTS		
Temperature	18.9	-	25.6	21.1	°C	Pass
Humidity	10	-	70	36	%	Pass
Moment at 30°	0	≤	94.9	90.59	N-m	Pass
Angle at 203 Nm	40	-	50	44.3	deg	Pass
Average Velocity	5	-	10	6.97	deg/sec	Pass



Max: 7.93 deg/sec Min: 5.55 deg/sec



Comments: Pelvis S/N: EU6859

Transportation Research Center Inc.

Left Knee Femur Response Test
HIII 50th Serial No. 037 Certification No. 83-1
Test Date: 3/1/2023

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.5 °C	20.8 °C	Yes
Relative Humidity	10 - 70 %	34 %	Yes
Probe Velocity	2.07 - 2.13 m/s	2.100 m/s	Yes
Peak Femur Force	(-4,715.2) - (-5,782.6) N	-5,526.29 N	Yes

Test meets specifications.

Condition: Used

Comments:
Knee Skin S/N: 2672

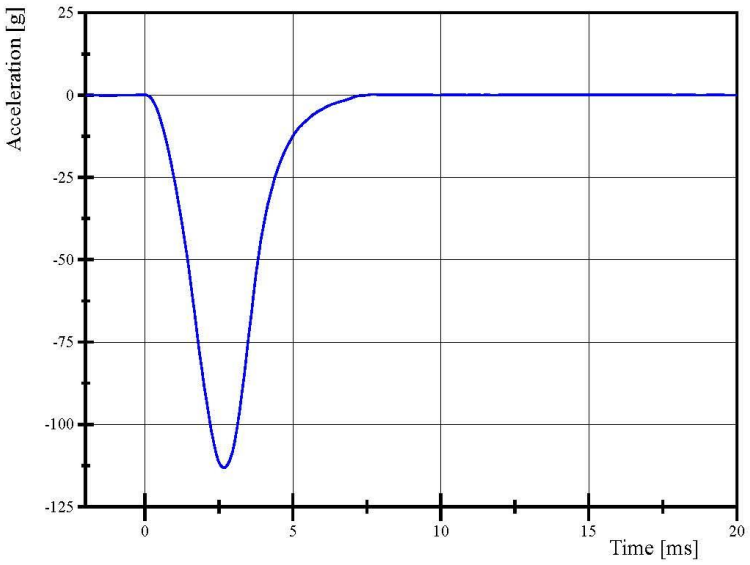
Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

03.01.2023 08:24:12 1817

Transportation Research Center Inc.

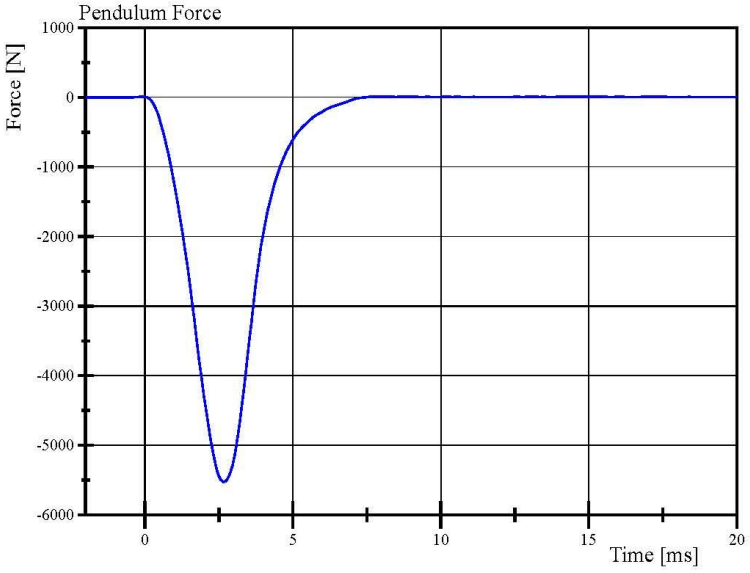
Left Knee Femur Response Test
HIII 50th Serial No. 037 Certification No. 83-1
Test Date: 3/1/2023

Pendulum Acceleration



Filter Class: CFC_600
Max: 0.2 g at 7.8 ms
Min: -113.2 g at 2.6 ms

Pendulum Force



Filter Class: CFC_600
Max: 11.0 N at 7.8 ms
Min: -5,526.3 N at 2.6 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

03.01.2023 08:24:43 1817

Transportation Research Center Inc.

Right Knee Femur Response Test
HIII 50th Serial No. 037 Certification No. 83-1
Test Date: 3/1/2023

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.5 °C	21.2 °C	Yes
Relative Humidity	10 - 70 %	34 %	Yes
Probe Velocity	2.07 - 2.13 m/s	2.101 m/s	Yes
Peak Femur Force	(-4,715.2) - (-5,782.6) N	-5,392.95 N	Yes

Test meets specifications.

Condition: Used

Comments:
Knee Skin S/N: 1248

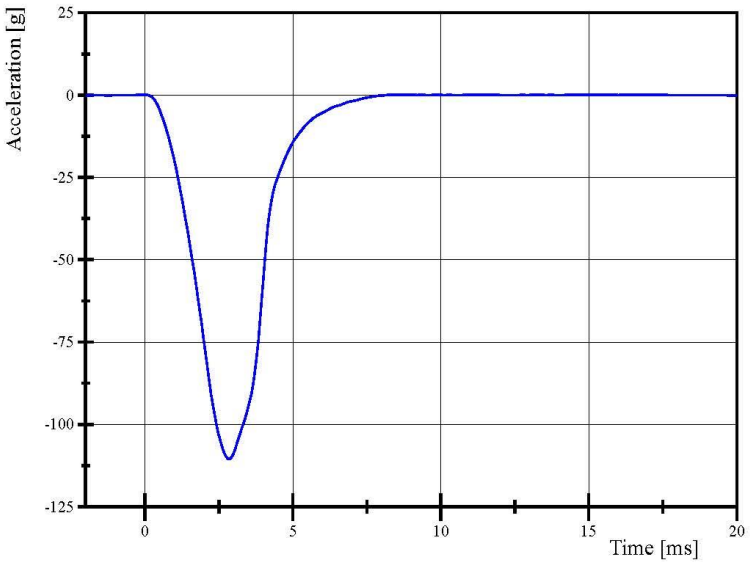
Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

03.01.2023 08:27:49 1812

Transportation Research Center Inc.

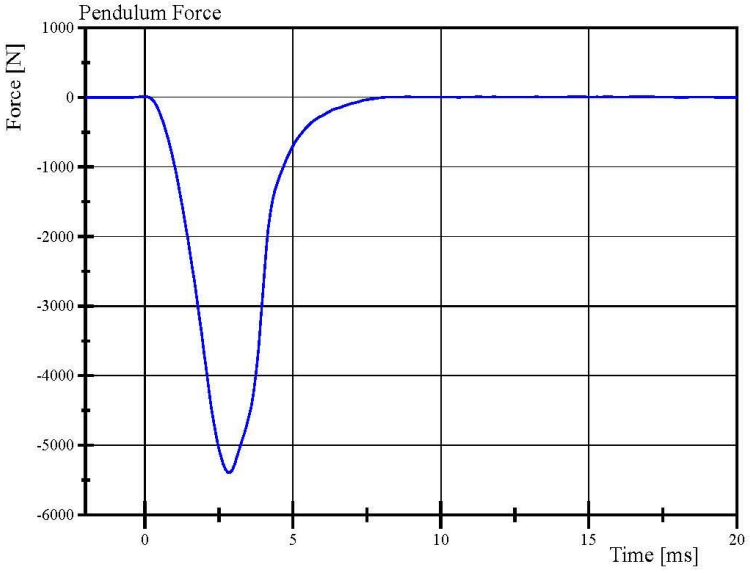
Right Knee Femur Response Test
HIII 50th Serial No. 037 Certification No. 83-1
Test Date: 3/1/2023

Pendulum Acceleration



Filter Class: CFC_600
Max: 0.2 g at 0.0 ms
Min: -110.4 g at 2.9 ms

Pendulum Force



Filter Class: CFC_600
Max: 8.0 N at 0.0 ms
Min: -5,393.0 N at 2.9 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

03.01.2023 08:28:14 1812

Post-Test Calibration Sheets

Driver S/N 037

Transportation Research Center Inc.
572E HIII 50th Male Dummy
External Dimensions
Serial No. 037
Calibration No. 84

Symbol	Description	Specification	Results	Pass
		mm	mm	
A	Total Sitting Height	878.8 - 889.0	880	Yes
B	Shoulder Pivot Height	505.5 - 520.7	510	Yes
C	H-Point Height	83.8 - 88.9	86	Yes
D	H-Point From Seatback	134.6 - 139.7	137	Yes
E	Shoulder Pivot From Backline	83.8 - 94.0	90	Yes
F	Thigh Clearance	139.7 - 154.9	150	Yes
G	Back Of Elbow To Wrist Pivot	289.6 - 304.8	295	Yes
H	Skull Cap To Backline	40.6 - 45.7	45	Yes
I	Shoulder-Elbow Length	330.2 - 345.4	337	Yes
J	Elbow Rest Height	190.5 - 210.8	198	Yes
K	Buttock Knee Length	579.1 - 604.5	601	Yes
L	Popliteal Height	429.3 - 454.7	440	Yes
M	Knee Pivot Height	485.1 - 500.4	494	Yes
N	Buttock Popliteal Length	452.1 - 477.5	470	Yes
O	Chest Depth	213.4 - 228.6	223	Yes
P	Foot Length	251.5 - 266.7	264	Yes
V	Shoulder Breadth	421.6 - 436.9	425	Yes
W	Foot Breadth	91.4 - 106.7	96	Yes
Y	Chest Circumference	970.3 - 1000.8	992	Yes
Z	Waist Circumference	835.7 - 866.1	865	Yes
AA	Location For Chest Circumference	429.3 - 434.3	432	Yes
BB	Location For Waist Circumference	226.1 - 231.1	229	Yes

Transportation Research Center Inc.

Front Head Drop
HIII 50th Serial No. 037 Certification No. 84-1
Test Date: 4/5/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.1 °C	Yes
Relative Humidity	10 - 70 %	66 %	Yes
Peak Head Resultant Acceleration	225 - 275 g	245.7 g	Yes
Peak Head Lateral Acceleration	(-15) - 15 g	11.2 g	Yes
Is Acceleration Curve Unimodal within 10% of Peak?	< 10 %	8.23 %	Yes

Test meets specifications.

Condition: Used

Comments:
Head Skin S/N: N/A

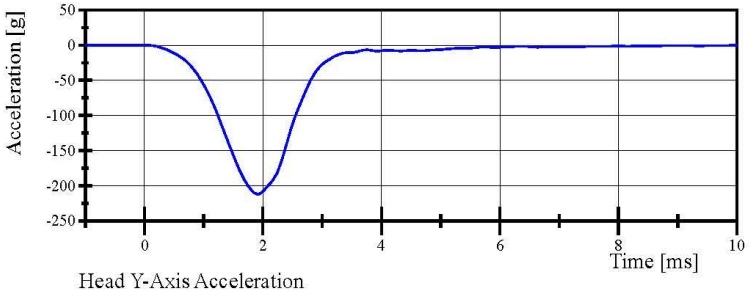
Specification Source: CFR49 Part 572 Subpart E with Polarity in accordance with J211

04.05.2023 09:55:11 613

Transportation Research Center Inc.

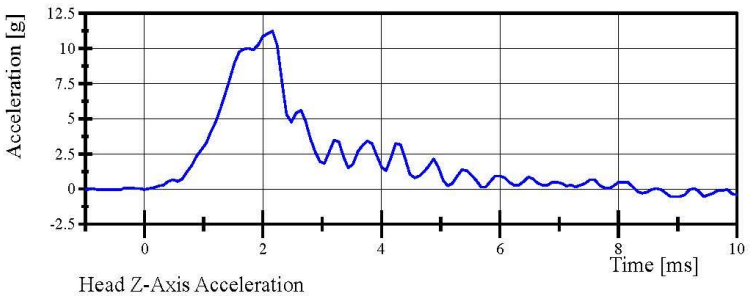
Front Head Drop
HIII 50th Serial No. 037 Certification No. 84-1
Test Date: 4/5/2023

Head X-Axis Acceleration



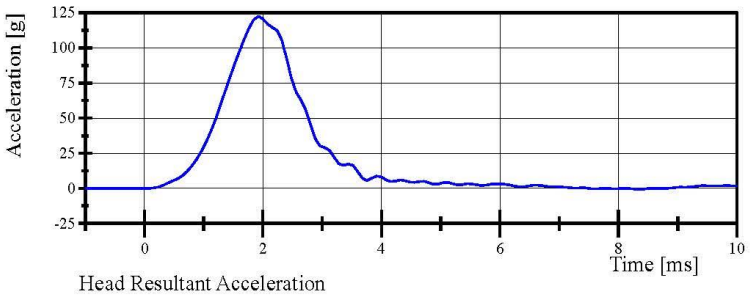
Filter Class: CFC_1000
Max: 0.1 g at -1.0 ms
Min: -212.8 g at 1.9 ms

Head Y-Axis Acceleration



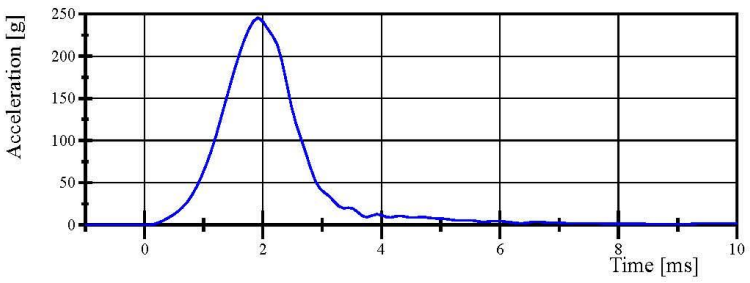
Filter Class: CFC_1000
Max: 11.2 g at 2.2 ms
Min: -0.5 g at 8.9 ms

Head Z-Axis Acceleration



Filter Class: CFC_1000
Max: 122.4 g at 1.9 ms
Min: -0.7 g at 8.4 ms

Head Resultant Acceleration



Filter Class: CFC_1000
Max: 245.7 g at 1.9 ms
Min: 0.0 g at -0.8 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

04.05.2023 09:55:44 613

Transportation Research Center Inc.

Neck Flexion
HIII 50th Serial No. 037 Certification No. 84-2
Test Date: 4/5/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.2 °C	Yes
Relative Humidity	10 - 70 %	65 %	Yes
Pendulum Velocity	6.89 - 7.13 m/s	6.912 m/s	Yes
Pendulum Acceleration Decay Crossing -5g	34 - 42 ms	35.7 ms	Yes
Pendulum Acceleration at 10ms	(-22.5) - (-27.5) g	-24.43 g	Yes
Pendulum Acceleration at 20ms	(-17.6) - (-22.6) g	-22.29 g	Yes
Pendulum Acceleration at 30ms	(-12.5) - (-18.5) g	-17.75 g	Yes
Pendulum Acceleration > 30ms	>= (-29.0) g	-17.75 g	Yes
Total Head D-Plane Rotation			
Peak	(-64) - (-78) °	-74.5 °	Yes
Time of Peak	57 - 64 ms	59.3 ms	Yes
Total Head D-Plane Rotation Decay to 0°	113 - 128 ms	119.4 ms	Yes
Total Neck Occipital Condyles Moment			
Peak	88.1 - 108.4 N·m	100.78 N·m	Yes
Time of Peak	47 - 58 ms	50.1 ms	Yes
Total Neck Occipital Condyles Moment Decay to 0 N·m	97 - 107 ms	98.3 ms	Yes

Test meets specifications.

Condition: Used

Comments:
Neck S/N: 47287

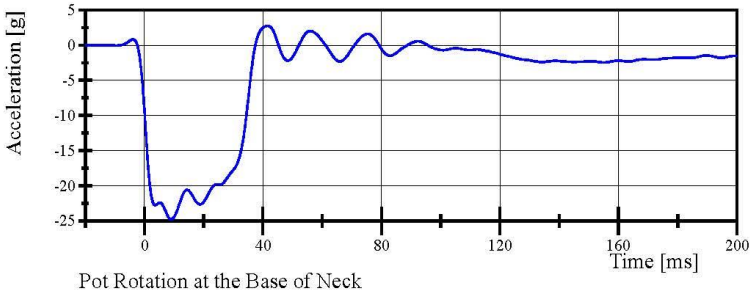
Specification Source: CFR49 Part 572 Subpart E with Polarity in accordance with J211

04.05.2023 11:15:01 1873

Transportation Research Center Inc.

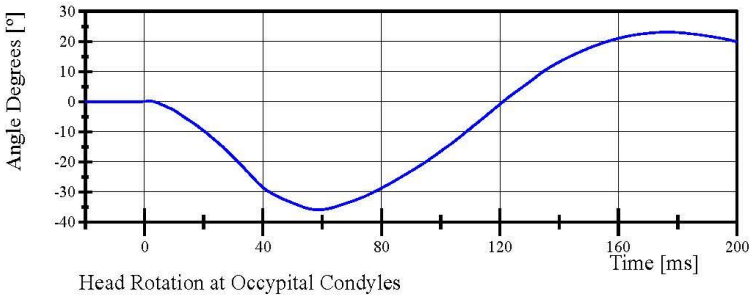
Neck Flexion
HIII 50th Serial No. 037 Certification No. 84-2
Test Date: 4/5/2023

Pendulum Acceleration



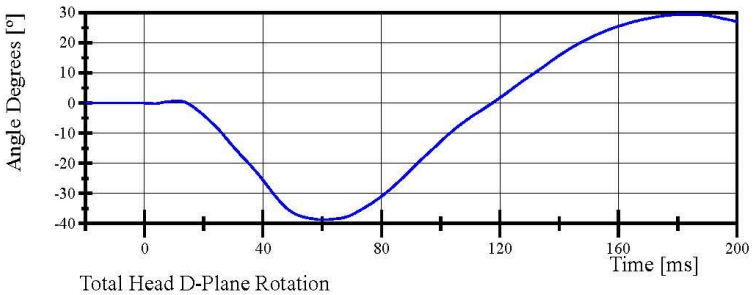
Filter Class: CFC_60
Max: 2.8 g at 41.6 ms
Min: -24.8 g at 9.0 ms

Pot Rotation at the Base of Neck



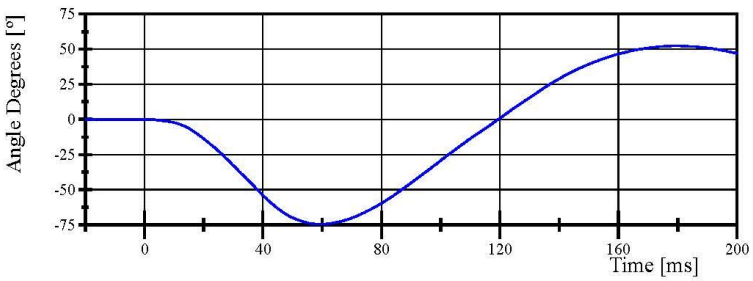
Filter Class: CFC_60
Max: 23.1 ° at 176.6 ms
Min: -35.8 ° at 58.7 ms

Head Rotation at Occypital Condyles



Filter Class: CFC_60
Max: 29.4 ° at 184.5 ms
Min: -38.7 ° at 60.3 ms

Total Head D-Plane Rotation



Filter Class: CFC_60
Max: 52.3 ° at 179.3 ms
Min: -74.5 ° at 59.3 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

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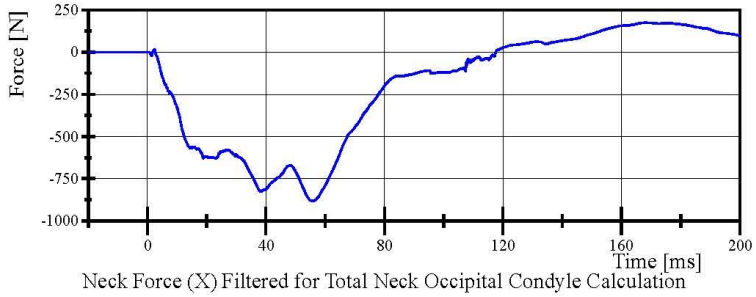
Transportation Research Center Inc.

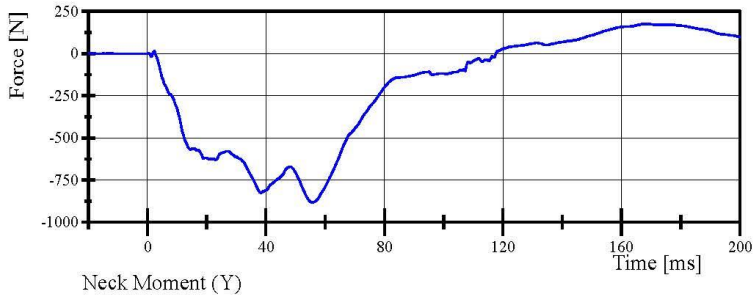
Neck Flexion
HIII 50th Serial No. 037 Certification No. 84-2
Test Date: 4/5/2023

Neck Force (X)



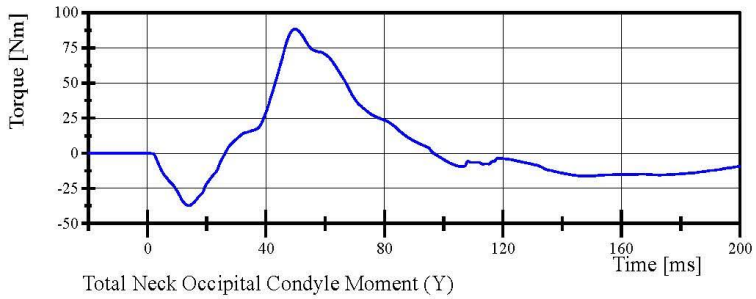
Filter Class: CFC_1000
Max: 176.6 N at 168.5 ms
Min: -883.3 N at 55.8 ms

Neck Force (X) Filtered for Total Neck Occipital Condyle Calculation



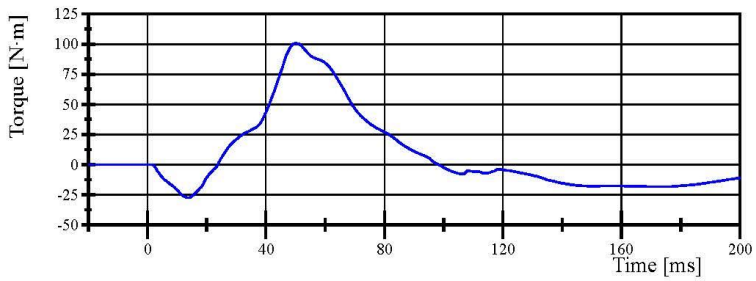
Filter Class: CFC_600
Max: 175.9 N at 168.5 ms
Min: -882.7 N at 55.7 ms

Neck Moment (Y)



Filter Class: CFC_600
Max: 88.3 Nm at 49.8 ms
Min: -37.3 Nm at 14.1 ms

Total Neck Occipital Condyle Moment (Y)



Filter Class: Without_(Constar
Max: 100.8 N·m at 50.1 ms
Min: -27.4 N·m at 13.9 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

04.05.2023 11:15:25 1873

Transportation Research Center Inc.

Neck Extension
HIII 50th Serial No. 037 Certification No. 84-1
Test Date: 4/5/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	20.9 °C	Yes
Relative Humidity	10 - 70 %	68 %	Yes
Pendulum Velocity	(-5.95) - (-6.18) m/s	-5.970 m/s	Yes
Pendulum Acceleration Decay Crossing 5g	38 - 46 ms	38.3 ms	Yes
Pendulum Acceleration at 10ms	17.2 - 21.2 g	19.38 g	Yes
Pendulum Acceleration at 20ms	14.0 - 19.0 g	17.73 g	Yes
Pendulum Acceleration at 30ms	11.0 - 16.0 g	15.50 g	Yes
Pendulum Acceleration > 30ms	<= 22.0 g	15.50 g	Yes
Total Head D-Plane Rotation			
Peak	81 - 106 °	95.1 °	Yes
Time of Peak	72 - 82 ms	77.0 ms	Yes
Total Head D-Plane Rotation Decay to 0°	147 - 174 ms	155.7 ms	Yes
Total Neck Occipital Condyles Moment			
Peak	(-52.9) - (-80) N·m	-68.33 N·m	Yes
Time of Peak	65 - 79 ms	70.2 ms	Yes
Total Neck Occipital Condyles Moment Decay to 0 N·m	120 - 148 ms	141.7 ms	Yes

Test meets specifications.

Condition: Used

Comments:
Neck S/N: 47287

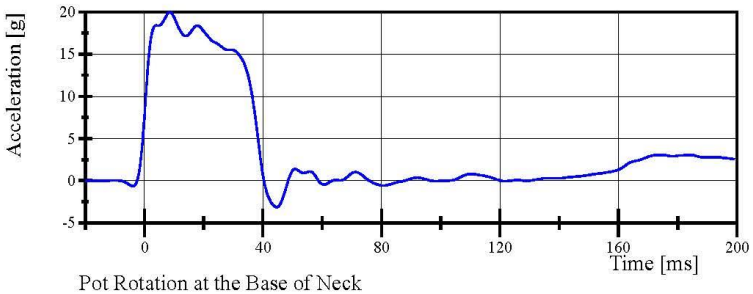
Specification Source: CFR49 Part 572 Subpart E with Polarity in accordance with J211

04.05.2023 11:46:24 2018

Transportation Research Center Inc.

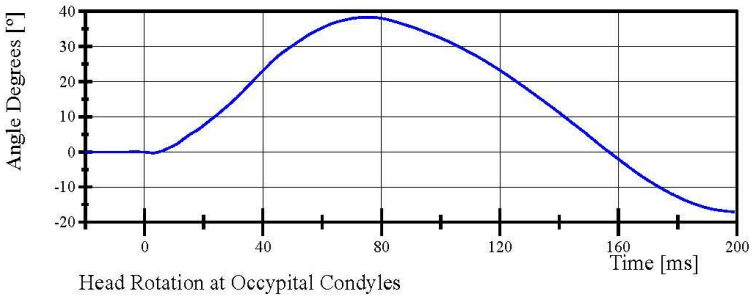
Neck Extension
HIII 50th Serial No. 037 Certification No. 84-1
Test Date: 4/5/2023

Pendulum Acceleration



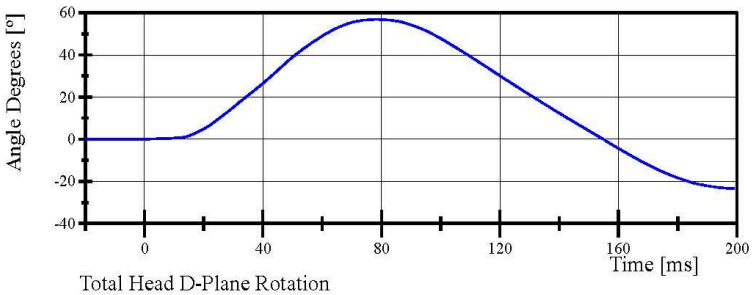
Filter Class: CFC_60
Max: 20.0 g at 8.6 ms
Min: -3.1 g at 44.6 ms

Pot Rotation at the Base of Neck



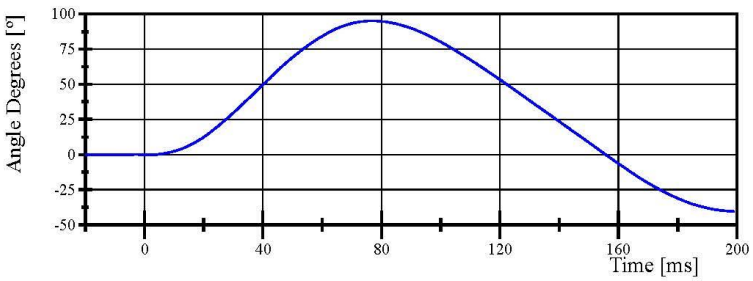
Filter Class: CFC_60
Max: 38.3 ° at 75.5 ms
Min: -17.1 ° at 199.1 ms

Head Rotation at Occypital Condyles



Filter Class: CFC_60
Max: 56.8 ° at 78.4 ms
Min: -23.5 ° at 199.1 ms

Total Head D-Plane Rotation



Filter Class: CFC_60
Max: 95.1 ° at 77.0 ms
Min: -40.6 ° at 199.1 ms

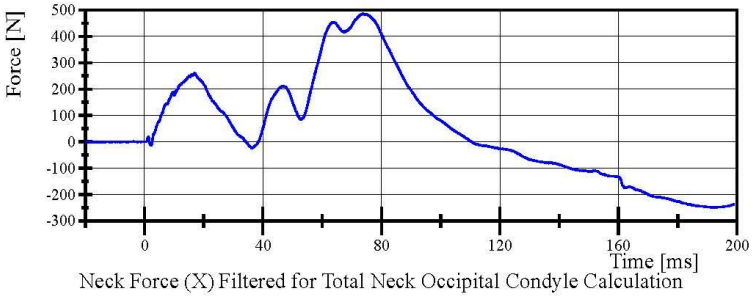
Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

04.05.2023 11:46:46 2018

Transportation Research Center Inc.

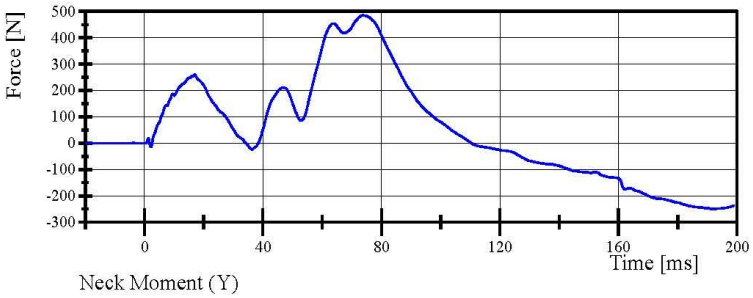
Neck Extension
HIII 50th Serial No. 037 Certification No. 84-1
Test Date: 4/5/2023

Neck Force (X)



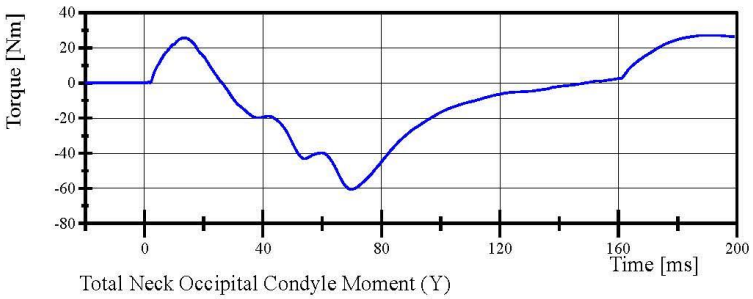
Filter Class: CFC_1000
Max: 485.8 N at 73.8 ms
Min: -249.5 N at 193.1 ms

Neck Force (X) Filtered for Total Neck Occipital Condyle Calculation



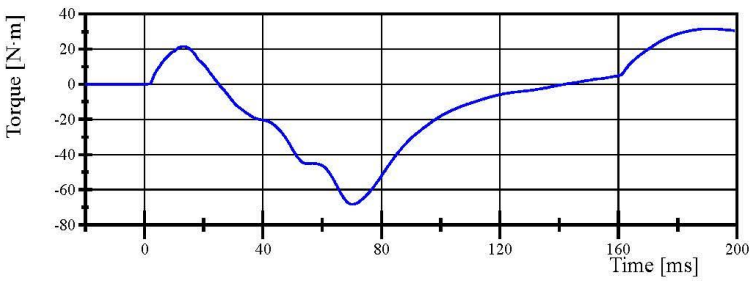
Filter Class: CFC_600
Max: 485.3 N at 73.7 ms
Min: -248.9 N at 191.4 ms

Neck Moment (Y)



Filter Class: CFC_600
Max: 27.2 Nm at 189.5 ms
Min: -60.5 Nm at 69.9 ms

Total Neck Occipital Condyle Moment (Y)



Filter Class: Without_(Constar
Max: 31.5 N·m at 190.1 ms
Min: -68.3 N·m at 70.2 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

04.05.2023 11:46:46 2018

Transportation Research Center Inc.

Front Thorax
HIII 50th Serial No. 037 Certification No. 84-1
Test Date: 4/5/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.4 °C	Yes
Relative Humidity	10 - 70 %	65 %	Yes
Probe Velocity	6.59 - 6.83 m/s	6.601 m/s	Yes
Probe Force Peak	(-5,160) - (-5,894) N	-5,390.1 N	Yes
Maximum Chest Compression	(-63.5) - (-72.6) mm	-68.52 mm	Yes
Internal Hysteresis	69 - 85 %	69.1 %	Yes

Test meets specifications.

Condition: Used

Comments:
Jacket S/N: ER6442
Rib Set S/N: 02033121A

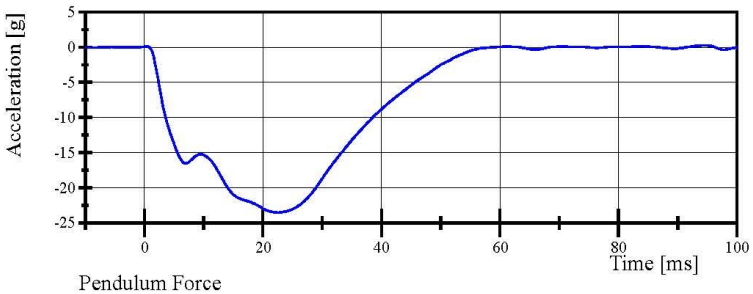
Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

04.05.2023 09:21:22 400

Transportation Research Center Inc.

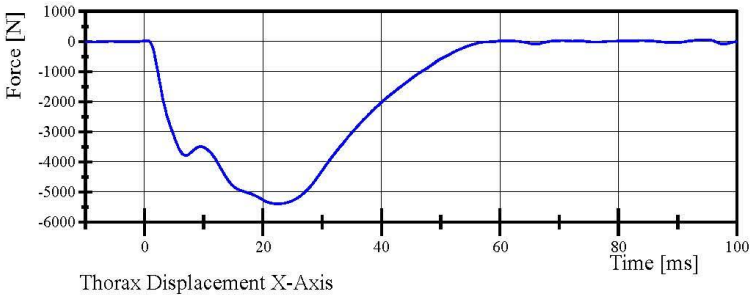
Front Thorax
HIII 50th Serial No. 037 Certification No. 84-1
Test Date: 4/5/2023

Pendulum Acceleration



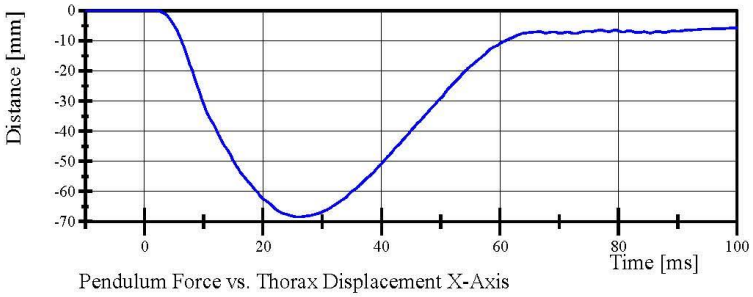
Filter Class: CFC_180
Max: 0.2 g at 94.6 ms
Min: -23.5 g at 22.6 ms

Pendulum Force



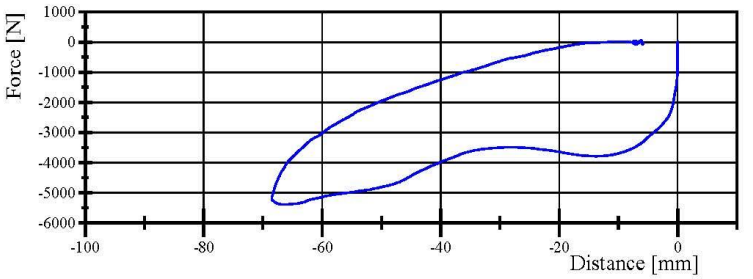
Filter Class: CFC_180
Max: 57.1 N at 94.6 ms
Min: -5,390.1 N at 22.6 ms

Thorax Displacement X-Axis



Filter Class: CFC_600
Max: 0.0 mm at -5.2 ms
Min: -68.5 mm at 26.0 ms

Pendulum Force vs. Thorax Displacement X-Axis



Filter Class: CFC_180
Max: 57.1 N at -6.1 mm
Min: -5,390.1 N at -66.5 mm

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

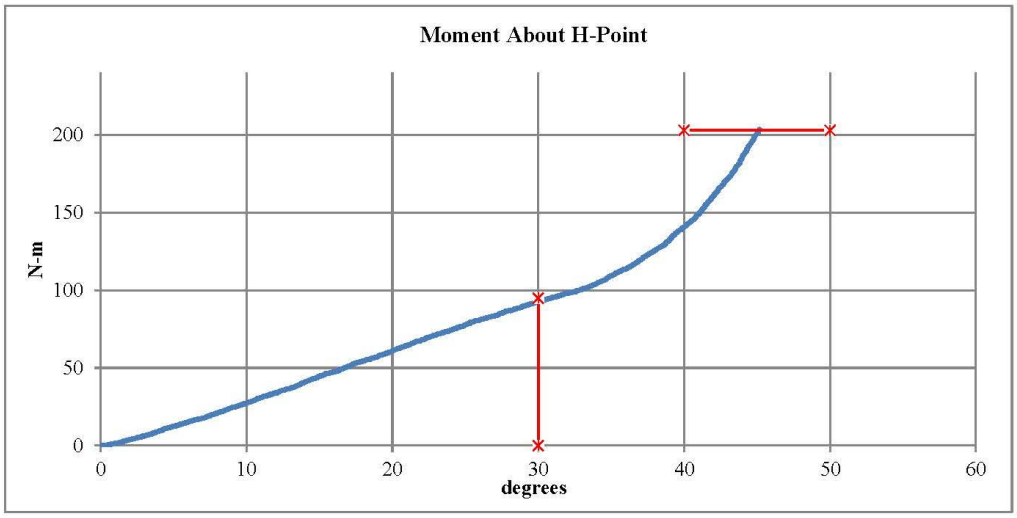
04.05.2023 09:21:49 400

Transportation Research Center Inc.

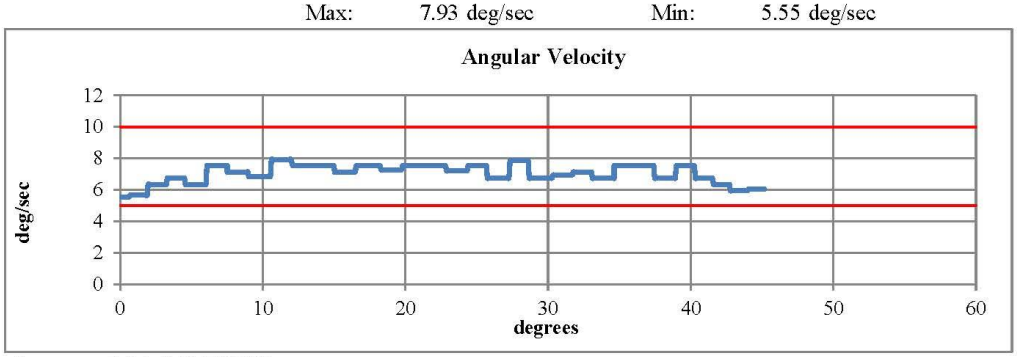
Hybrid III 50th Male Hip Range of Motion

Serial Number:	037	Date:	05-Apr-2023
Side Tested:	Left Hip	Time:	9:45
Test Number:	1		

TEST PARAMETER	SPECIFICATION			TEST RESULTS		
Temperature	18.9	-	25.6	20.9	°C	Pass
Humidity	10	-	70	67	%	Pass
Moment at 30°	0	≤	94.9	92.71	N-m	Pass
Angle at 203 Nm	40	-	50	45.17	deg	Pass
Average Velocity	5	-	10	7.01	deg/sec	Pass



Max: 7.93 deg/sec Min: 5.55 deg/sec



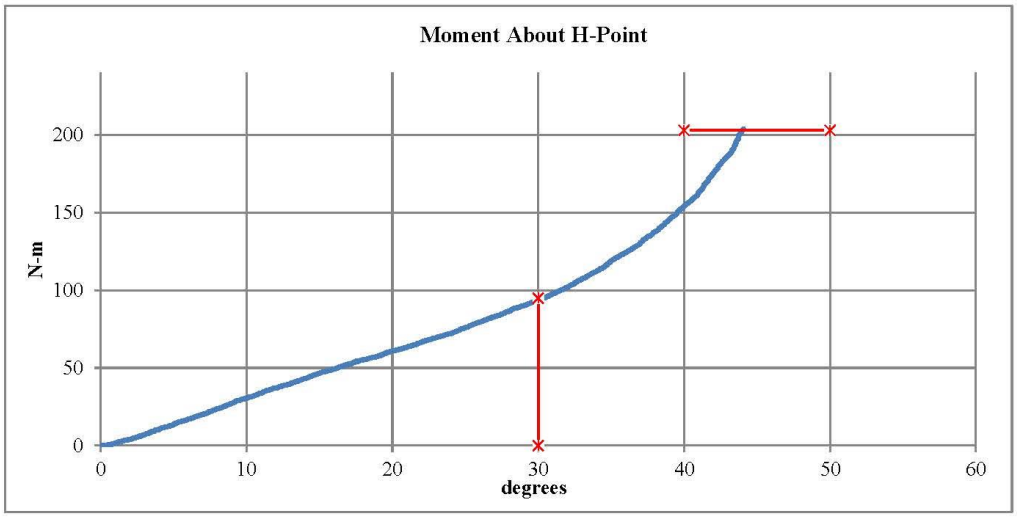
Comments: Pelvis S/N: EU6859

Transportation Research Center Inc.

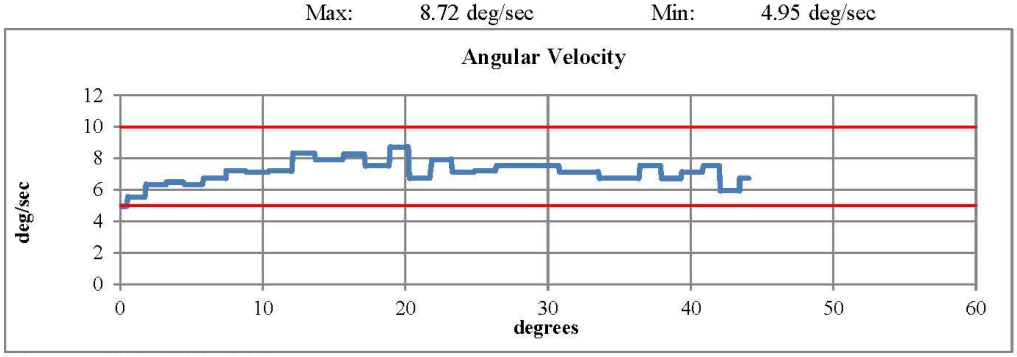
Hybrid III 50th Male Hip Range of Motion

Serial Number:	037	Date:	05-Apr-2023
Side Tested:	Right Hip	Time:	10:26
Test Number:	1		

TEST PARAMETER	SPECIFICATION			TEST RESULTS		
Temperature	18.9	-	25.6	20.8	°C	Pass
Humidity	10	-	70	67	%	Pass
Moment at 30°	0	≤	94.9	93.62	N-m	Pass
Angle at 203 Nm	40	-	50	44.06	deg	Pass
Average Velocity	5	-	10	7.13	deg/sec	Pass



Max: 8.72 deg/sec Min: 4.95 deg/sec



Comments: Pelvis S/N: EU6859

Transportation Research Center Inc.

Left Knee Femur Response Test
HIII 50th Serial No. 037 Certification No. 84-1
Test Date: 4/5/2023

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.5 °C	21.0 °C	Yes
Relative Humidity	10 - 70 %	60 %	Yes
Probe Velocity	2.07 - 2.13 m/s	2.115 m/s	Yes
Peak Femur Force	(-4,715.2) - (-5,782.6) N	-5,453.77 N	Yes

Test meets specifications.

Condition: Used

Comments:
Knee Skin S/N: 2672

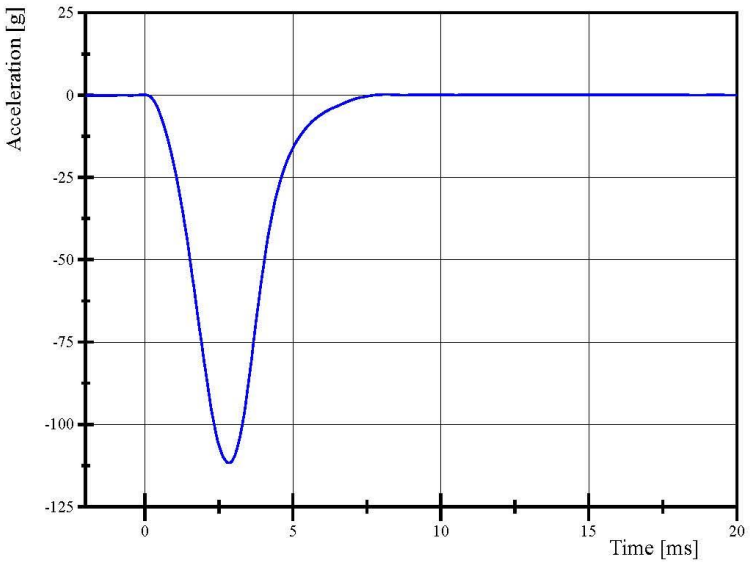
Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

04.05.2023 08:38:44 1851

Transportation Research Center Inc.

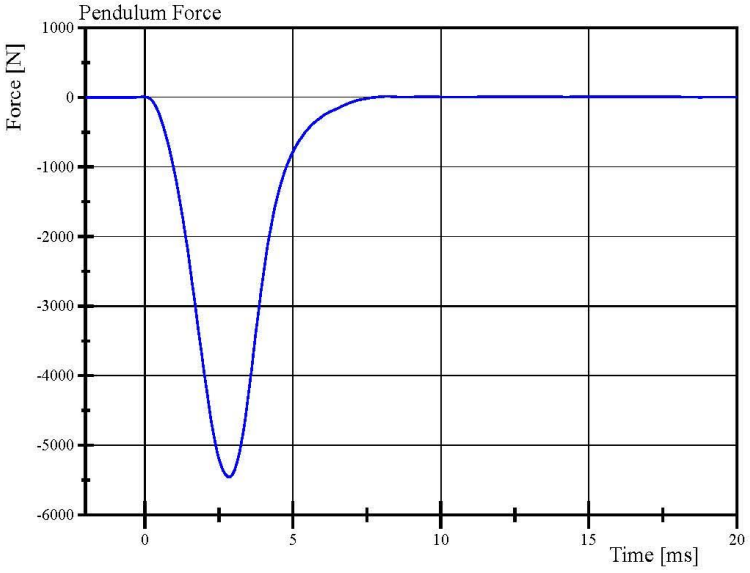
Left Knee Femur Response Test
HIII 50th Serial No. 037 Certification No. 84-1
Test Date: 4/5/2023

Pendulum Acceleration



Filter Class: CFC_600
Max: 0.2 g at 8.2 ms
Min: -111.7 g at 2.9 ms

Pendulum Force



Filter Class: CFC_600
Max: 12.0 N at 8.2 ms
Min: -5,453.8 N at 2.9 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

04.05.2023 08:39:47 1851

Transportation Research Center Inc.

Right Knee Femur Response Test
HIII 50th Serial No. 037 Certification No. 84-1
Test Date: 4/5/2023

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.5 °C	20.8 °C	Yes
Relative Humidity	10 - 70 %	61 %	Yes
Probe Velocity	2.07 - 2.13 m/s	2.114 m/s	Yes
Peak Femur Force	(-4,715.2) - (-5,782.6) N	-5,345.14 N	Yes

Test meets specifications.

Condition: Used

Comments:
Knee Skin S/N: 1248

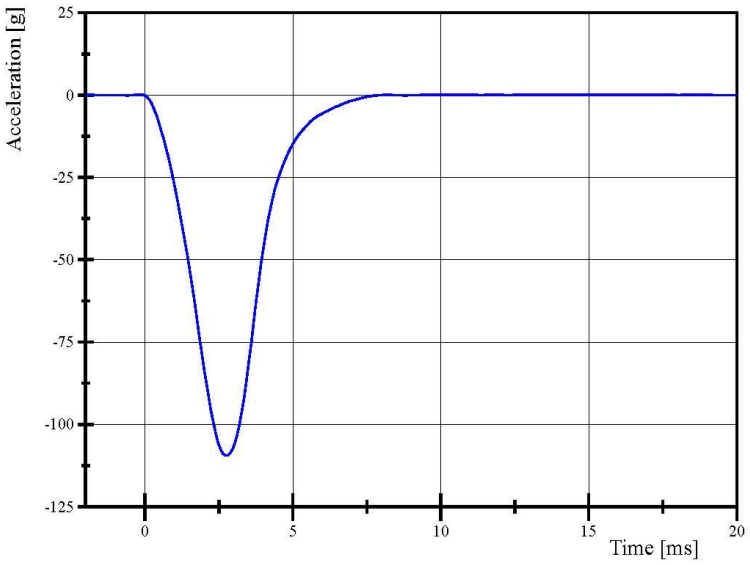
Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

04.05.2023 08:42:20 1848

Transportation Research Center Inc.

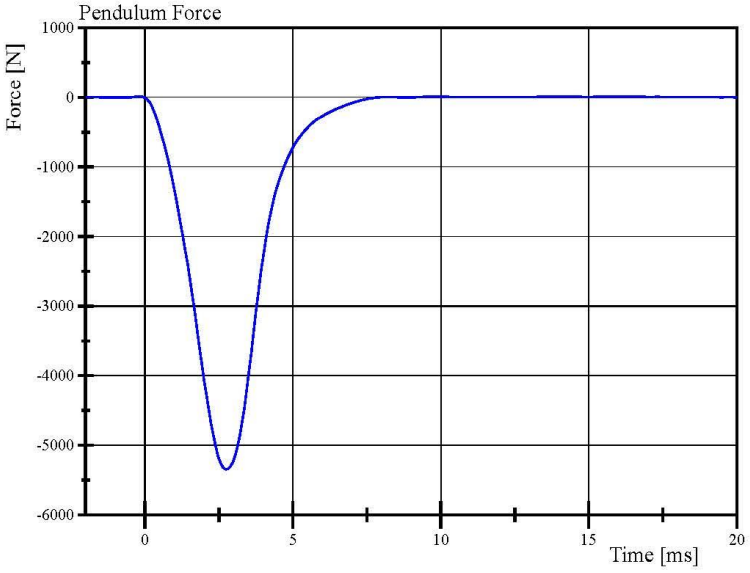
Right Knee Femur Response Test
HIII 50th Serial No. 037 Certification No. 84-1
Test Date: 4/5/2023

Pendulum Acceleration



Filter Class: CFC_600
Max: 0.2 g at -0.2 ms
Min: -109.4 g at 2.7 ms

Pendulum Force



Filter Class: CFC_600
Max: 9.0 N at -0.2 ms
Min: -5,345.1 N at 2.7 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

04.05.2023 08:42:45 1848

Pre-Test Calibration Sheets

Passenger S/N DH1659

Transportation Research Center Inc.
572O HIII 5th Dummy
External Dimensions
Serial No. DH1659 Calibration No. 09

Symbol	Description	Specification	Results	Pass
		mm	mm	
A	Total Sitting Height	774.7 - 800.1	781	Yes
B	Shoulder Pivot Height	431.8 - 457.2	445	Yes
C	Hip Pivot Height	81.3 - 86.3	86	Yes
D	Hip Pivot from Backline	144.8 - 149.8	148	Yes
E	Shoulder Pivot from Backline	68.6 - 83.8	80	Yes
F	Thigh Clearance	119.4 - 134.6	130	Yes
G	Back of Elbow to Wrist Pivot	243.9 - 259.1	249	Yes
H	Head Back to Backline	43.2 - 48.2	45	Yes
I	Shoulder to Elbow Length	276.8 - 297.2	286	Yes
J	Elbow Rest Height	182.8 - 203.2	198	Yes
K	Buttock Knee Length	520.7 - 546.1	533	Yes
L	Popliteal Height	355.6 - 376.0	360	Yes
M	Knee Pivot Height	393.7 - 419.1	409	Yes
N	Buttock Popliteal Length	414.0 - 439.4	430	Yes
O	Chest Depth without Jacket	175.3 - 190.5	185	Yes
P	Foot Length	218.5 - 233.7	225	Yes
R	Buttock to Knee Pivot Length	457.2 - 482.6	473	Yes
S	Head Breadth	137.1 - 147.3	141	Yes
T	Head Depth	177.8 - 188.0	180	Yes
U	Hip Breadth	299.7 - 314.9	305	Yes
V	Shoulder Breadth	350.5 - 365.7	356	Yes
W	Foot Breadth	78.8 - 94.0	85	Yes
X	Head Circumference	528.3 - 548.7	539	Yes
Y	Chest Circumference with Jacket	850.9 - 881.3	869	Yes
Z	Waist Circumference	759.5 - 789.9	776	Yes
AA	Reference Location for Chest Circumference	332.7 - 358.1	345	Yes
BB	Reference Location for Waist Circumference	160.0 - 170.2	165	Yes

Transportation Research Center Inc.

Front Head Drop
HIII 5th Serial No. DH1659 Certification No. 9-1
Test Date: 3/1/2023

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.5 °C	20.9 °C	Yes
Relative Humidity	10 - 70 %	34 %	Yes
Peak Head Resultant Acceleration	250 - 300 g	255.3 g	Yes
Peak Head Lateral Acceleration	(-15) - 15 g	7.7 g	Yes
Is Acceleration Curve Unimodal within 10% of Peak?	< 10 %	4.10 %	Yes

Test meets specifications.

Condition: Used

Comments:
Head Skin S/N: DU2864

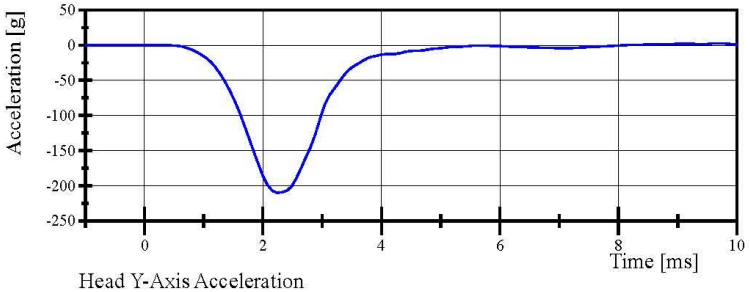
Specification Source: CFR49 Part 572 Subpart O with Polarity in accordance with J211

03.01.2023 15:14:38 608

Transportation Research Center Inc.

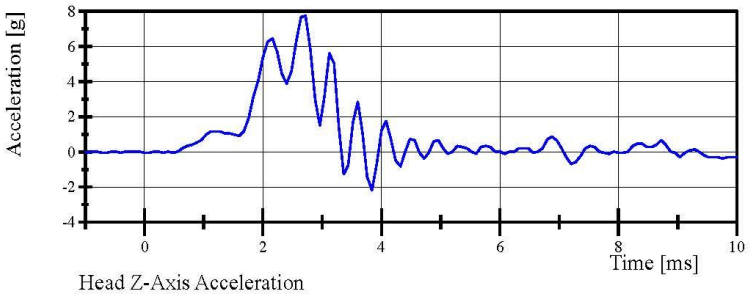
Front Head Drop
HIII 5th Serial No. DH1659 Certification No. 9-1
Test Date: 3/1/2023

Head X-Axis Acceleration



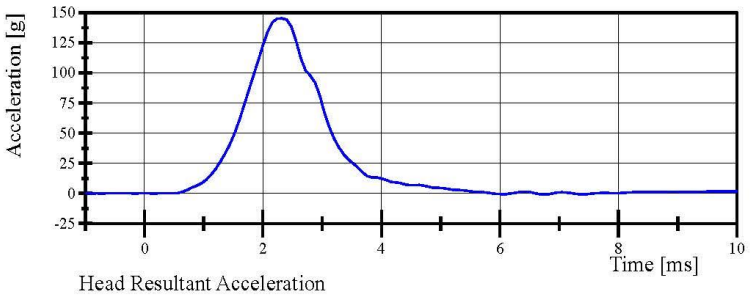
Filter Class: CFC_1000
Max: 2.7 g at 9.7 ms
Min: -210.1 g at 2.2 ms

Head Y-Axis Acceleration



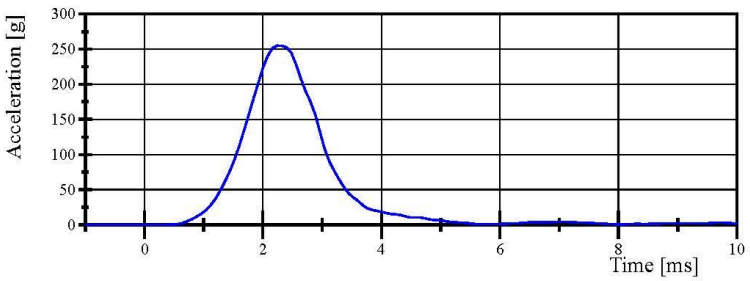
Filter Class: CFC_1000
Max: 7.7 g at 2.7 ms
Min: -2.2 g at 3.8 ms

Head Z-Axis Acceleration



Filter Class: CFC_1000
Max: 145.3 g at 2.3 ms
Min: -0.9 g at 6.7 ms

Head Resultant Acceleration



Filter Class: CFC_1000
Max: 255.3 g at 2.2 ms
Min: 0.0 g at -0.6 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

03.01.2023 15:15:13 608

Transportation Research Center Inc.

Neck Flexion
HIII 5th Serial No. DH1659 Certification No. 9-1
Test Date: 3/1/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	20.9 °C	Yes
Relative Humidity	10 - 70 %	35 %	Yes
Pendulum Velocity	6.89 - 7.13 m/s	7.057 m/s	Yes
Pendulum Integrated Velocity Change at 10ms	(-2.1) - (-2.5) m/s	-2.37 m/s	Yes
Pendulum Integrated Velocity Change at 20ms	(-4.0) - (-5.0) m/s	-4.58 m/s	Yes
Pendulum Integrated Velocity Change at 30ms	(-5.8) - (-7.0) m/s	-6.45 m/s	Yes
Total Head D-Plane Rotation	(-77) - (-91) °	-81.8 °	Yes
Total Neck Occipital Condyles Moment Between -77° and -91° Rotation	69 - 83 N·m	76.2 N·m	Yes
Total Neck Occipital Condyles Moment Decay to 10 N·m	80 - 100 ms	88.6 ms	Yes

Test meets specifications.

Condition: Used

Comments:
Neck S/N: EE9454

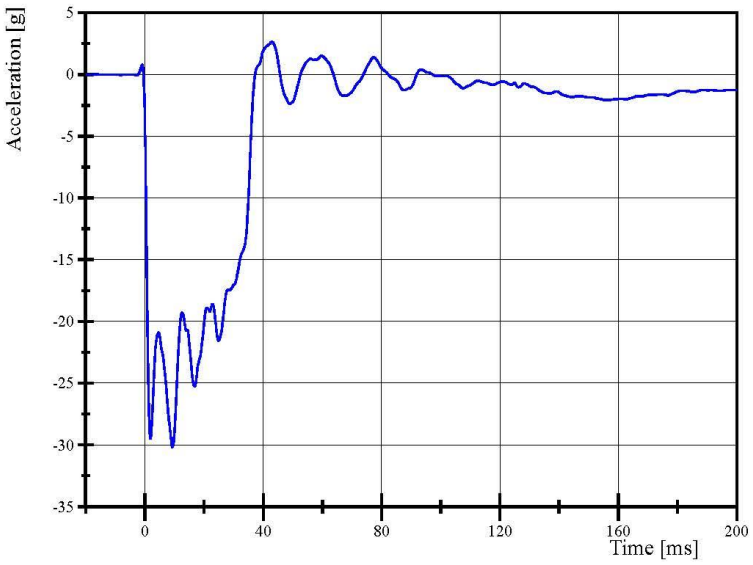
Specification Source: CFR49 Part 572 Subpart O with Polarity in accordance with J211

03.01.2023 15:26:40 1850

Transportation Research Center Inc.

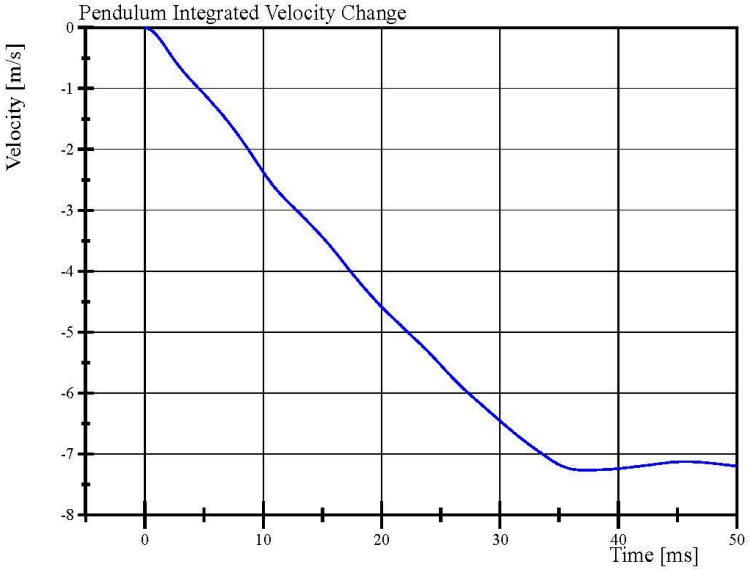
Neck Flexion
HIII 5th Serial No. DH1659 Certification No. 9-1
Test Date: 3/1/2023

Pendulum Acceleration



Filter Class: CFC_180
Max: 2.7 g at 43.0 ms
Min: -30.2 g at 9.3 ms

Pendulum Integrated Velocity Change



Filter Class: CFC_180
Max: 0.0 m/s at 0.0 ms
Min: -7.3 m/s at 37.3 ms

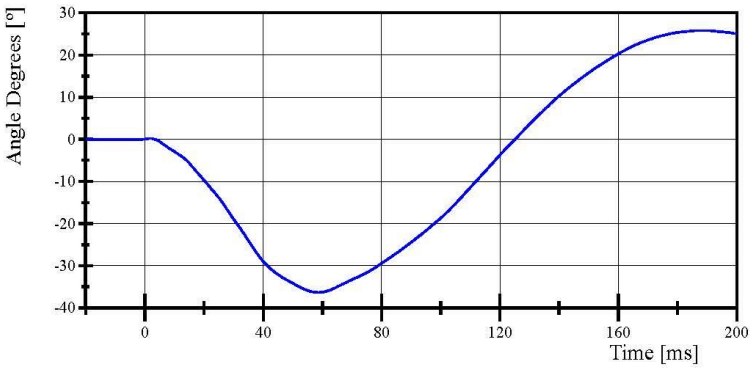
Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

03.01.2023 15:27:10 1850

Transportation Research Center Inc.

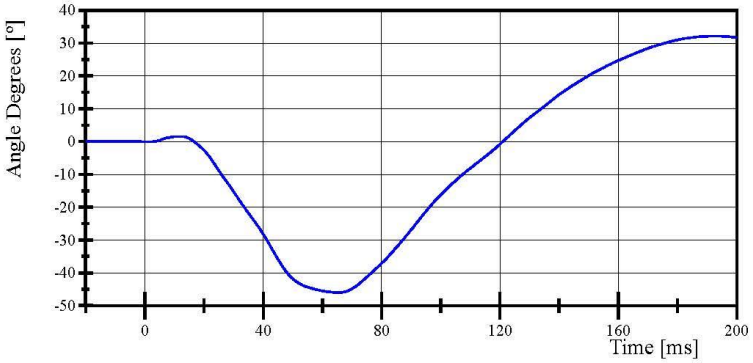
Neck Flexion
HIII 5th Serial No. DH1659 Certification No. 9-1
Test Date: 3/1/2023

Pot Rotation at the Base of Neck



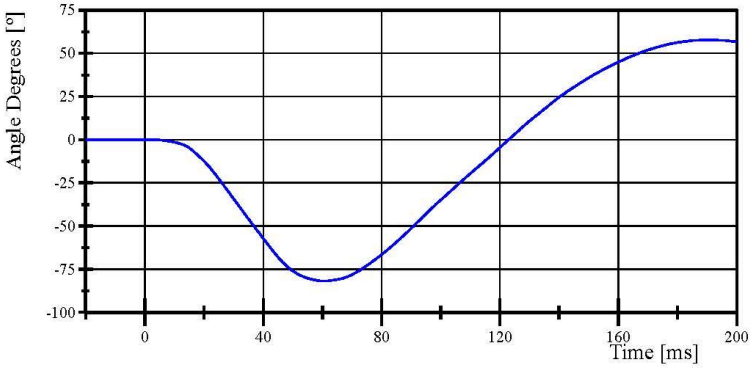
Filter Class: CFC_60
Max: 25.8 ° at 188.6 ms
Min: -36.3 ° at 58.7 ms

Head Rotation at Occypital Condyles



Filter Class: CFC_60
Max: 32.1 ° at 192.9 ms
Min: -46.0 ° at 65.3 ms

Total Head D-Plane Rotation



Filter Class: CFC_60
Max: 57.9 ° at 190.5 ms
Min: -81.8 ° at 60.5 ms

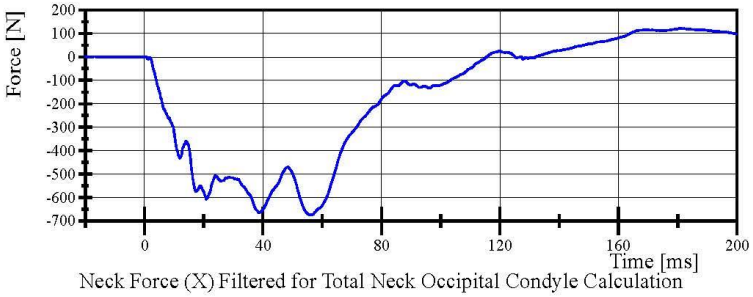
Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

03.01.2023 15:27:11 1850

Transportation Research Center Inc.

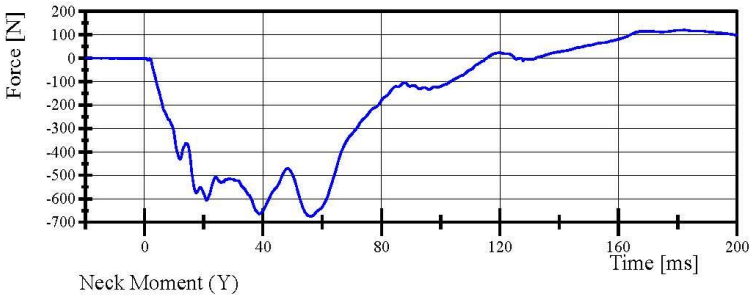
Neck Flexion
HIII 5th Serial No. DH1659 Certification No. 9-1
Test Date: 3/1/2023

Neck Force (X)



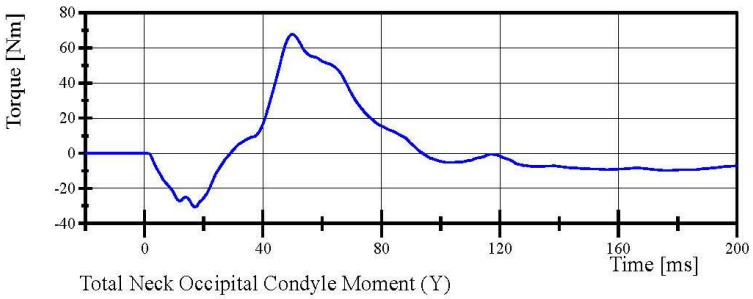
Filter Class: CFC_1000
Max: 121.2 N at 182.0 ms
Min: -674.8 N at 56.2 ms

Neck Force (X) Filtered for Total Neck Occipital Condyle Calculation



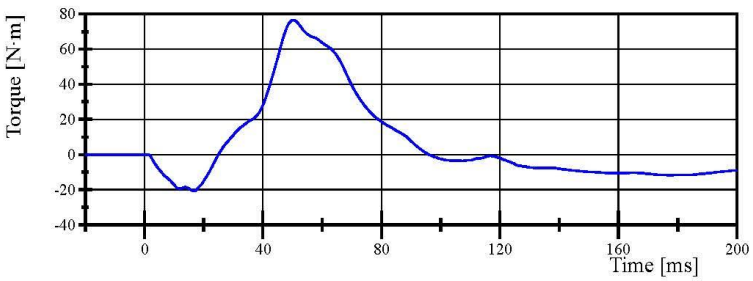
Filter Class: CFC_600
Max: 120.8 N at 182.1 ms
Min: -674.5 N at 56.3 ms

Neck Moment (Y)



Filter Class: CFC_600
Max: 67.6 Nm at 49.9 ms
Min: -30.6 Nm at 17.2 ms

Total Neck Occipital Condyle Moment (Y)



Filter Class: Without_(Constar
Max: 76.5 N·m at 50.2 ms
Min: -20.7 N·m at 16.6 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

03.01.2023 15:27:11 1850

Transportation Research Center Inc.

Neck Extension
HIII 5th Serial No. DH1659 Certification No. 9-1
Test Date: 3/1/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.0 °C	Yes
Relative Humidity	10 - 70 %	35 %	Yes
Pendulum Velocity	(-5.95) - (-6.19) m/s	-6.036 m/s	Yes
Pendulum Integrated Velocity Change at 10ms	1.5 - 1.9 m/s	1.85 m/s	Yes
Pendulum Integrated Velocity Change at 20ms	3.1 - 3.9 m/s	3.67 m/s	Yes
Pendulum Integrated Velocity Change at 30ms	4.6 - 5.6 m/s	5.30 m/s	Yes
Total Head D-Plane Rotation	99 - 114 °	107.5 °	Yes
Total Neck Occipital Condyles Moment Between 99° and 114° Rotation	(-53) - (-65) N·m	-57.0 N·m	Yes
Total Neck Occipital Condyles Moment Decay to -10 N·m	94 - 114 ms	104.0 ms	Yes

Test meets specifications.

Condition: Used

Comments:
Neck S/N: EE9454

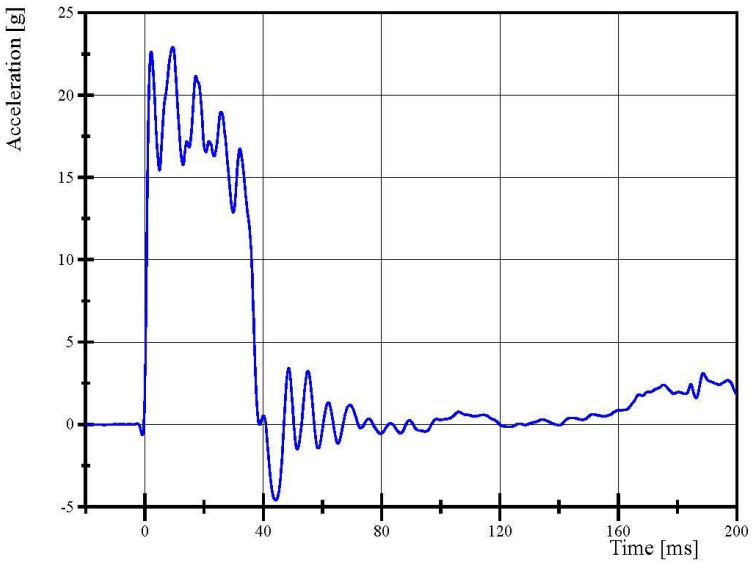
Specification Source: CFR49 Part 572 Subpart O with Polarity in accordance with J211

03.01.2023 15:56:15 2003

Transportation Research Center Inc.

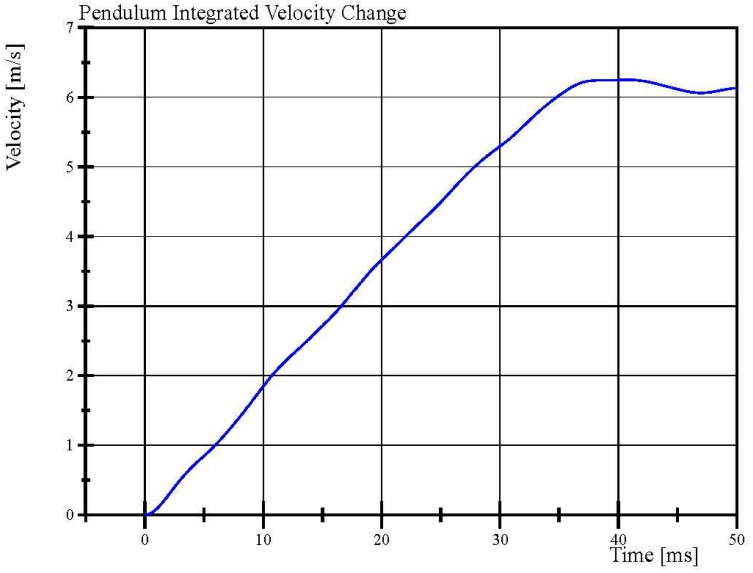
Neck Extension
HIII 5th Serial No. DH1659 Certification No. 9-1
Test Date: 3/1/2023

Pendulum Acceleration



Filter Class: CFC_180
Max: 22.9 g at 9.4 ms
Min: -4.6 g at 44.3 ms

Pendulum Integrated Velocity Change



Filter Class: CFC_180
Max: 6.2 m/s at 40.9 ms
Min: 0.0 m/s at 0.0 ms

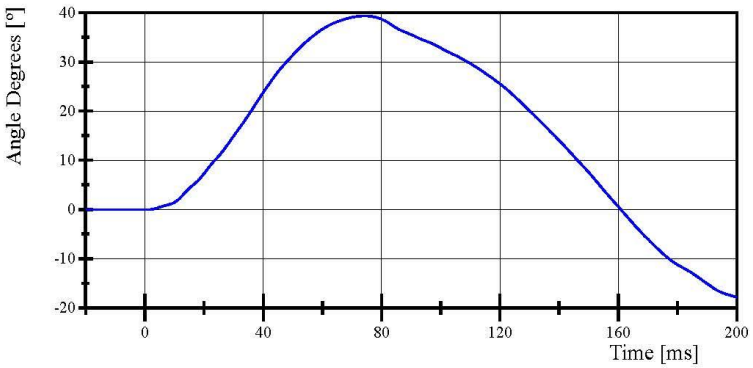
Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

03.01.2023 15:56:36 2003

Transportation Research Center Inc.

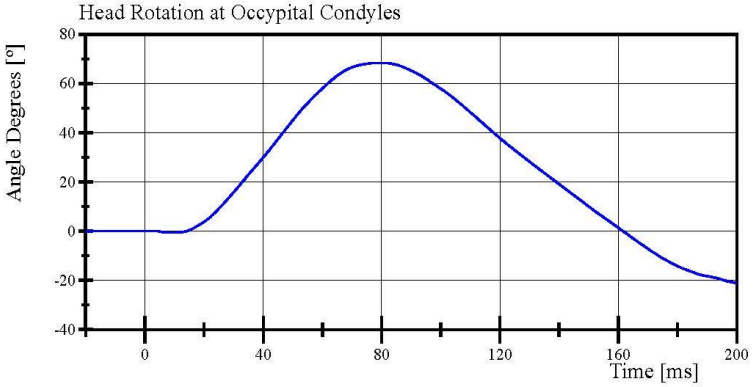
Neck Extension
HIII 5th Serial No. DH1659 Certification No. 9-1
Test Date: 3/1/2023

Pot Rotation at the Base of Neck



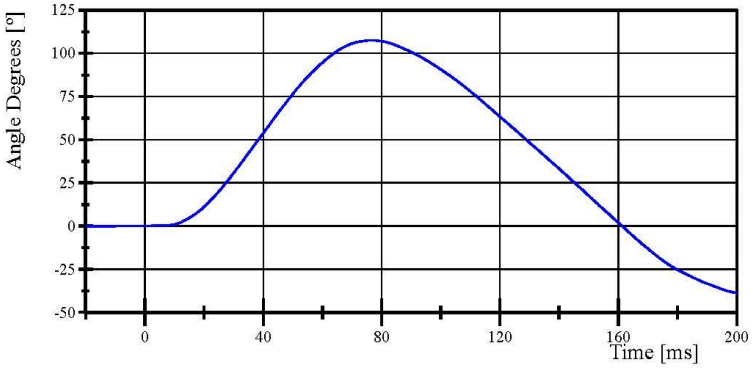
Filter Class: CFC_60
Max: 39.4 ° at 74.2 ms
Min: -17.8 ° at 199.9 ms

Head Rotation at Occypital Condyles



Filter Class: CFC_60
Max: 68.4 ° at 79.5 ms
Min: -21.0 ° at 199.9 ms

Total Head D-Plane Rotation



Filter Class: CFC_60
Max: 107.5 ° at 76.8 ms
Min: -38.8 ° at 199.9 ms

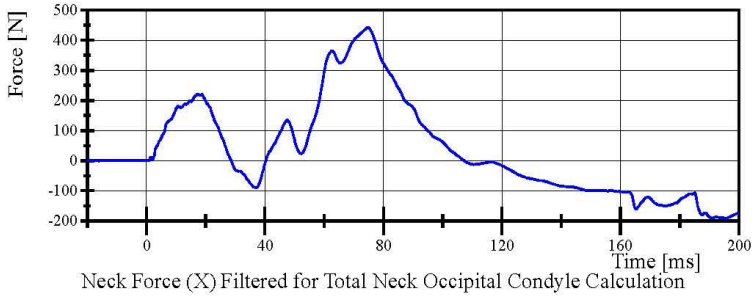
Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

03.01.2023 15:56:36 2003

Transportation Research Center Inc.

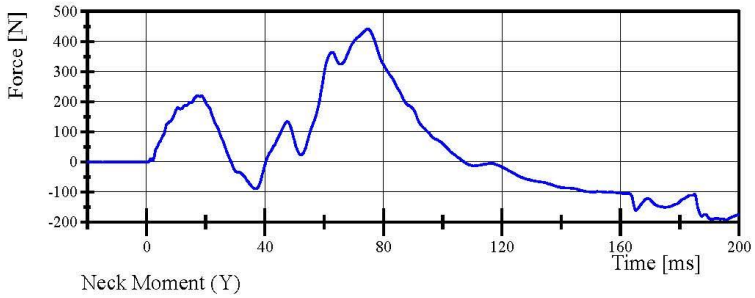
Neck Extension
HIII 5th Serial No. DH1659 Certification No. 9-1
Test Date: 3/1/2023

Neck Force (X)



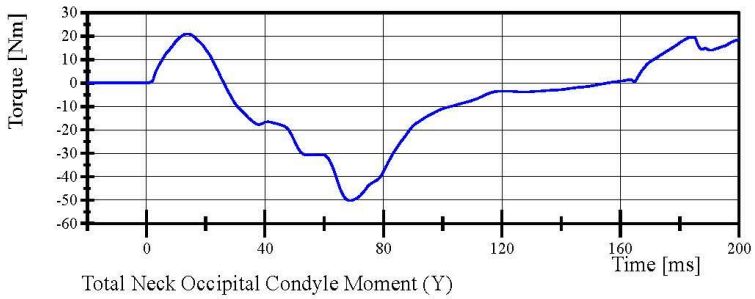
Filter Class: CFC_1000
Max: 441.8 N at 74.5 ms
Min: -192.3 N at 195.7 ms

Neck Force (X) Filtered for Total Neck Occipital Condyle Calculation



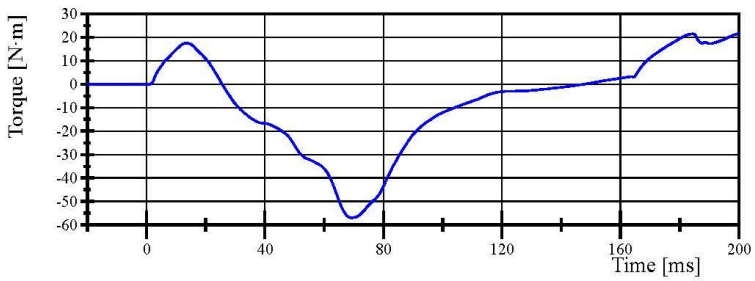
Filter Class: CFC_600
Max: 441.8 N at 74.8 ms
Min: -192.0 N at 195.8 ms

Neck Moment (Y)



Filter Class: CFC_600
Max: 21.0 Nm at 13.9 ms
Min: -50.2 Nm at 68.9 ms

Total Neck Occipital Condyle Moment (Y)



Filter Class: Without_(Constar
Max: 21.7 N·m at 199.9 ms
Min: -57.0 N·m at 69.4 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

03.01.2023 15:56:36 2003

Transportation Research Center Inc.

Front Thorax
HIII 5th Serial No. DH1659 Certification No. 9-1
Test Date: 3/1/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.0 °C	Yes
Relative Humidity	10 - 70 %	36 %	Yes
Probe Velocity	6.59 - 6.83 m/s	6.811 m/s	Yes
Probe Force Peak Between 50.0 mm and 58.0 mm Chest Deflection	(-3,900) - (-4,400) N	-4,198.9 N	Yes
Probe Force Peak Between 18.0 mm and 50.0 mm Chest Deflection	>= (-4,600) N	-4,410.4 N	Yes
Maximum Chest Compression	(-50) - (-58) mm	-50.3 mm	Yes
Internal Hysteresis	69 - 85 %	76.5 %	Yes

Test meets specifications.

Condition: Used

Comments:
Jacket S/N: EE8365
Rib Set S/N: EA4110

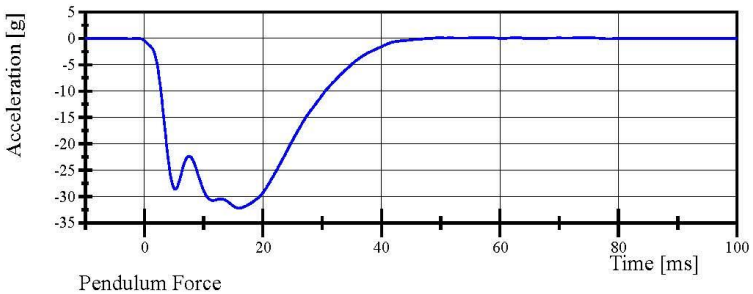
Specification Source: CFR49 Part 572 Subpart O with Polarity in accordance with J211

03.01.2023 14:05:28 423

Transportation Research Center Inc.

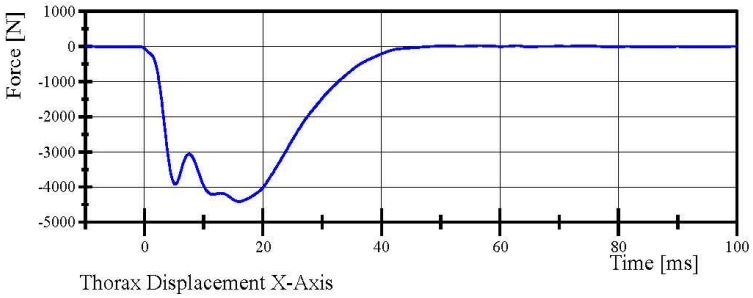
Front Thorax
HIII 5th Serial No. DH1659 Certification No. 9-1
Test Date: 3/1/2023

Pendulum Acceleration



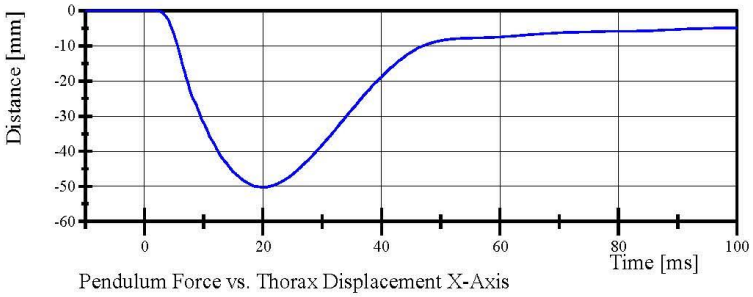
Filter Class: CFC_180
Max: 0.1 g at 63.0 ms
Min: -32.2 g at 15.9 ms

Pendulum Force



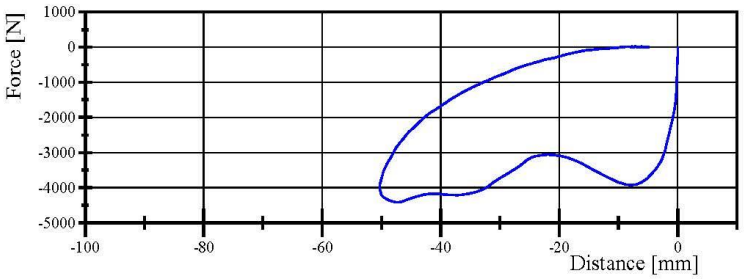
Filter Class: CFC_180
Max: 19.7 N at 63.0 ms
Min: -4,410.4 N at 15.9 ms

Thorax Displacement X-Axis



Filter Class: CFC_600
Max: 0.0 mm at -6.2 ms
Min: -50.3 mm at 20.2 ms

Pendulum Force vs. Thorax Displacement X-Axis



Filter Class: CFC_180
Max: 19.7 N at -7.1 mm
Min: -4,410.4 N at -47.2 mm

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

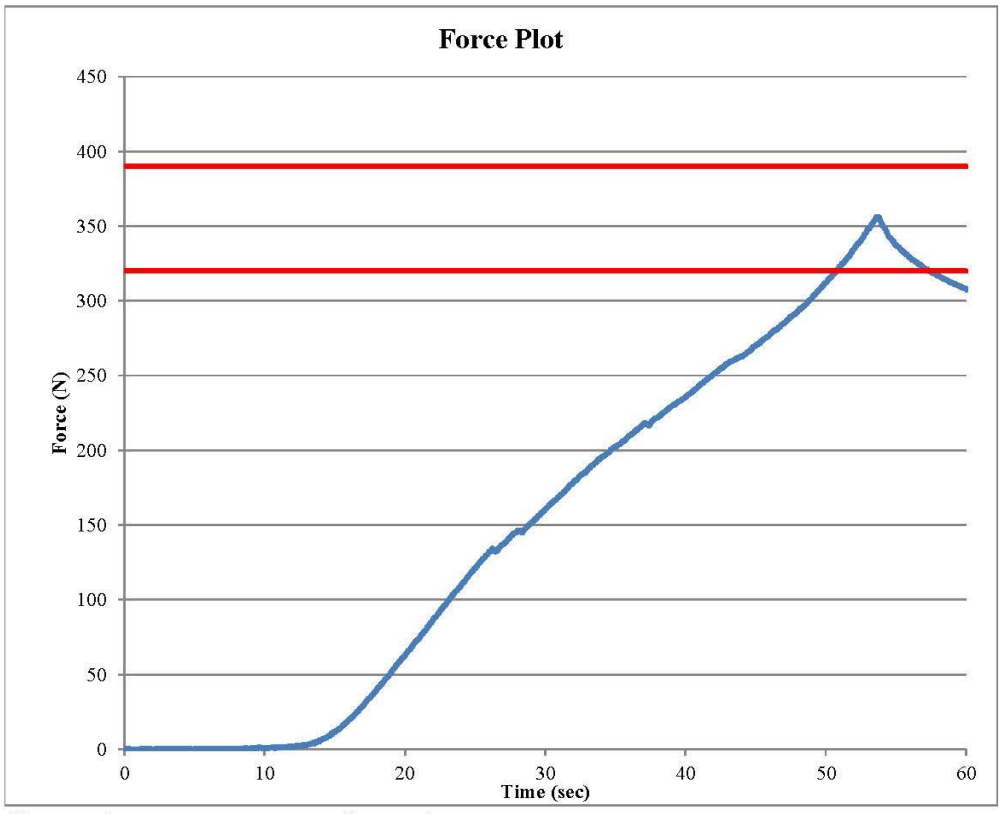
03.01.2023 14:07:01 423

Transportation Research Center Inc.

Hybrid III Small Female Torso Flexion

Customer:	NHTSA		
Serial Number:	DH1659	Date:	3/1/2023
Test Number:	1	Time:	14:30

TEST PARAMETER	SPECIFICATION			TEST RESULTS		
Temperature	18.9	-	25.6	20.9	°C	Pass
Humidity	10	-	70	35	%	Pass
Average Angular Rate	0.5	-	1.5	0.77	deg/sec	Pass
Initial Angle	0	-	20	15.14	deg	Pass
Peak Force at 45.53°	320	-	390	356.24	N	Pass
Final Angle	-8	-	8	3.5	deg	Pass



Components:		Comments:
Jacket S/N:	EE8385	
Abdomen S/N:	EE8393	
Lumbar S/N:	DG9121	

Transportation Research Center Inc.

Left Knee Femur Response Test
HIII 5th Serial No. DH1659 Certification No. 9-1
Test Date: 3/1/2023

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.6 ºC	20.9 ºC	Yes
Relative Humidity	10 - 70 %	35 %	Yes
Probe Velocity	2.07 - 2.13 m/s	2.078 m/s	Yes
Peak Femur Force	(-3,450) - (-4,060) N	-3,985.8 N	Yes

Test meets specifications.

Condition: Used

Comments:
Knee Skin S/N: ED6729

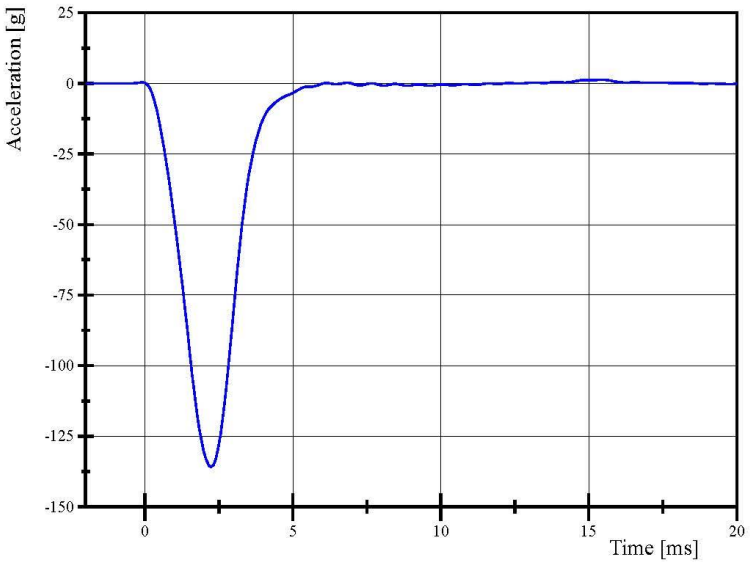
Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

03.01.2023 14:52:49 1876

Transportation Research Center Inc.

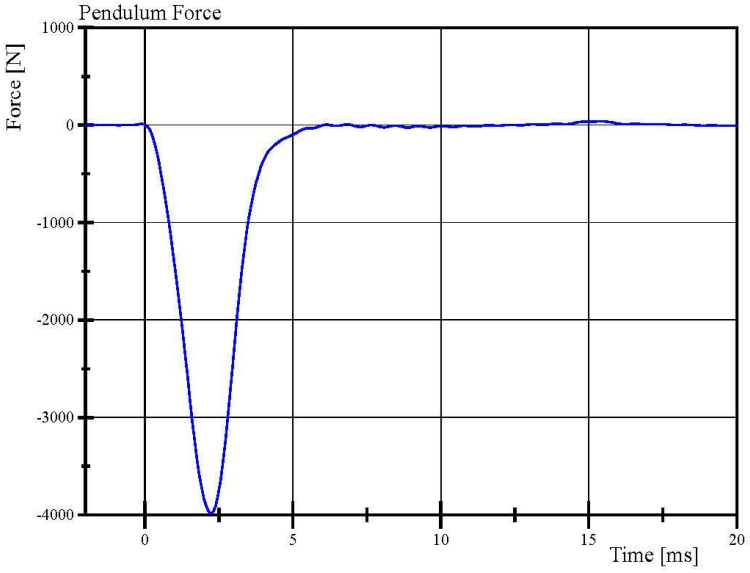
Left Knee Femur Response Test
HIII 5th Serial No. DH1659 Certification No. 9-1
Test Date: 3/1/2023

Pendulum Acceleration



Filter Class: CFC_600
Max: 1.3 g at 15.4 ms
Min: -135.9 g at 2.2 ms

Pendulum Force



Filter Class: CFC_600
Max: 38.2 N at 15.4 ms
Min: -3,985.8 N at 2.2 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

03.01.2023 14:53:48 1876

Transportation Research Center Inc.

Right Knee Femur Response Test
HIII 5th Serial No. DH1659 Certification No. 9-1
Test Date: 3/1/2023

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.6 °C	20.9 °C	Yes
Relative Humidity	10 - 70 %	35 %	Yes
Probe Velocity	2.07 - 2.13 m/s	2.095 m/s	Yes
Peak Femur Force	(-3,450) - (-4,060) N	-4,041.6 N	Yes

Test meets specifications.

Condition: Used

Comments:
Knee Skin S/N: EC5852

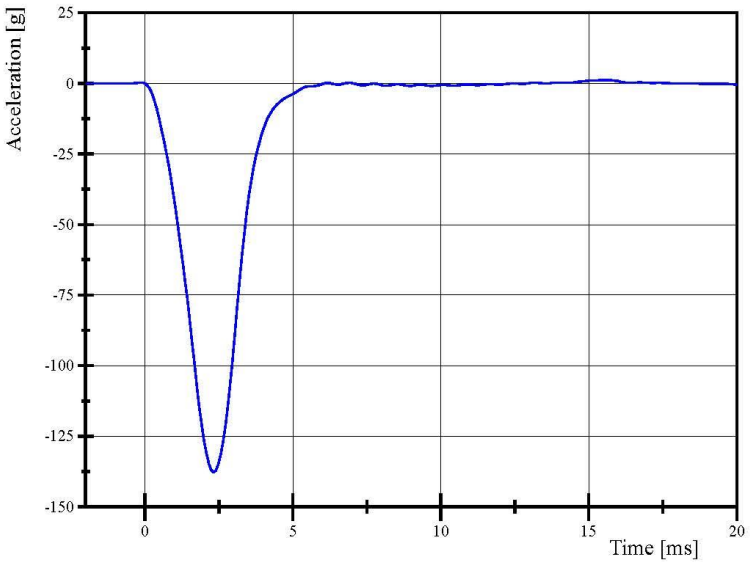
Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

03.01.2023 14:56:56 1864

Transportation Research Center Inc.

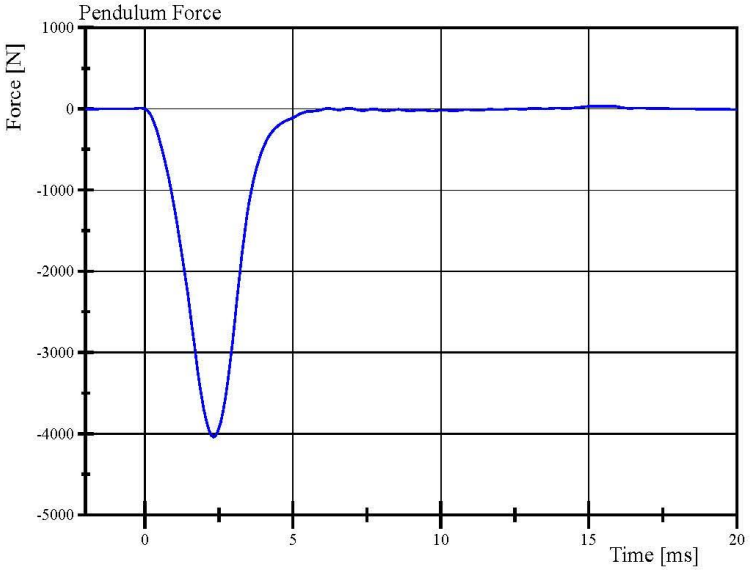
Right Knee Femur Response Test
HIII 5th Serial No. DH1659 Certification No. 9-1
Test Date: 3/1/2023

Pendulum Acceleration



Filter Class: CFC_600
Max: 1.1 g at 15.7 ms
Min: -137.8 g at 2.3 ms

Pendulum Force



Filter Class: CFC_600
Max: 33.5 N at 15.7 ms
Min: -4,041.6 N at 2.3 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

03.01.2023 14:57:59 1864

Post-Test Calibration Sheets

Passenger S/N DH1659

Transportation Research Center Inc.
572O HIII 5th Dummy
External Dimensions
Serial No. DH1659 Calibration No. 10

Symbol	Description	Specification	Results	Pass
		mm	mm	
A	Total Sitting Height	774.7 - 800.1	781	Yes
B	Shoulder Pivot Height	431.8 - 457.2	445	Yes
C	Hip Pivot Height	81.3 - 86.3	86	Yes
D	Hip Pivot from Backline	144.8 - 149.8	148	Yes
E	Shoulder Pivot from Backline	68.6 - 83.8	80	Yes
F	Thigh Clearance	119.4 - 134.6	130	Yes
G	Back of Elbow to Wrist Pivot	243.9 - 259.1	249	Yes
H	Head Back to Backline	43.2 - 48.2	45	Yes
I	Shoulder to Elbow Length	276.8 - 297.2	286	Yes
J	Elbow Rest Height	182.8 - 203.2	198	Yes
K	Buttock Knee Length	520.7 - 546.1	533	Yes
L	Popliteal Height	355.6 - 376.0	360	Yes
M	Knee Pivot Height	393.7 - 419.1	409	Yes
N	Buttock Popliteal Length	414.0 - 439.4	430	Yes
O	Chest Depth without Jacket	175.3 - 190.5	185	Yes
P	Foot Length	218.5 - 233.7	225	Yes
R	Buttock to Knee Pivot Length	457.2 - 482.6	473	Yes
S	Head Breadth	137.1 - 147.3	141	Yes
T	Head Depth	177.8 - 188.0	180	Yes
U	Hip Breadth	299.7 - 314.9	305	Yes
V	Shoulder Breadth	350.5 - 365.7	356	Yes
W	Foot Breadth	78.8 - 94.0	85	Yes
X	Head Circumference	528.3 - 548.7	539	Yes
Y	Chest Circumference with Jacket	850.9 - 881.3	869	Yes
Z	Waist Circumference	759.5 - 789.9	776	Yes
AA	Reference Location for Chest Circumference	332.7 - 358.1	345	Yes
BB	Reference Location for Waist Circumference	160.0 - 170.2	165	Yes

Transportation Research Center Inc.

Front Head Drop
HIII 5th Serial No. DH1659 Certification No. 10-1
Test Date: 4/5/2023

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.5 °C	21.0 °C	Yes
Relative Humidity	10 - 70 %	67 %	Yes
Peak Head Resultant Acceleration	250 - 300 g	266.9 g	Yes
Peak Head Lateral Acceleration	(-15) - 15 g	-5.3 g	Yes
Is Acceleration Curve Unimodal within 10% of Peak?	< 10 %	1.68 %	Yes

Test meets specifications.

Condition: Used

Comments:
Head Skin S/N: DU2864

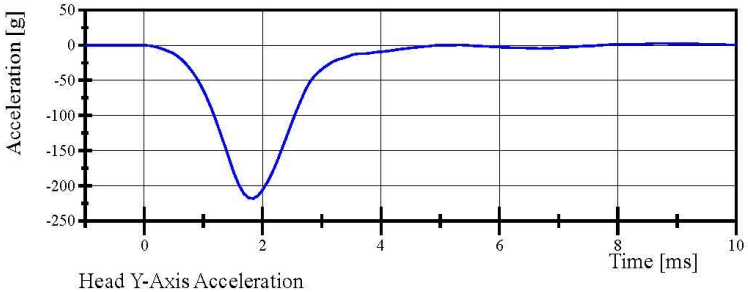
Specification Source: CFR49 Part 572 Subpart O with Polarity in accordance with J211

04.05.2023 14:22:26 614

Transportation Research Center Inc.

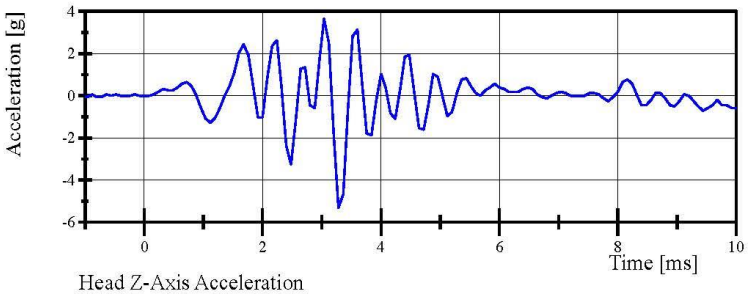
Front Head Drop
HIII 5th Serial No. DH1659 Certification No. 10-1
Test Date: 4/5/2023

Head X-Axis Acceleration



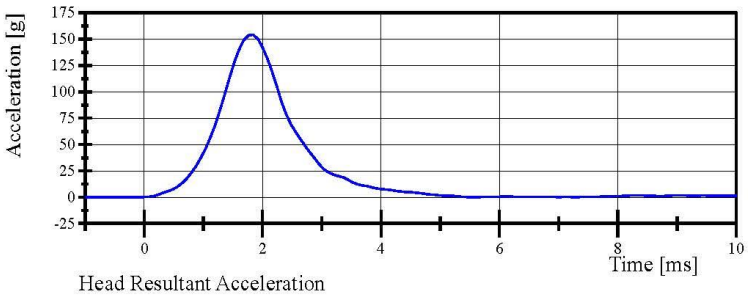
Filter Class: CFC_1000
Max: 2.7 g at 8.7 ms
Min: -218.0 g at 1.8 ms

Head Y-Axis Acceleration



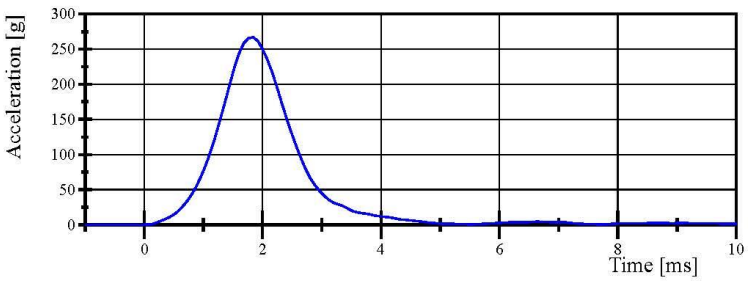
Filter Class: CFC_1000
Max: 3.6 g at 3.0 ms
Min: -5.3 g at 3.3 ms

Head Z-Axis Acceleration



Filter Class: CFC_1000
Max: 154.0 g at 1.8 ms
Min: -0.1 g at -0.7 ms

Head Resultant Acceleration



Filter Class: CFC_1000
Max: 266.9 g at 1.8 ms
Min: 0.0 g at -0.4 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

04.05.2023 14:22:51 614

Transportation Research Center Inc.

Neck Flexion
HIII 5th Serial No. DH1659 Certification No. 10-1
Test Date: 4/5/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	20.8 °C	Yes
Relative Humidity	10 - 70 %	66 %	Yes
Pendulum Velocity	6.89 - 7.13 m/s	7.049 m/s	Yes
Pendulum Integrated Velocity Change at 10ms	(-2.1) - (-2.5) m/s	-2.44 m/s	Yes
Pendulum Integrated Velocity Change at 20ms	(-4.0) - (-5.0) m/s	-4.81 m/s	Yes
Pendulum Integrated Velocity Change at 30ms	(-5.8) - (-7.0) m/s	-6.86 m/s	Yes
Total Head D-Plane Rotation	(-77) - (-91) °	-84.5 °	Yes
Total Neck Occipital Condyles Moment Between -77° and -91° Rotation	69 - 83 N·m	76.1 N·m	Yes
Total Neck Occipital Condyles Moment Decay to 10 N·m	80 - 100 ms	86.9 ms	Yes

Test meets specifications.

Condition: Used

Comments:
Neck S/N: EE9454

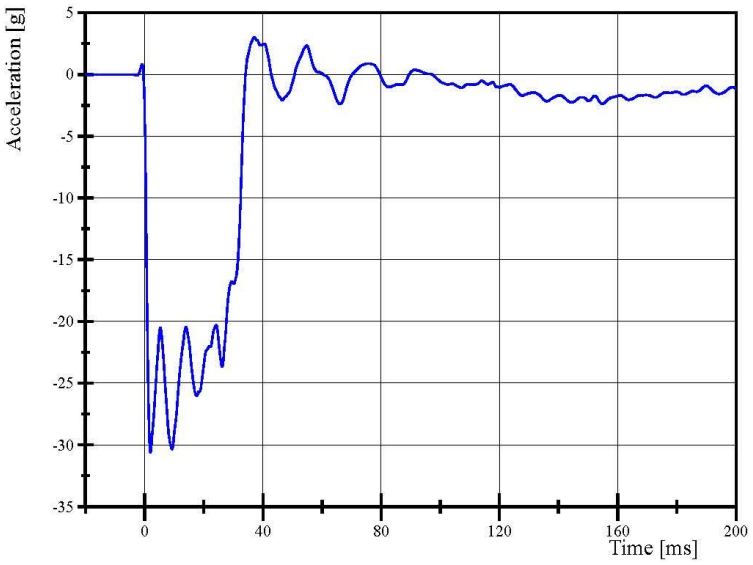
Specification Source: CFR49 Part 572 Subpart O with Polarity in accordance with J211

04.05.2023 14:51:35 1852

Transportation Research Center Inc.

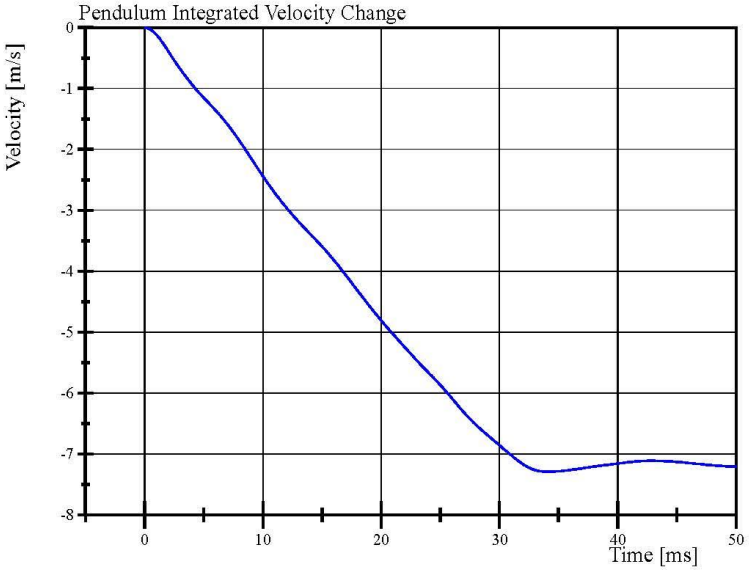
Neck Flexion
HIII 5th Serial No. DH1659 Certification No. 10-1
Test Date: 4/5/2023

Pendulum Acceleration



Filter Class: CFC_180
Max: 3.0 g at 37.1 ms
Min: -30.6 g at 2.0 ms

Pendulum Integrated Velocity Change



Filter Class: CFC_180
Max: 0.0 m/s at 0.0 ms
Min: -7.3 m/s at 34.2 ms

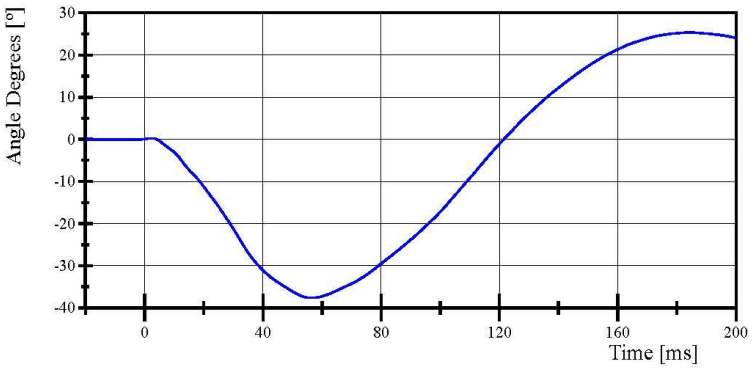
Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

04.05.2023 14:52:01 1852

Transportation Research Center Inc.

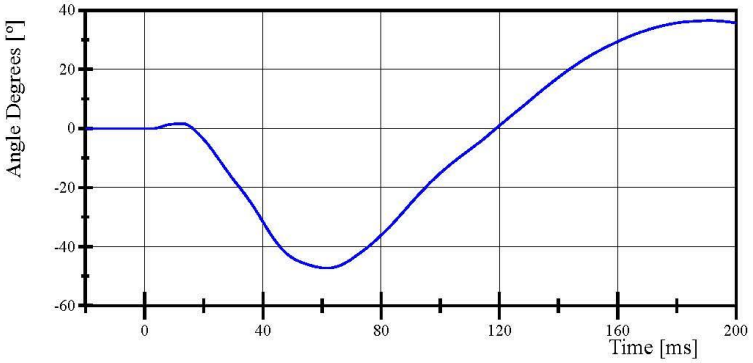
Neck Flexion
HIII 5th Serial No. DH1659 Certification No. 10-1
Test Date: 4/5/2023

Pot Rotation at the Base of Neck



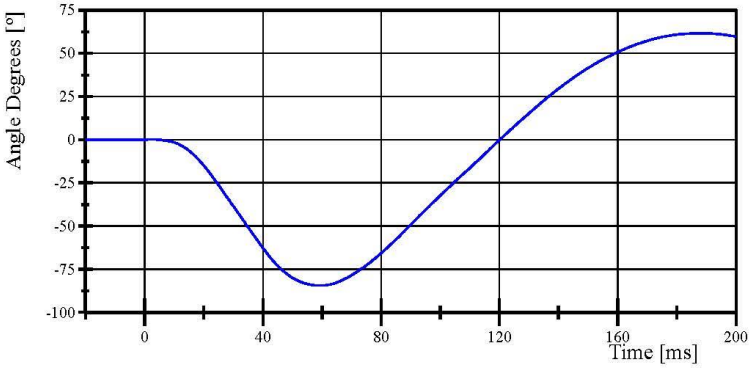
Filter Class: CFC_60
Max: 25.3 ° at 184.4 ms
Min: -37.6 ° at 56.5 ms

Head Rotation at Occypital Condyles



Filter Class: CFC_60
Max: 36.6 ° at 191.1 ms
Min: -47.3 ° at 61.6 ms

Total Head D-Plane Rotation



Filter Class: CFC_60
Max: 61.6 ° at 189.0 ms
Min: -84.5 ° at 59.2 ms

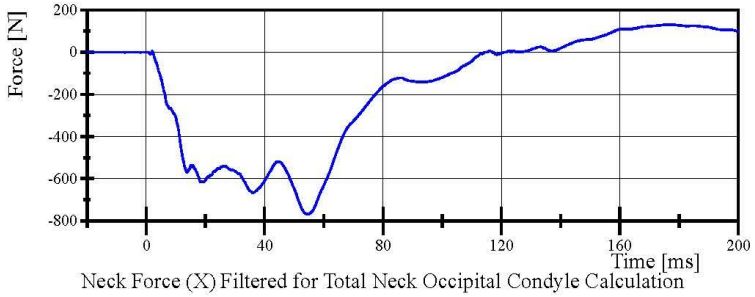
Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

04.05.2023 14:52:01 1852

Transportation Research Center Inc.

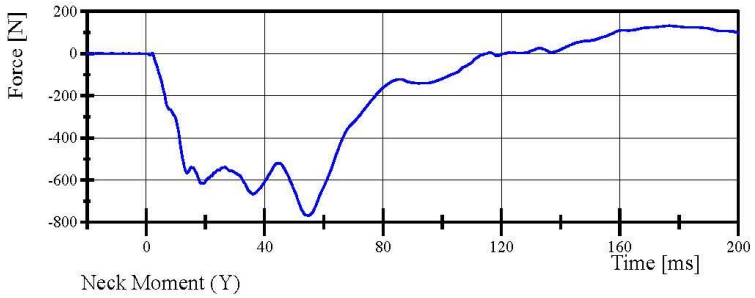
Neck Flexion
HIII 5th Serial No. DH1659 Certification No. 10-1
Test Date: 4/5/2023

Neck Force (X)



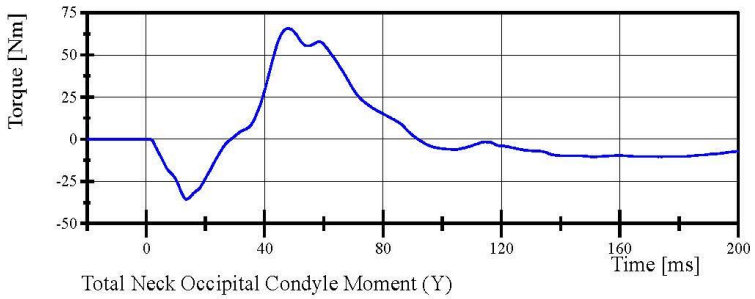
Filter Class: CFC_1000
Max: 132.0 N at 176.6 ms
Min: -768.3 N at 54.6 ms

Neck Force (X) Filtered for Total Neck Occipital Condyle Calculation



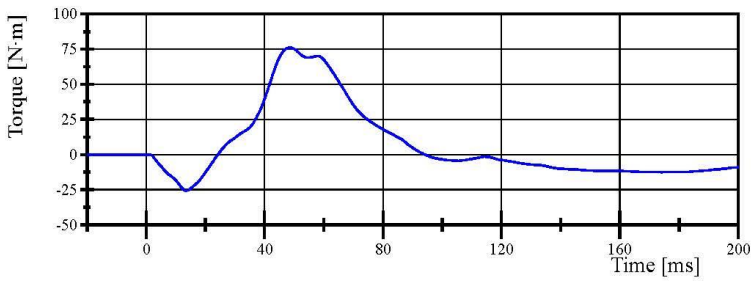
Filter Class: CFC_600
Max: 131.8 N at 176.6 ms
Min: -768.0 N at 54.8 ms

Neck Moment (Y)



Filter Class: CFC_600
Max: 65.7 Nm at 48.0 ms
Min: -35.7 Nm at 13.6 ms

Total Neck Occipital Condyle Moment (Y)



Filter Class: Without_(Constar
Max: 76.1 N·m at 48.5 ms
Min: -25.7 N·m at 13.5 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

04.05.2023 14:52:02 1852

Transportation Research Center Inc.

Neck Extension
HIII 5th Serial No. DH1659 Certification No. 10-1
Test Date: 4/5/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	20.8 °C	Yes
Relative Humidity	10 - 70 %	67 %	Yes
Pendulum Velocity	(-5.95) - (-6.19) m/s	-6.029 m/s	Yes
Pendulum Integrated Velocity Change at 10ms	1.5 - 1.9 m/s	1.82 m/s	Yes
Pendulum Integrated Velocity Change at 20ms	3.1 - 3.9 m/s	3.56 m/s	Yes
Pendulum Integrated Velocity Change at 30ms	4.6 - 5.6 m/s	5.27 m/s	Yes
Total Head D-Plane Rotation	99 - 114 °	109.5 °	Yes
Total Neck Occipital Condyles Moment Between 99° and 114° Rotation	(-53) - (-65) N·m	-57.1 N·m	Yes
Total Neck Occipital Condyles Moment Decay to -10 N·m	94 - 114 ms	103.7 ms	Yes

Test meets specifications.

Condition: Used

Comments:
Neck S/N: EE9454

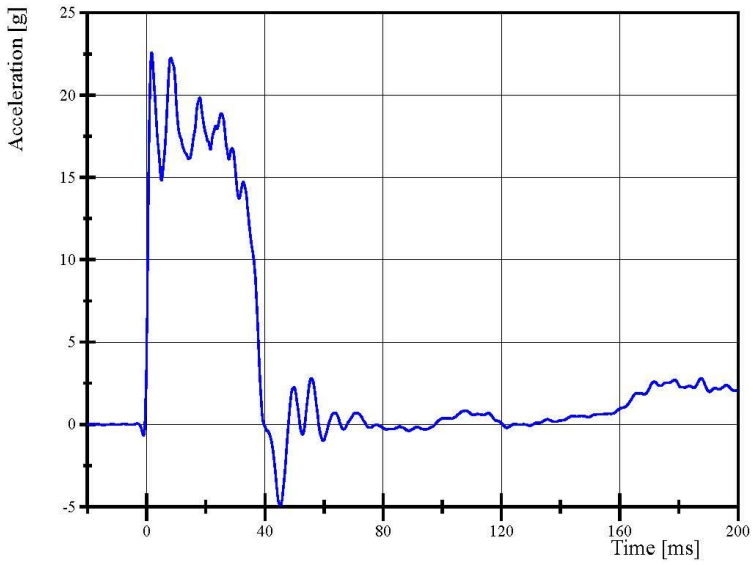
Specification Source: CFR49 Part 572 Subpart O with Polarity in accordance with J211

04.05.2023 15:24:34 2008

Transportation Research Center Inc.

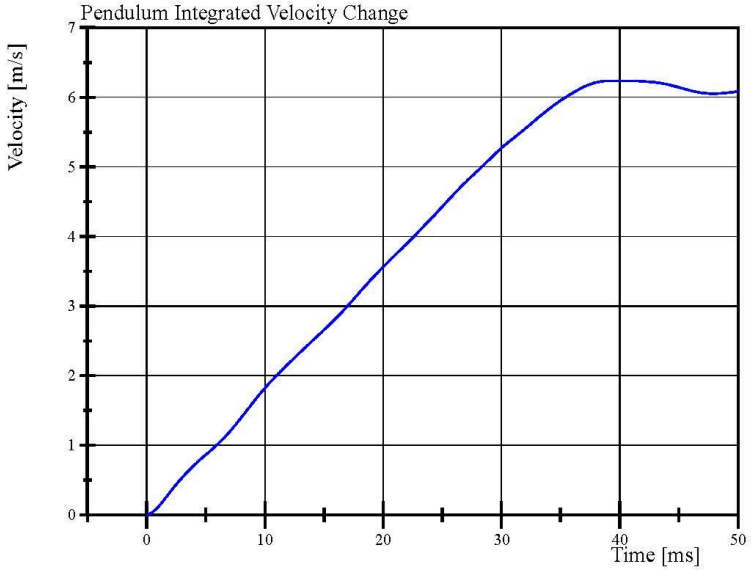
Neck Extension
HIII 5th Serial No. DH1659 Certification No. 10-1
Test Date: 4/5/2023

Pendulum Acceleration



Filter Class: CFC_180
Max: 22.6 g at 1.7 ms
Min: -4.9 g at 45.3 ms

Pendulum Integrated Velocity Change



Filter Class: CFC_180
Max: 6.2 m/s at 39.7 ms
Min: 0.0 m/s at 0.0 ms

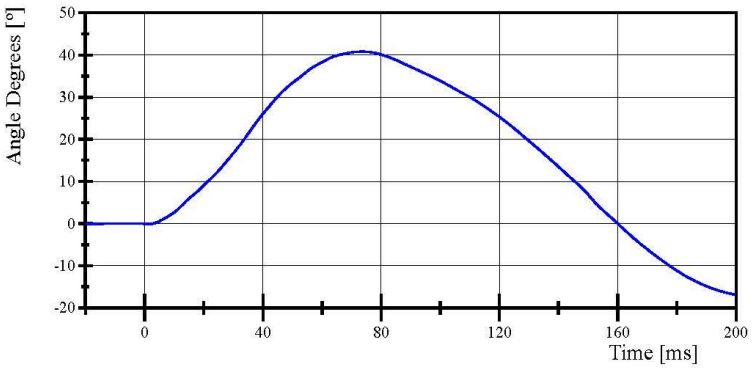
Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

04.05.2023 15:24:58 2008

Transportation Research Center Inc.

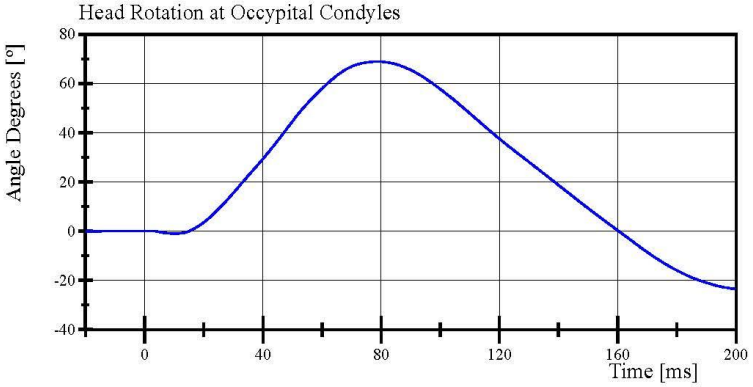
Neck Extension
HIII 5th Serial No. DH1659 Certification No. 10-1
Test Date: 4/5/2023

Pot Rotation at the Base of Neck



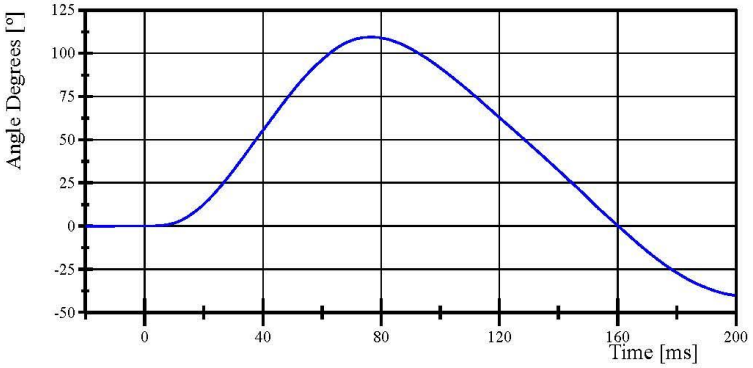
Filter Class: CFC_60
Max: 40.8 ° at 73.6 ms
Min: -16.8 ° at 199.6 ms

Head Rotation at Occypital Condyles



Filter Class: CFC_60
Max: 68.9 ° at 78.8 ms
Min: -23.5 ° at 199.6 ms

Total Head D-Plane Rotation



Filter Class: CFC_60
Max: 109.5 ° at 76.7 ms
Min: -40.3 ° at 199.6 ms

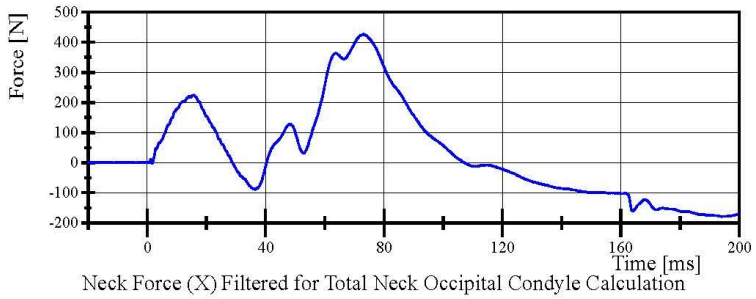
Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

04.05.2023 15:24:58 2008

Transportation Research Center Inc.

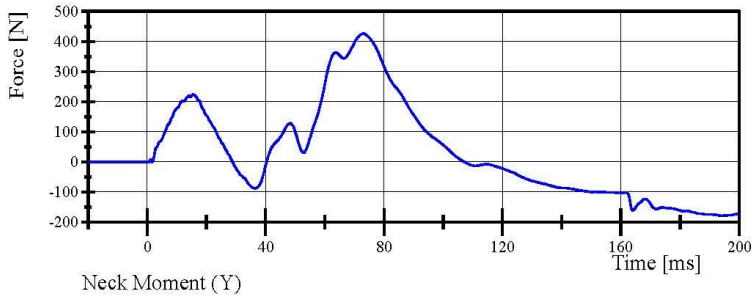
Neck Extension
HIII 5th Serial No. DH1659 Certification No. 10-1
Test Date: 4/5/2023

Neck Force (X)



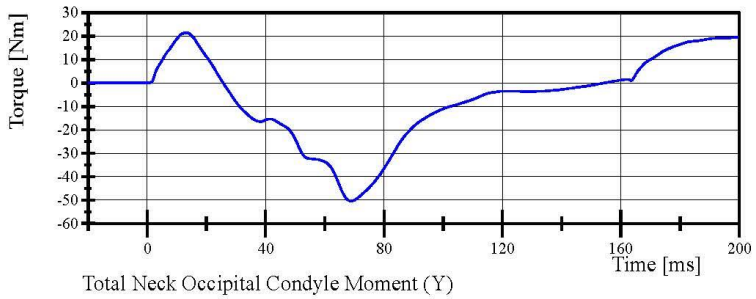
Filter Class: CFC_1000
Max: 426.9 N at 73.2 ms
Min: -179.5 N at 194.0 ms

Neck Force (X) Filtered for Total Neck Occipital Condyle Calculation



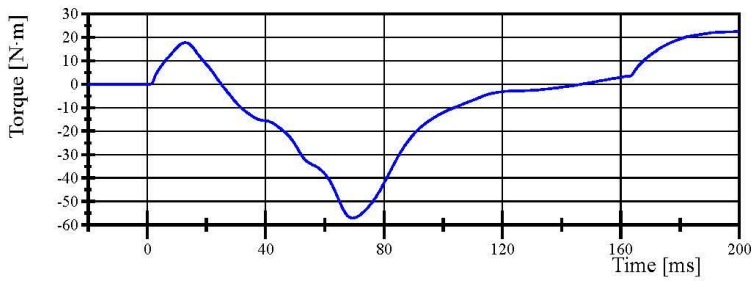
Filter Class: CFC_600
Max: 426.4 N at 73.1 ms
Min: -178.9 N at 194.1 ms

Neck Moment (Y)



Filter Class: CFC_600
Max: 21.5 Nm at 13.5 ms
Min: -50.4 Nm at 69.0 ms

Total Neck Occipital Condyle Moment (Y)



Filter Class: Without_(Constar
Max: 22.6 N·m at 199.6 ms
Min: -57.1 N·m at 69.3 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

04.05.2023 15:24:58 2008

Transportation Research Center Inc.

Front Thorax
HIII 5th Serial No. DH1659 Certification No. 10-1
Test Date: 4/5/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	20.8 °C	Yes
Relative Humidity	10 - 70 %	63 %	Yes
Probe Velocity	6.59 - 6.83 m/s	6.805 m/s	Yes
Probe Force Peak Between 50.0 mm and 58.0 mm Chest Deflection	(-3,900) - (-4,400) N	Not Attained	No
Probe Force Peak Between 18.0 mm and 50.0 mm Chest Deflection	>= (-4,600) N	-4,530.5 N	Yes
Maximum Chest Compression	(-50) - (-58) mm	-49.3 mm	No
Internal Hysteresis	69 - 85 %	76.5 %	Yes

Test does not meet specifications.

Condition: Used

Comments:

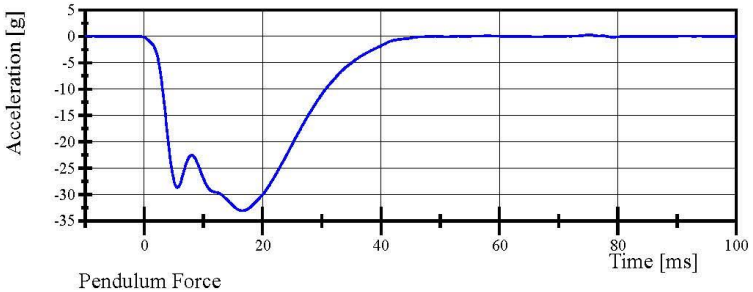
Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

04.05.2023 13:10:27 445

Transportation Research Center Inc.

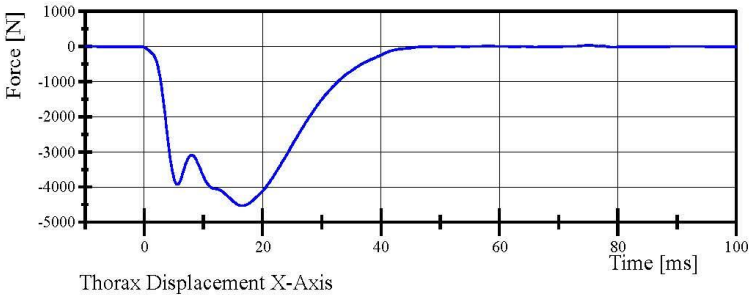
Front Thorax
HIII 5th Serial No. DH1659 Certification No. 10-1
Test Date: 4/5/2023

Pendulum Acceleration



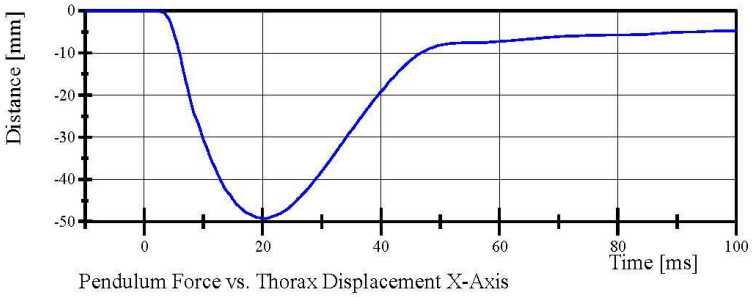
Filter Class: CFC_180
Max: 0.3 g at 75.2 ms
Min: -33.1 g at 16.6 ms

Pendulum Force



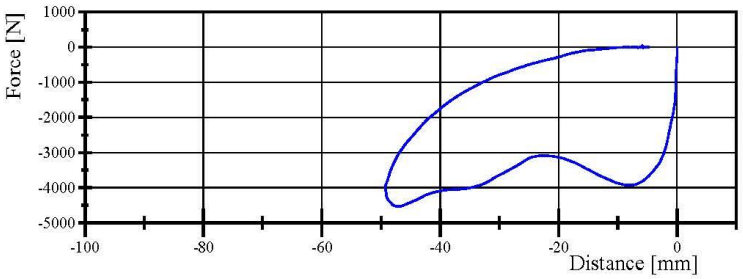
Filter Class: CFC_180
Max: 44.8 N at 75.2 ms
Min: -4,530.5 N at 16.6 ms

Thorax Displacement X-Axis



Filter Class: CFC_600
Max: 0.0 mm at -7.8 ms
Min: -49.3 mm at 20.6 ms

Pendulum Force vs. Thorax Displacement X-Axis



Filter Class: CFC_180
Max: 44.8 N at -5.8 mm
Min: -4,530.5 N at -47.1 mm

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

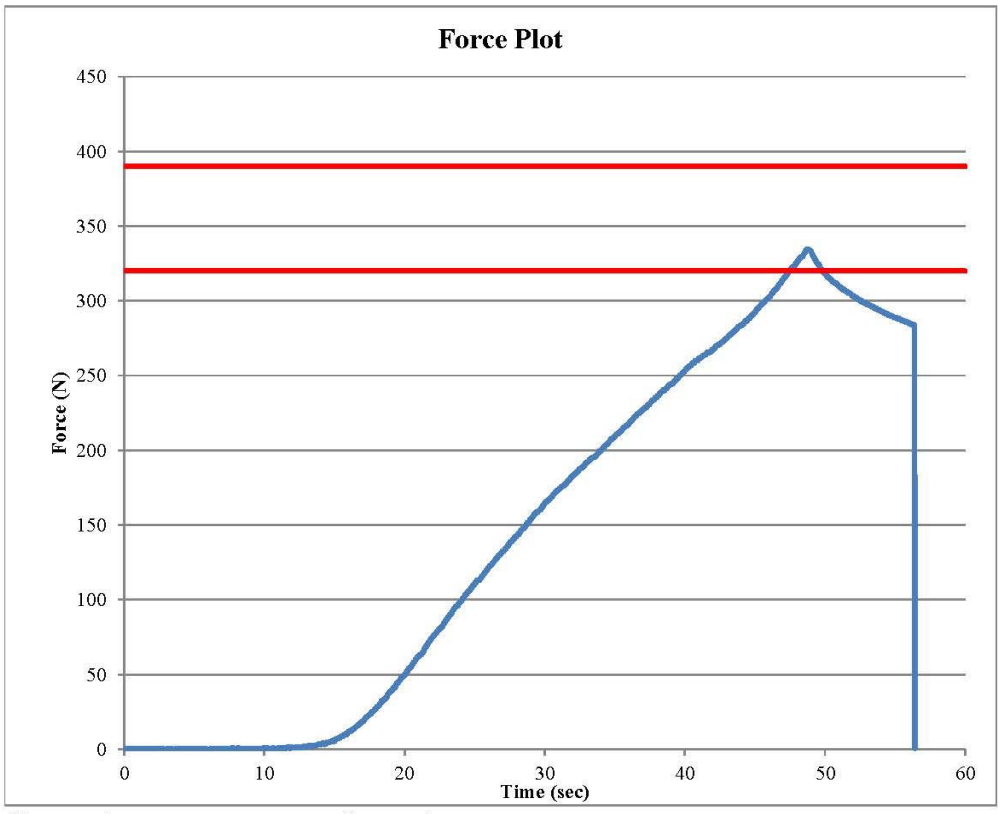
04.05.2023 13:10:33 445

Transportation Research Center Inc.

Hybrid III Small Female Torso Flexion

Customer:	NHTSA		
Serial Number:	DH1659	Date:	4/5/2023
Test Number:	1	Time:	13:56

TEST PARAMETER	SPECIFICATION			TEST RESULTS		
Temperature	18.9	-	25.6	20.8	°C	Pass
Humidity	10	-	70	64	%	Pass
Average Angular Rate	0.5	-	1.5	0.85	deg/sec	Pass
Initial Angle	0	-	20	17.61	deg	Pass
Peak Force at 45.63°	320	-	390	334.71	N	Pass
Final Angle	-8	-	8	2.58	deg	Pass



Components:		Comments:
Jacket S/N:	EE8385	
Abdomen S/N:	EE8393	
Lumbar S/N:	DG9121	

Transportation Research Center Inc.

Left Knee Femur Response Test
HIII 5th Serial No. DH1659 Certification No. 10-1
Test Date: 4/5/2023

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.6 °C	21.0 °C	Yes
Relative Humidity	10 - 70 %	64 %	Yes
Probe Velocity	2.07 - 2.13 m/s	2.089 m/s	Yes
Peak Femur Force	(-3,450) - (-4,060) N	-3,689.3 N	Yes

Test meets specifications.

Condition: Used

Comments:
Knee Skin S/N: ED6729

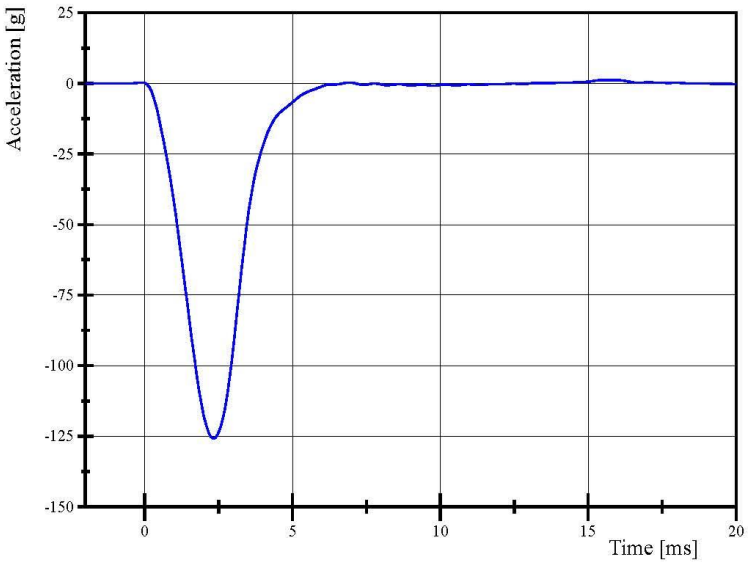
Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

04.05.2023 13:22:06 1767

Transportation Research Center Inc.

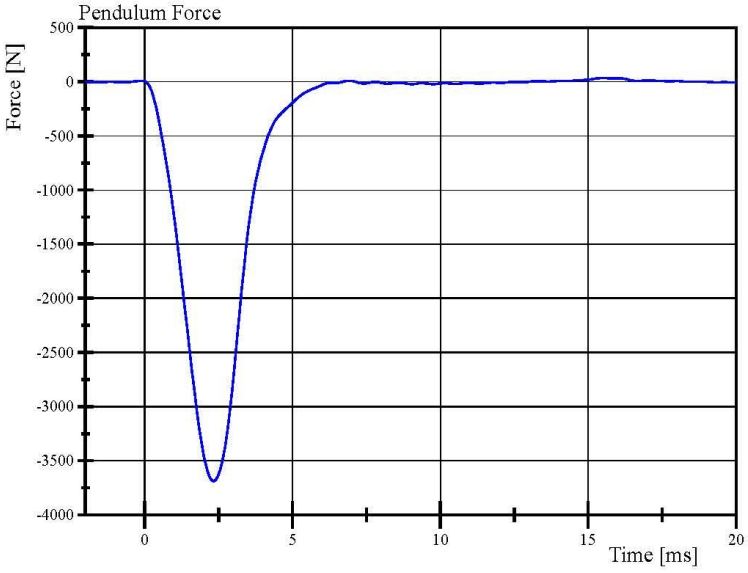
Left Knee Femur Response Test
HIII 5th Serial No. DH1659 Certification No. 10-1
Test Date: 4/5/2023

Pendulum Acceleration



Filter Class: CFC_600
Max: 1.2 g at 15.4 ms
Min: -125.8 g at 2.3 ms

Pendulum Force



Filter Class: CFC_600
Max: 34.9 N at 15.4 ms
Min: -3,689.3 N at 2.3 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

04.05.2023 13:22:29 1767

Transportation Research Center Inc.

Right Knee Femur Response Test
HIII 5th Serial No. DH1659 Certification No. 10-1
Test Date: 4/5/2023

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.6 °C	21.2 °C	Yes
Relative Humidity	10 - 70 %	67 %	Yes
Probe Velocity	2.07 - 2.13 m/s	2.091 m/s	Yes
Peak Femur Force	(-3,450) - (-4,060) N	-3,644.4 N	Yes

Test meets specifications.

Condition: Used

Comments:
Knee Skin S/N: EC5852

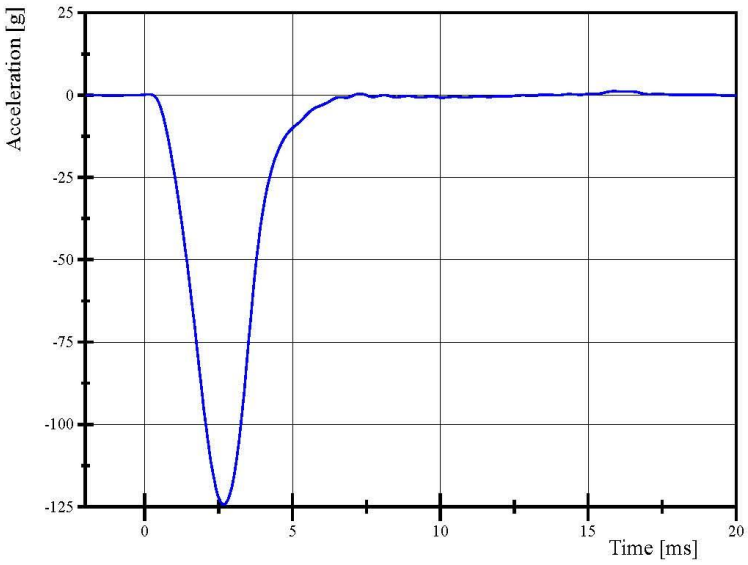
Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

04.05.2023 13:25:34 1762

Transportation Research Center Inc.

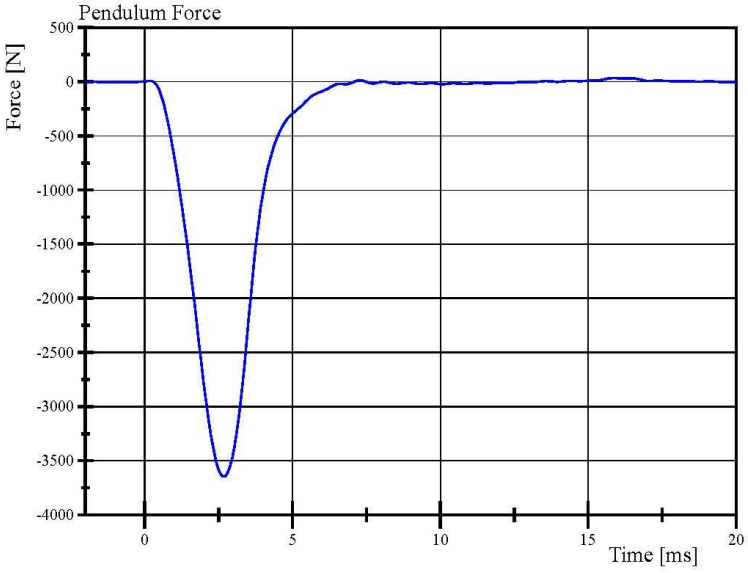
Right Knee Femur Response Test
HIII 5th Serial No. DH1659 Certification No. 10-1
Test Date: 4/5/2023

Pendulum Acceleration



Filter Class: CFC_600
Max: 1.2 g at 15.8 ms
Min: -124.3 g at 2.6 ms

Pendulum Force



Filter Class: CFC_600
Max: 34.9 N at 15.8 ms
Min: -3,644.4 N at 2.6 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

04.05.2023 13:25:56 1762

APPENDIX D
TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION

TABLE 1 – Driver Dummy Instrumentation

Instrumentation			Axis/Location	Hybrid III 50th S/N 037		
				Serial Number	Manufacturer	Calibration Date
Head Accelerometers		Primary	X	T10650	Endevco	23-Jan-2023
			Y	P94650	Endevco	23-Jan-2023
			Z	P94622	Endevco	23-Jan-2023
		Redundant	X	P94431	Endevco	23-Jan-2023
			Y	P94487	Endevco	23-Jan-2023
			Z	P94645	Endevco	23-Jan-2023
Head Angular Rate Sensors			X	ARS14948	DTS	13-Sep-2022
			Y	ARS14949	DTS	13-Sep-2022
			Z	ARS14952	DTS	13-Sep-2022
Upper Neck Load Cell			FX, FY, FZ, MX, MY, MZ	2021	Humanetics	24-Jan-2023
Chest Accelerometers		Primary	X	P97714	Endevco	23-Jan-2023
			Y	P61255	Endevco	23-Jan-2023
			Z	P45008	Endevco	23-Jan-2023
		Redundant	X	P91177	Endevco	23-Jan-2023
			Y	P94570	Endevco	23-Jan-2023
			Z	P91172	Endevco	23-Jan-2023
Chest Potentiometer			X	CST037	Servo	24-Jan-2023
Pelvis Accelerometers			X	T11801	Endevco	23-Jan-2023
			Y	P91876	Endevco	23-Jan-2023
			Z	T11390	Endevco	23-Jan-2023
Femur Load Cells	Left	Primary	Z	DI4215-FZ1	Denton	24-Jan-2023
		Redundant	Z	DI4215-FZ2	Denton	24-Jan-2023
	Right	Primary	Z	DI4216-FZ1	Denton	24-Jan-2023
		Redundant	Z	DI4216-FZ2	Denton	24-Jan-2023
Tibia Load Cells	Left	Upper	MX, MY, FZ	3643-94	Denton	27-Jan-2023
		Lower	MX, MY, FZ	3644-370	Denton	27-Jan-2023
	Right	Upper	MX, MY, FZ	3643-413	Denton	27-Jan-2023
		Lower	MX, MY, FZ	3644-401	Denton	27-Jan-2023
Foot Accelerometers	Left	Rear	X	P90848	Endevco	27-Jan-2023
			Z	P91498	Endevco	30-Jan-2023
		Front	Z	P90841	Endevco	30-Jan-2023
	Right	Rear	X	P93467	Endevco	30-Jan-2023
			Z	P97619	Endevco	30-Jan-2023
		Front	Z	P94523	Endevco	30-Jan-2023
Seat Belt Load Cells		Lap	N/A	N/A	N/A	N/A
		Shoulder	N/A	R141C7	Measurement Specialties	26-May-2022

TABLE 2 – Front Passenger Dummy Instrumentation

Instrumentation			Axis/Location	Hybrid III 5th S/N DH1659		
				Serial Number	Manufacturer	Calibration Date
Head Accelerometers		Primary	X	P44972	Endevco	26-Jan-2023
			Y	T11806	Endevco	26-Jan-2023
			Z	P69062	Endevco	26-Jan-2023
		Redundant	X	T11046	Endevco	26-Jan-2023
			Y	P97525	Endevco	26-Jan-2023
			Z	P73228	Endevco	26-Jan-2023
Head Angular Rate Sensors			X	ARS6120	DTS	13-Sep-2022
			Y	ARS10776	DTS	13-Sep-2022
			Z	ARS4732	DTS	13-Sep-2022
Upper Neck Load Cell			FX, FY, FZ, MX, MY, MZ	1874	Denton	24-Jan-2023
Chest Accelerometers		Primary	X	P80855	Endevco	26-Jan-2023
			Y	P93546	Endevco	26-Jan-2023
			Z	P57791	Endevco	26-Jan-2023
		Redundant	X	P73221	Endevco	26-Jan-2023
			Y	T11872	Endevco	27-Jan-2023
			Z	T16784	Endevco	26-Jan-2023
Chest Potentiometer			X	CST3410	Servo	27-Jan-2023
Pelvis Accelerometers			X	P91969	Endevco	26-Jan-2023
			Y	P91958	Endevco	26-Jan-2023
			Z	P80721	Endevco	26-Jan-2023
Femur Load Cells	Left	Primary	Z	DT0997-FZ1	Denton	26-Jan-2023
		Redundant	Z	DT0997-FZ2	Denton	26-Jan-2023
	Right	Primary	Z	DS4140-FZ1	Denton	26-Jan-2023
		Redundant	Z	DS4140-FZ2	Denton	26-Jan-2023
Tibia Load Cells	Left	Upper	MX, MY, FZ	3643-92	Denton	26-Jan-2023
		Lower	MX, MY, FZ	3644-92	Denton	26-Jan-2023
	Right	Upper	MX, MY, FZ	3643-484	Denton	26-Jan-2023
		Lower	MX, MY, FZ	3644-369	Denton	25-Jan-2023
Foot Accelerometers	Left	Rear	X	P90866	Endevco	26-Jan-2023
			Z	P93533	Endevco	20-Feb-2023
		Front	Z	P97890	Endevco	26-Jan-2023
	Right	Rear	X	P97640	Endevco	26-Jan-2023
			Z	P91471	Endevco	26-Jan-2023
		Front	Z	P91907	Endevco	26-Jan-2023
Seat Belt Load Cells		Lap	N/A	N/A	N/A	N/A
		Shoulder	N/A	R141CC	Measurement Specialties	3-Aug-2022

TABLE 3 – Vehicle Instrumentation

Instrumentation			Axis	Serial Number	Manufacturer	Calibration Date
Crossmember/Rear Seat Accelerometers	Left	Primary	X	A349883	Measurement Specialties	10-Nov-2022
			Z	A378375	Measurement Specialties	10-Nov-2022
		Redundant	X	A254929	Measurement Specialties	10-Nov-2022
	Right	Primary	X	A349877	Measurement Specialties	10-Nov-2022
			Z	A300458	Measurement Specialties	10-Nov-2022
		Redundant	X	A298539	Measurement Specialties	10-Nov-2022
Engine Accelerometers	Top		X	A251672	Measurement Specialties	10-Nov-2022
	Bottom		X	A298543	Measurement Specialties	10-Nov-2022