

**Vehicle Research and Test Center
ECE R16 Dynamic Testing
Hybrid III 50th**

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



Summary Report

June – July 2020

**Prepared For
Vehicle Research and Test Center
P. O. Box 37
East Liberty, OH 43319**

SECTION 1
PURPOSE AND SUMMARY FOR HYBRID III 50TH

The purpose of the testing is: (1) To understand the correlation between static requirements in U.S. regulation and dynamic requirements in European regulation (ECE R16 test), (2) Collect injury metrics for ECE R16 manikin, Hybrid III 50th and THOR 50th ATDs, including chest and pelvis excursion

SUMMARY

A Hybrid III 50th (serial number 045) was secured in the left rear occupant position (position 4 or P4) or in the right rear occupant position (position 6 or P6). The Hybrid III 50th was instrumented with head, chest, and pelvis triaxial accelerometers, redundant head and chest triaxial accelerometers, and head rotational velocity sensors, upper/lower neck and lumbar force and moment load cells, femur force load cells, a displacement potentiometer in the chest and two (2) string pots. During this test series the dummy was restrained with a 2019 Lexus ES (US or EU), 2018 Subaru Impreza (WGN) (US or EU) or 2019 Chevrolet Suburban (US or EU) 3-point seatbelt.

Section 2 contains the left rear occupant position side views of the dummy. Section 3 contains the right rear occupant position side views of the dummy. Section 4 contains the dummy certification information.

SECTION 2
LEFT REAR OCCUPANT POSITION TEST SUMMARY

TEST DUMMY INFORMATION

Description	Position # 4
ATD Type/Serial No.	Hybrid III 50th/045
Belt Types	2019 Lexus ES
Regulation	US, EU
Positions	Left Hand (LH) Rear

CAMERA POSITIONING FARO MEASUREMENTS

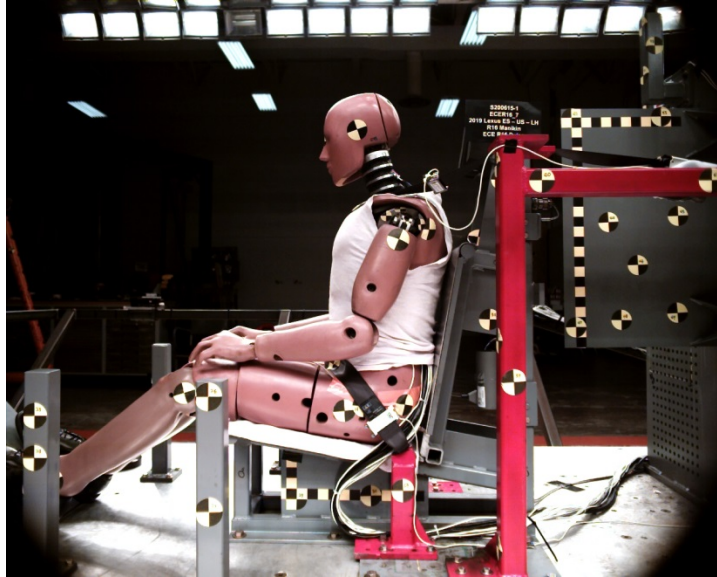
Description	Units	X	Y	Z
Origin	mm	0.00	0.00	0.00
N1 Front	mm	1803.77	-2.49	-398.31
N3 Left Oblique	mm	1295.72	-1569.04	-436.91
N5 Left Side	mm	102.26	-1554.89	-366.82

DUMMY POSITIONING

BELT: 2019 Lexus ES – US – LH
NHTSA Vehicle Database Number: v11252

TRC Test Number: S200615-1

VRTC Test Number: ECER16_7



DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Top of Head	mm	148.89	4.64	-890.82
Bridge of Nose	mm	233.18	6.12	-770.76
Right Head CG	mm	144.93	80.44	-784.26
Left Head CG	mm	146.98	-65.80	-782.56
Left Shoulder	mm	34.36	-200.51	-535.56
Right Shoulder	mm	33.06	202.54	-531.40
Left Shoulder Front	mm	77.91	-151.14	-556.12
Left Shoulder Top	mm	45.04	-154.38	-570.57
Left Shoulder Rear	mm	-0.78	-162.71	-533.27
Right H-Point	mm	123.87	199.61	-117.33
Right H-Point on Skin	mm	124.99	188.65	-120.73
Left H-Point	mm	128.50	-204.53	-122.38
Left H-Point on Skin	mm	129.08	-187.32	-124.88
Left Knee	mm	526.51	-125.21	-147.94
Left Knee on Skin	mm	548.44	-149.45	-143.34
Right Knee	mm	521.23	128.19	-147.05
Right Knee on Skin	mm	555.79	152.27	-158.64
Right Ankle	mm	818.92	132.58	58.88
Right Ankle Top	mm	888.95	88.74	57.48
Left Ankle	mm	863.04	-147.56	67.65
Left Ankle Top	mm	899.34	-113.12	52.52
Top of Shoulder Belt	mm	187.78	-0.51	-550.79
Bottom of Shoulder Belt	mm	208.65	-0.17	-470.51

DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED

Top of Lap Belt	mm	223.34	0.26	-239.52
Bottom of Lap Belt	mm	230.91	0.38	-192.97
Belt spool out	mm	-11.21	-176.27	-636.09
Shoulder belt spool out	mm	139.20	-66.00	-594.86
4 inch shoulder Belt	mm	210.61	56.03	-425.13
Shoulder Belt Center	mm	205.18	-0.40	-508.88
Lap Belt Center	mm	230.03	0.52	-214.26
4 inch Lap Belt	mm	202.80	-95.34	-208.97
String Pot Top	mm	-158.23	-4.60	-521.17
String Pot Bottom	mm	-52.08	-2.53	-121.55
Dummy Top String Pot	mm	-18.45	-172.29	-520.82
Dummy Bottom String Pot	mm	36.73	-161.48	-123.49
Dummy Bottom String Pot Front	mm	171.92	-191.88	-114.12
Retractor Bolt 1	mm	-686.07	-190.28	-658.15
Retractor Bolt 2	mm	-451.73	-166.24	-617.87
Outboard Anchor Bolt	mm	32.72	132.80	-11.35
Inboard Anchor Bolt	mm	53.80	-191.24	-31.20
Guide Loop Bolt 1	mm	-225.33	-215.82	-691.93
Guide Loop Bolt 2	mm	-215.83	-247.31	-692.16

DUMMY INJURY

HIC36 (36 ms)	169
HIC15 (15 ms)	86
BrIC	0.61
NIJ Max	0.35
Chest Clip (3 ms)	30.4
Chest Deflection (mm)	-21.7
Torso String Pot (mm)	369
Pelvis String Pot (mm)	145

DUMMY POSITIONING

BELT: 2019 Lexus ES – EU – LH
NHTSA Vehicle Database Number: v11253

TRC Test Number: S200824-1

VRTC Test Number: ECER16_20



DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Top of Head	mm	150.41	4.24	-890.21
Bridge of Nose	mm	232.92	4.69	-769.47
Right Head CG	mm	146.14	78.28	-784.04
Left Head CG	mm	149.90	-67.39	-782.40
Left Shoulder	mm	38.94	-203.91	-536.84
Right Shoulder	mm	34.81	199.23	-534.25
Left Shoulder Front	mm	78.06	-154.53	-556.16
Left Shoulder Top	mm	45.51	-157.37	-570.86
Left Shoulder Rear	mm	-1.06	-165.32	-534.29
Left Shoulder on the Skin	mm	44.18	-235.11	-492.08
Right H-Point on Skin	mm	123.58	186.86	-121.13
Left H-Point on Skin	mm	129.38	-187.70	-124.02
Left Knee	mm	526.16	-128.59	-146.89
Left Knee on Skin	mm	552.29	-151.19	-144.39
Right Knee	mm	523.68	127.55	-146.29
Right Knee on Skin	mm	552.69	148.58	-152.32
Right Ankle	mm	823.19	126.02	56.98
Right Ankle Top	mm	891.68	83.03	50.90
Left Ankle	mm	866.29	-144.00	65.60
Left Ankle Top	mm	899.08	-109.32	51.60
Top of Shoulder Belt	mm	188.36	-0.89	-550.73
Bottom of Shoulder Belt	mm	208.31	0.19	-466.78
Top of Lap Belt	mm	217.56	0.55	-240.17

DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED

Bottom of Lap Belt	mm	228.49	0.03	-192.92
Belt spool out	mm	-11.06	-178.19	-625.58
Shoulder belt spool out	mm	141.05	-66.55	-595.63
4 inch shoulder Belt	mm	210.21	56.58	-422.05
Shoulder Belt Center	mm	206.07	0.76	-506.83
Lap Belt Center	mm	225.98	0.71	-220.85
4 inch Lap Belt	mm	198.01	-96.03	-209.33
String Pot Top	mm	-147.66	-6.42	-525.56
String Pot Bottom	mm	-55.60	-1.98	-126.18
Dummy Top String Pot	mm	-19.05	-172.15	-521.58
Dummy Bottom String Pot	mm	35.67	-161.71	-122.95
Dummy Bottom String Pot Front	mm	172.32	-191.44	-111.59
Retractor Bolt 1	mm	-685.80	-189.94	-657.86
Retractor Bolt 2	mm	-451.12	-166.52	-618.21
Outboard Anchor Bolt	mm	32.07	131.15	-11.68
Inboard Anchor Bolt	mm	54.96	-191.47	-30.63
Guide Loop Bolt 1	mm	-224.74	-216.75	-692.03
Guide Loop Bolt 2	mm	-215.63	-248.13	-692.02

DUMMY INJURY

HIC36 (36 ms)	152
HIC15 (15 ms)	93
BrIC	0.66
NIJ Max	0.40
Chest Clip (3 ms)	30.4
Chest Deflection (mm)	-23.3
Torso String Pot (mm)	384
Pelvis String Pot (mm)	147

SECTION 3
RIGHT REAR OCCUPANT POSITION TEST SUMMARY

TEST DUMMY INFORMATION

Description	Position # 6
ATD Type/Serial No.	Hybrid III 50th/045
Belt Types	2018 Subaru Impreza (WGN), 2019 Chevrolet Suburban
Regulation	US, EU
Positions	Right Hand (RH) Rear

CAMERA POSITIONING FARO MEASUREMENTS

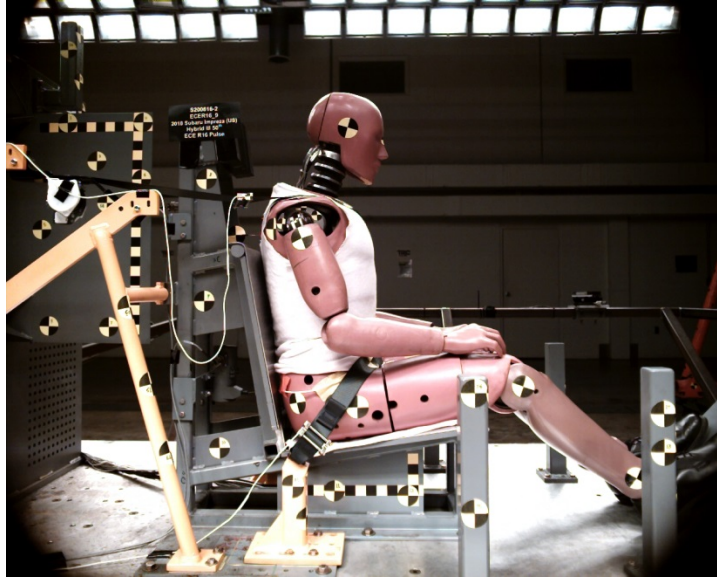
Description	Units	X	Y	Z
Origin	mm	0.00	0.00	0.00
N1 Front	mm	1803.34	-2.66	-398.21
N3 Right Oblique	mm	1300.38	1578.38	-433.35
N5 Right Side	mm	215.79	1564.50	-360.62

DUMMY POSITIONING

BELT: 2018 Subaru Impreza (WGN) – US – RH
NHTSA Vehicle Database Number: v11254

TRC Test Number: S200616-2

VRTC Test Number: ECER16_9



DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Top of Head	mm	148.51	0.90	-889.47
Bridge of Nose	mm	231.84	0.82	-770.12
Right Head CG	mm	142.82	72.53	-783.07
Left Head CG	mm	145.74	-70.15	-781.59
Left Shoulder	mm	31.27	-203.76	-530.56
Left Shoulder on the Skin	mm	50.51	-235.38	-490.27
Right Shoulder	mm	33.27	198.94	-535.97
Right Shoulder Front	mm	76.42	148.04	-554.12
Right Shoulder Top	mm	39.45	152.09	-570.69
Right Shoulder Rear	mm	-3.55	162.31	-532.03
Right Shoulder on the Skin	mm	50.96	230.71	-490.76
Right H-Point	mm	125.61	199.22	-118.39
Right H-Point on Skin	mm	126.56	188.92	-120.52
Left H-Point on Skin	mm	125.50	-187.23	-122.61
Left Knee	mm	524.28	-126.46	-151.23
Left Knee on Skin	mm	548.89	-150.65	-148.41
Right Knee	mm	522.44	129.88	-150.02
Right Knee on Skin	mm	554.45	151.11	-156.33
Right Ankle	mm	819.70	135.05	59.38
Right Ankle Top	mm	889.17	93.16	55.09
Left Ankle	mm	861.20	-142.29	68.41
Left Ankle Top	mm	894.29	-108.66	55.06
Top of Shoulder Belt	mm	173.82	-0.50	-574.59

DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED

Bottom of Shoulder Belt	mm	205.05	0.37	-506.31
Top of Lap Belt	mm	218.84	-0.16	-244.33
Bottom of Lap Belt	mm	233.51	-0.31	-199.10
Belt spool out	mm	-69.78	194.67	-590.12
Shoulder belt spool out	mm	137.45	55.05	-596.41
4 inch shoulder Belt	mm	207.79	-60.10	-462.58
Shoulder Belt Center	mm	192.20	-0.91	-542.38
Lap Belt Center	mm	226.92	0.52	-221.31
4 inch Lap Belt	mm	201.83	96.39	-206.36
String Pot Top	mm	-146.23	6.25	-523.00
String Pot Bottom	mm	-66.17	4.50	-121.43
Dummy Top String Pot	mm	-21.13	162.55	-520.98
Dummy Bottom String Pot	mm	33.84	161.39	-119.55
Dummy Bottom String Pot Front	mm	174.58	193.83	-116.30
Retractor Bolt 1	mm	-532.87	322.07	-641.21
Retractor Bolt 2	mm	-279.28	301.76	-547.66
Outboard Anchor Bolt	mm	-55.61	-176.78	-18.43
Inboard Anchor Bolt	mm	50.12	231.51	-15.46
Guide Loop Bolt 1	mm	-459.61	305.07	-615.15
Guide Loop Bolt 2	mm	-455.53	321.10	-615.53

DUMMY INJURY

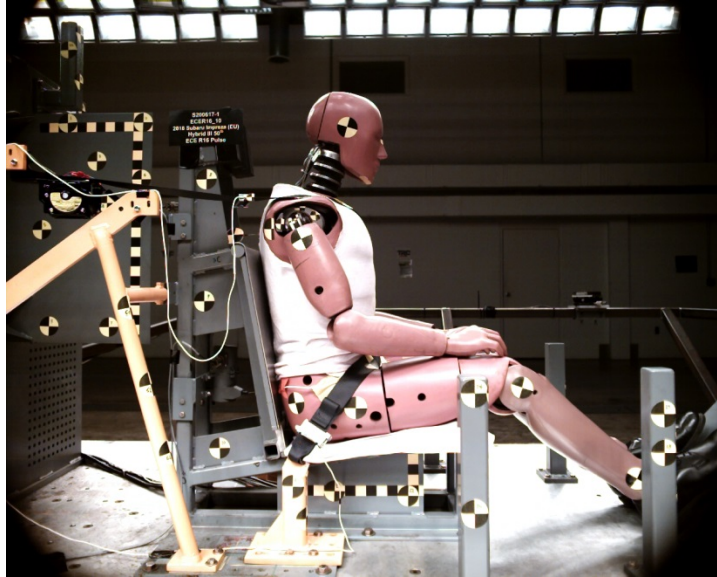
HIC36 (36 ms)	555
HIC15 (15 ms)	327
BrIC	0.86
NIJ Max	0.65
Chest Clip (3 ms)	51.4
Chest Deflection (mm)	-36.6
Torso String Pot (mm)	255
Pelvis String Pot (mm)	205

DUMMY POSITIONING

BELT: 2018 Subaru Impreza (WGN) – EU – RH
NHTSA Vehicle Database Number: v11255

TRC Test Number: S200617-1

VRTC Test Number: ECER16_10



DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Top of Head	mm	149.55	-0.68	-890.39
Bridge of Nose	mm	232.88	1.06	-770.10
Right Head CG	mm	144.18	74.38	-784.65
Left Head CG	mm	145.11	-70.48	-781.28
Left Shoulder	mm	34.43	-203.54	-530.54
Left Shoulder on the Skin	mm	53.38	-234.76	-488.65
Right Shoulder	mm	30.52	199.45	-535.68
Right Shoulder Front	mm	74.09	149.54	-554.51
Right Shoulder Top	mm	36.35	153.32	-570.82
Right Shoulder Rear	mm	-5.85	163.05	-531.25
Right Shoulder on the Skin	mm	49.12	231.46	-490.52
Right H-Point on Skin	mm	120.53	188.38	-120.85
Left H-Point on Skin	mm	123.71	-187.15	-123.76
Left Knee	mm	521.92	-131.23	-143.24
Left Knee on Skin	mm	548.07	-154.01	-139.33
Right Knee	mm	518.59	130.04	-148.38
Right Knee on Skin	mm	551.37	152.25	-152.81
Right Ankle	mm	820.52	134.26	57.21
Right Ankle Top	mm	890.29	90.39	58.17
Left Ankle	mm	861.57	-146.15	72.49
Left Ankle Top	mm	894.07	-114.30	56.81
Top of Shoulder Belt	mm	168.73	0.92	-570.96
Bottom of Shoulder Belt	mm	202.20	0.37	-500.73

DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED

Top of Lap Belt	mm	218.00	-0.05	-241.50
Bottom of Lap Belt	mm	228.29	1.59	-195.73
Belt spool out	mm	-66.08	195.37	-587.71
Shoulder belt spool out	mm	137.07	56.36	-594.51
4 inch shoulder Belt	mm	203.22	-57.90	-460.19
Shoulder Belt Center	mm	188.37	1.63	-542.24
Lap Belt Center	mm	224.77	0.52	-219.94
4 inch Lap Belt	mm	199.49	93.53	-203.05
String Pot Top	mm	-150.93	3.06	-525.08
String Pot Bottom	mm	-64.00	6.21	-122.32
Dummy Top String Pot	mm	-25.86	162.52	-522.32
Dummy Bottom String Pot	mm	30.83	161.09	-119.59
Dummy Bottom String Pot Front	mm	171.10	194.42	-114.96
Retractor Bolt 1	mm	-533.08	321.96	-641.24
Retractor Bolt 2	mm	-279.25	301.45	-546.77
Outboard Anchor Bolt	mm	-54.92	-176.91	-18.56
Inboard Anchor Bolt	mm	49.82	229.45	-15.51
Guide Loop Bolt 1	mm	-474.73	310.44	-613.30
Guide Loop Bolt 2	mm	-470.10	324.92	-613.40

DUMMY INJURY

HIC36 (36 ms)	87
HIC15 (15 ms)	47
BrIC	0.44
NIJ Max	0.34
Chest Clip (3 ms)	22.2
Chest Deflection (mm)	-21.7
Torso String Pot (mm)	341
Pelvis String Pot (mm)	142

DUMMY POSITIONING

BELT: 2019 Chevrolet Suburban – US – RH
NHTSA Vehicle Database Number: v11256

TRC Test Number: S200618-1

VRTC Test Number: ECER16_11



DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Top of Head	mm	148.55	-3.59	-890.62
Bridge of Nose	mm	231.58	-1.51	-770.90
Right Head CG	mm	143.58	72.47	-785.03
Left Head CG	mm	144.94	-72.21	-781.65
Left Shoulder	mm	32.94	-204.68	-533.08
Left Shoulder on the Skin	mm	53.20	-235.75	-490.62
Right Shoulder	mm	34.48	198.81	-535.79
Right Shoulder Front	mm	76.58	147.66	-553.83
Right Shoulder Top	mm	39.11	152.30	-570.93
Right Shoulder Rear	mm	-2.89	162.51	-531.85
Right Shoulder on the Skin	mm	53.71	230.21	-490.94
Right H-Point	mm	120.93	200.11	-118.30
Right H-Point on Skin	mm	122.17	187.96	-121.08
Left H-Point on Skin	mm	123.46	-186.57	-121.83
Left Knee	mm	521.25	-131.52	-145.65
Left Knee on Skin	mm	547.51	-154.14	-140.89
Right Knee	mm	518.92	132.51	-145.66
Right Knee on Skin	mm	552.65	152.37	-152.08
Right Ankle	mm	821.98	136.46	60.76
Right Ankle Top	mm	890.39	93.99	54.51
Left Ankle	mm	862.27	-143.43	70.43
Left Ankle Top	mm	894.15	-110.08	51.27
Top of Shoulder Belt	mm	163.80	-0.15	-579.09

DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED

Bottom of Shoulder Belt	mm	202.43	-0.30	-502.50
Top of Lap Belt	mm	217.51	-0.39	-240.99
Bottom of Lap Belt	mm	226.83	-0.86	-192.55
Belt spool out	mm	-12.28	181.91	-660.67
Shoulder belt spool out	mm	121.96	56.13	-602.66
4 inch shoulder Belt	mm	203.36	-53.90	-457.59
Shoulder Belt Center	mm	188.44	0.10	-543.28
Lap Belt Center	mm	223.44	-3.47	-218.94
4 inch Lap Belt	mm	192.85	90.28	-209.73
String Pot Top	mm	-143.60	3.14	-524.97
String Pot Bottom	mm	-69.38	2.83	-121.70
Dummy Top String Pot	mm	-25.21	162.76	-521.70
Dummy Bottom String Pot	mm	31.25	160.56	-120.10
Dummy Bottom String Pot Front	mm	169.86	194.33	-114.31
Retractor Bolt 1	mm	-376.14	384.78	-239.45
D-Ring	mm	-208.32	252.13	-788.39
Outboard Anchor Bolt	mm	1.82	-205.18	10.14
Inboard Anchor Bolt	mm	-147.91	291.35	102.20

DUMMY INJURY

HIC36 (36 ms)	580
HIC15 (15 ms)	365
BrIC	0.84
NIJ Max	0.65
Chest Clip (3 ms)	52.0
Chest Deflection (mm)	-35.6
Torso String Pot (mm)	281
Pelvis String Pot (mm)	182

DUMMY POSITIONING

BELT: 2019 Chevrolet Suburban – EU – RH
NHTSA Vehicle Database Number: v11257

TRC Test Number: S200702-1

VRTC Test Number: ECER16_12



DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Top of Head	mm	150.61	3.45	-889.63
Bridge of Nose	mm	233.64	2.52	-769.70
Right Head CG	mm	147.59	77.20	-783.03
Left Head CG	mm	146.97	-68.17	-782.30
Left Shoulder	mm	33.34	-201.54	-537.69
Left Shoulder on the Skin	mm	48.82	-235.30	-495.66
Right Shoulder	mm	34.57	200.23	-532.41
Right Shoulder Front	mm	77.81	150.87	-550.52
Right Shoulder Top	mm	40.35	155.64	-567.40
Right Shoulder Rear	mm	-2.31	164.96	-528.35
Right Shoulder on the Skin	mm	50.68	233.74	-487.99
Right H-Point on Skin	mm	122.37	186.51	-120.97
Left H-Point on Skin	mm	122.21	-188.95	-122.84
Left Knee	mm	520.63	-128.33	-141.10
Left Knee on Skin	mm	546.78	-151.65	-139.32
Right Knee	mm	520.72	128.40	-143.95
Right Knee on Skin	mm	550.39	147.66	-151.83
Right Ankle	mm	819.05	131.40	59.43
Right Ankle Top	mm	891.69	87.74	54.10
Left Ankle	mm	863.00	-148.47	70.37
Left Ankle Top	mm	894.39	-114.31	55.18
Top of Shoulder Belt	mm	167.99	0.44	-576.52
Bottom of Shoulder Belt	mm	204.57	0.56	-500.24

DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED

Top of Lap Belt	mm	215.64	0.44	-241.17
Bottom of Lap Belt	mm	226.17	-0.06	-195.81
Belt spool out	mm	-14.51	183.82	-673.52
Shoulder belt spool out	mm	123.47	56.22	-603.84
4 inch shoulder Belt	mm	204.47	-54.93	-454.74
Shoulder Belt Center	mm	192.55	1.17	-540.69
Lap Belt Center	mm	224.63	-0.13	-216.48
4 inch Lap Belt	mm	194.08	92.35	-207.69
String Pot Top	mm	-152.21	-1.94	-524.00
String Pot Bottom	mm	-63.81	2.70	-125.51
Dummy Top String Pot	mm	-22.92	165.52	-518.58
Dummy Bottom String Pot	mm	31.80	160.72	-120.82
Dummy Bottom String Pot Front	mm	169.89	192.51	-114.58
Retractor Bolt 1	mm	-376.29	386.08	-238.04
D-Ring	mm	-208.59	252.97	-786.46
Outboard Anchor Bolt	mm	2.08	-205.31	11.39
Inboard Anchor Bolt	mm	-147.69	290.46	100.71

DUMMY INJURY

HIC36 (36 ms)	535
HIC15 (15 ms)	373
BrIC	0.84
NIJ Max	0.63
Chest Clip (3 ms)	51.6
Chest Deflection (mm)	-35.5
Torso String Pot (mm)	282
Pelvis String Pot (mm)	175

SECTION 4

DUMMY CALIBRATION DATA

Transportation Research Center Inc. ATD Certification Report

Customer:

Vehicle Research and Test Center
10820 State Route 347
East Liberty, OH 43319

Anthropomorphic Device:

Hybrid III 50th Percentile Male
Serial No. 045
Certification No. 50



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Introduction

Customer Name: VRTC
Customer Contact: Bryan Crabtree
Email: Bryan.Crabtree.CTR@dot.gov
Phone: (937) 666-4511
Date Received: May 18, 2020
Date Completed: May 20, 2020

Special Instruction: N/A


This Certification Report meets the requirements set forth by the ANSI National Accreditation Board ISO/IEC 17025:2017 accreditation under the scope of Mechanical Testing for Crash Test Dummy Certification Testing (ANAB Certificate #L2187). **This testing certification shall not be reproduced, except in full, without written approval of TRC Inc.**

The evidence measurements of this Certification Report are traceable by the Serial Number and Certification Number located at the top of the first section for each certification.

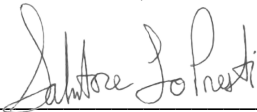
Each certification test was conducted by an authorized Transportation Research Center Inc. (TRC Inc.) employee within the requirements of the ISO/IEC 17025:2017 standards and adheres to CFR Part 572 Subparts B, E, N, O, P, R, T, U, V, SAE J2860, J2856, J2862; depending on ATD type. Any statements of conformity in this report are made using the shared risk method.

Each component of the ATD to be tested was contained in a temperature controlled environment for a period of at least 4 hours before the test. The temperature in the ATD Certification Laboratory was between 20.6°C and 22.2°C (69.08°F – 71.96°F). The relative humidity in the ATD Certification Laboratory was between 10% and 70%.

Date Testing Requested: 05/18/2020

Testing Conducted by: 
Robert Benavides, Test Technician III

Date: 05/20/2020

Testing Approved by: 
Sal LoPresti, Supervisor - Calibration Services

Date: 05/26/2020



Appendix A – Incoming Inspection





TRC ATD Laboratory As Received Inspection Report

Name: Robert Benavides

Date: 5/19/2020

Customer: VRTC

ATD S/N: 045

HEAD / NECK		
No.	Comments	Photo No.
1	None to report.	
2		
3		

THORAX / ABDOMEN		
No.	Comments	Photo No.
4	None to report.	
5		
6		

SHOULDERS / ARMS		
No.	Comments	Photo No.
7	None to report.	
8		
9		

PELVIS / LUMBAR		
No.	Comments	Photo No.
10	None to report.	
11		
12		

FEMUR / KNEES		
No.	Comments	Photo No.
13	None to report.	
14		
15		

LOWER LEGS / FEET		
No.	Comments	Photo No.
16	None to report.	
17		
18		





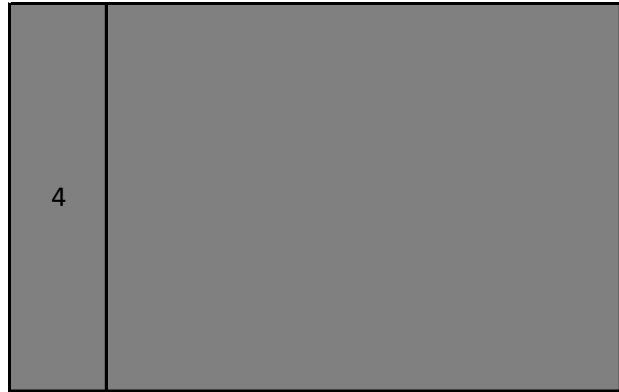
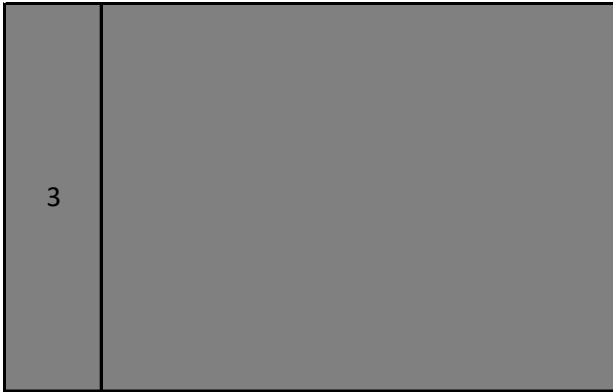
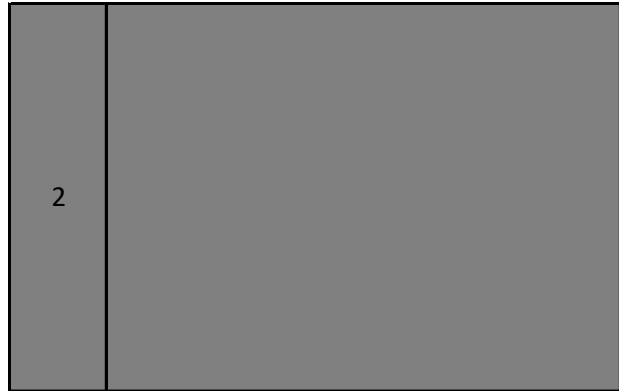
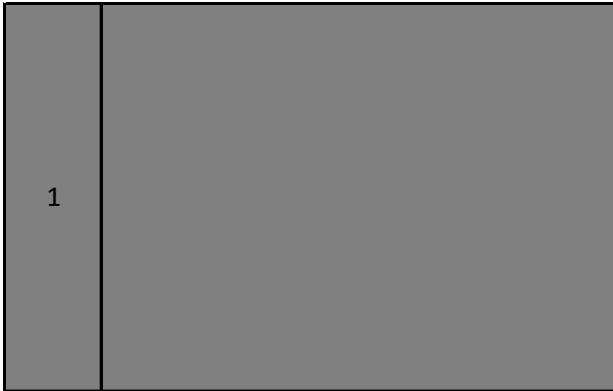
TRC ATD Laboratory As Received Inspection Photos

Name: Robert Benavides

Date: 5/19/2020

Customer: VRTC

ATD S/N: 045





TRC ATD Laboratory Inspection Report Action Items

Name: Robert Benavides

Date: 5/19/2020

Customer: VRTC

ATD S/N: 045

Action #1	None to report.
Resolution #1	
Action #2	
Resolution #2	
Action #3	
Resolution #3	
Comments	



Appendix B – Test Results



Transportation Research Center Inc.

Front Head Drop

HIII 50th Serial No. 045 Certification No. 50-1

Test Date: 5/19/2020

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	20.8 °C	Yes
Relative Humidity	10 - 70 %	59 %	Yes
Peak Head Resultant Acceleration	225 - 275 g	230.6 g	Yes
Peak Head Lateral Acceleration	(-15) - 15 g	11.4 g	Yes
Is Acceleration Curve Unimodal within 10% of Peak?	< 10 %	3.96 %	Yes

Test meets specifications.

Condition: Used

Comments:

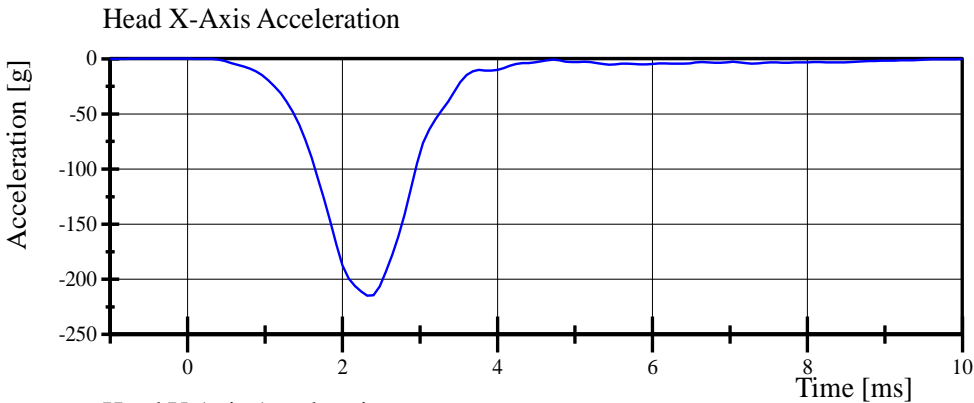
Head Skin S/N: N/A

Transportation Research Center Inc.

Front Head Drop

HIII 50th Serial No. 045 Certification No. 50-1

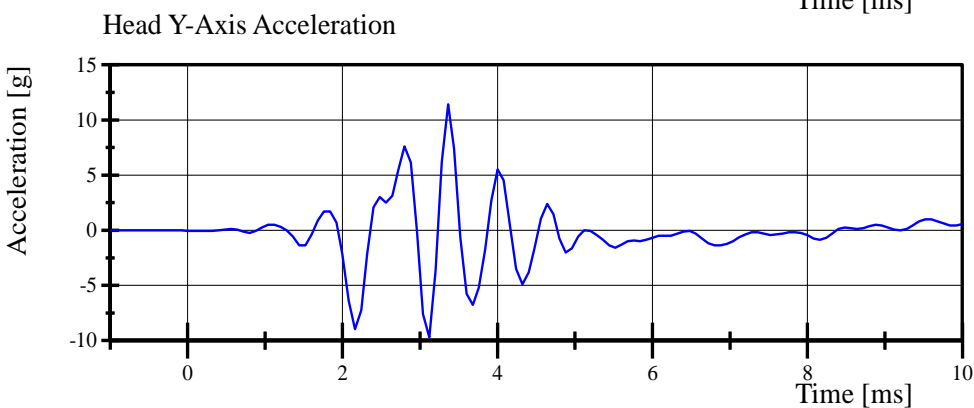
Test Date: 5/19/2020



Filter Class: CFC_1000

Max: 0.0 g at -0.7 ms

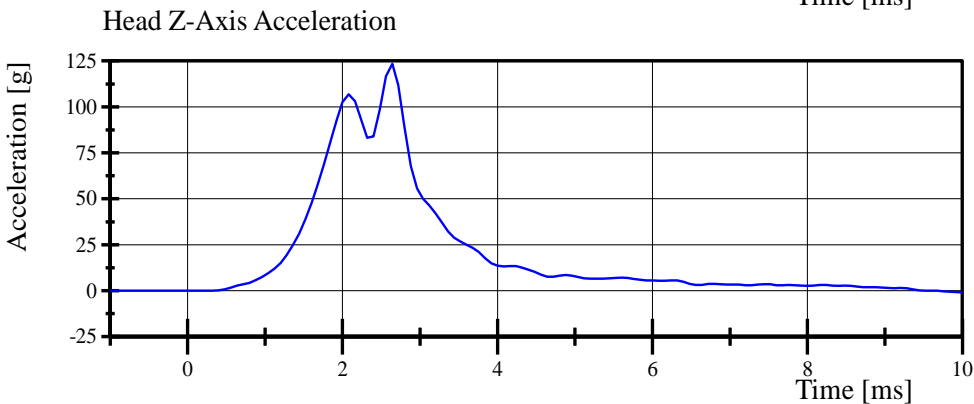
Min: -214.9 g at 2.3 ms



Filter Class: CFC_1000

Max: 11.4 g at 3.4 ms

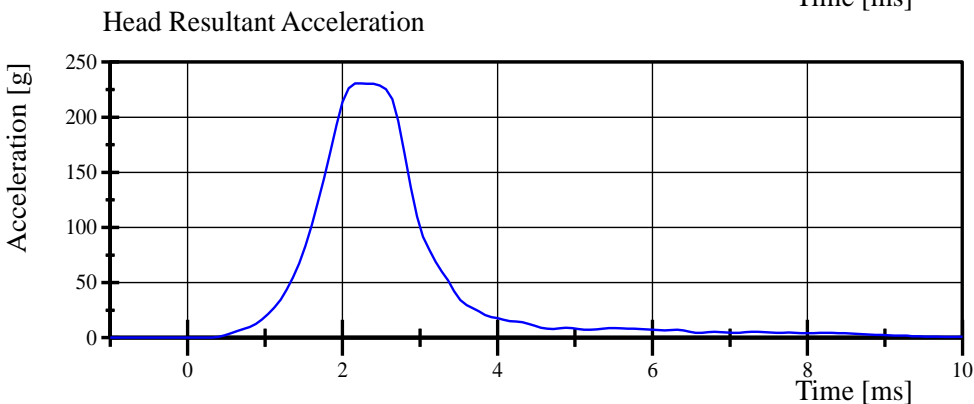
Min: -9.7 g at 3.1 ms



Filter Class: CFC_1000

Max: 123.4 g at 2.6 ms

Min: -0.9 g at 10.0 ms



Filter Class: CFC_1000

Max: 230.6 g at 2.2 ms

Min: 0.0 g at -0.7 ms

Transportation Research Center Inc.

Neck Flexion

HIII 50th Serial No. 045 Certification No. 50-1

Test Date: 5/19/2020

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	20.8 °C	Yes
Relative Humidity	10 - 70 %	59 %	Yes
Pendulum Velocity	6.89 - 7.13 m/s	6.932 m/s	Yes
Pendulum Acceleration Decay Crossing -5g	34 - 42 ms	38.5 ms	Yes
Pendulum Acceleration at 10ms	(-22.5) - (-27.5) g	-23.68 g	Yes
Pendulum Acceleration at 20ms	(-17.6) - (-22.6) g	-21.43 g	Yes
Pendulum Acceleration at 30ms	(-12.5) - (-18.5) g	-16.74 g	Yes
Pendulum Acceleration > 30ms	>= (-29.0) g	-16.74 g	Yes
Total Head D-Plane Rotation Peak	(-64) - (-78) °	-77.3 °	Yes
Time of Peak	57 - 64 ms	62.1 ms	Yes
Total Head D-Plane Rotation Decay to 0°	113 - 128 ms	123.0 ms	Yes
Total Neck Occipital Condyles Moment Peak	88.1 - 108.4 N·m	99.87 N·m	Yes
Time of Peak	47 - 58 ms	51.9 ms	Yes
Total Neck Occipital Condyles Moment Decay to 0 N·m	97 - 107 ms	99.1 ms	Yes

Test meets specifications.

Condition: Used

Comments:

Neck S/N: N/A

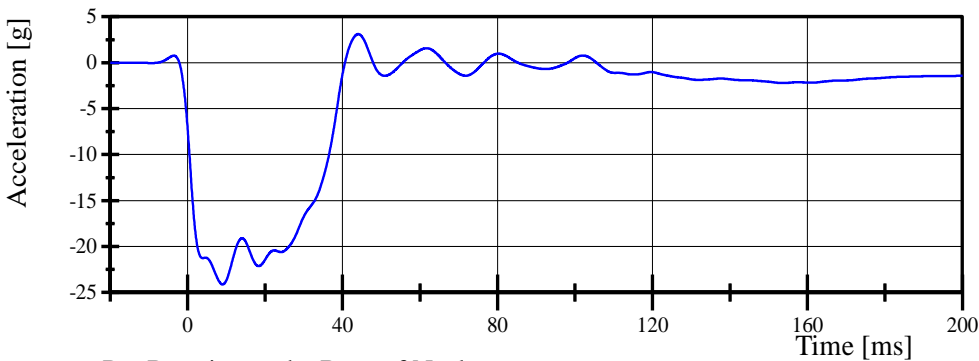
Transportation Research Center Inc.

Neck Flexion

HIII 50th Serial No. 045 Certification No. 50-1

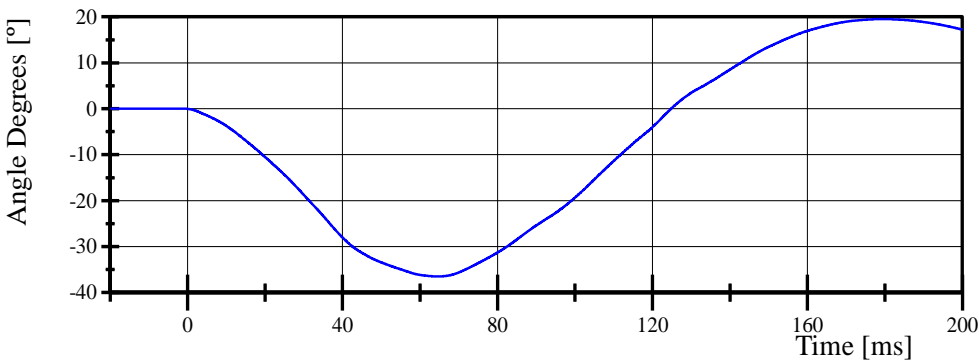
Test Date: 5/19/2020

Pendulum Acceleration



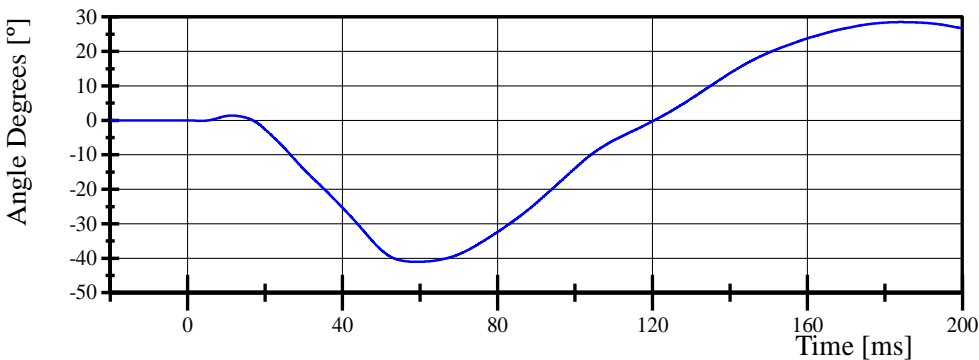
Filter Class: CFC_60
Max: 3.1 g at 44.1 ms
Min: -24.1 g at 9.0 ms

Pot Rotation at the Base of Neck



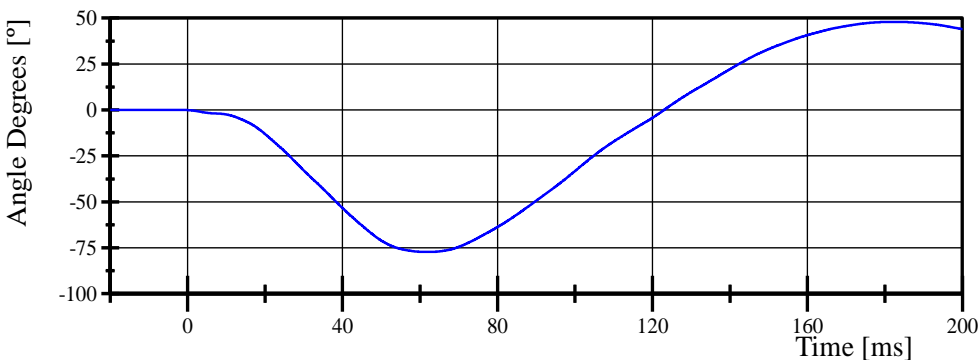
Filter Class: CFC_60
Max: 19.5 ° at 179.3 ms
Min: -36.5 ° at 64.6 ms

Head Rotation at Occypital Condyles



Filter Class: CFC_60
Max: 28.5 ° at 184.1 ms
Min: -41.0 ° at 59.0 ms

Total Head D-Plane Rotation



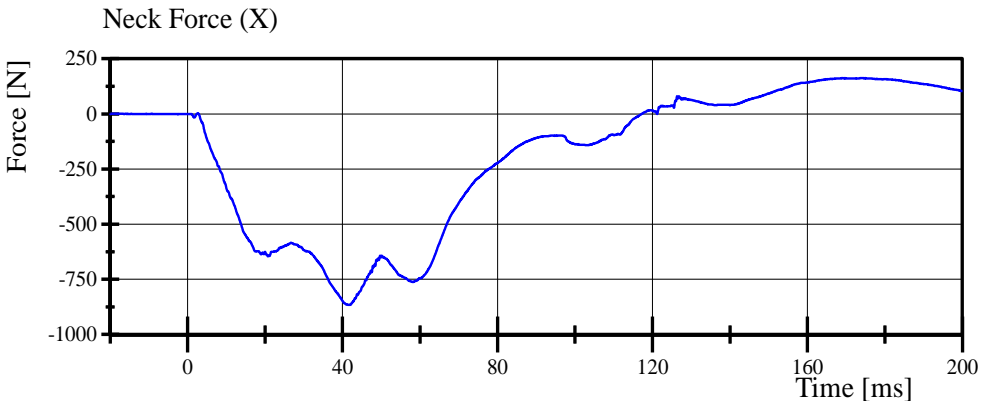
Filter Class: CFC_60
Max: 47.9 ° at 182.4 ms
Min: -77.3 ° at 62.1 ms

Transportation Research Center Inc.

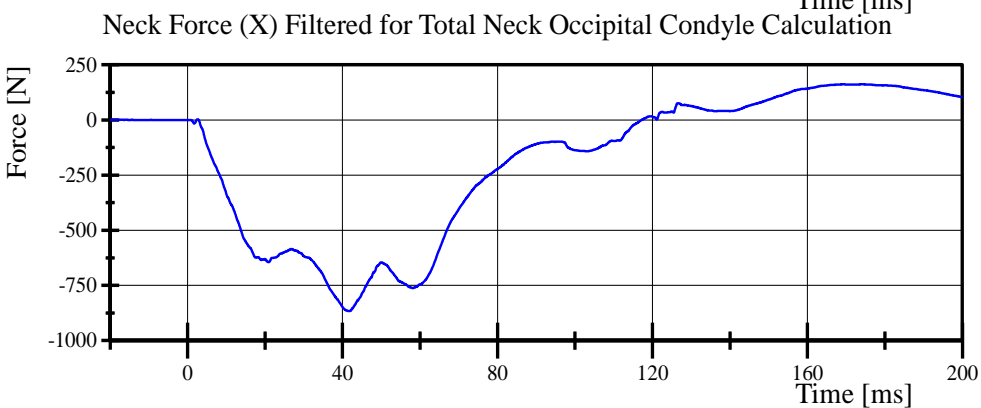
Neck Flexion

HIII 50th Serial No. 045 Certification No. 50-1

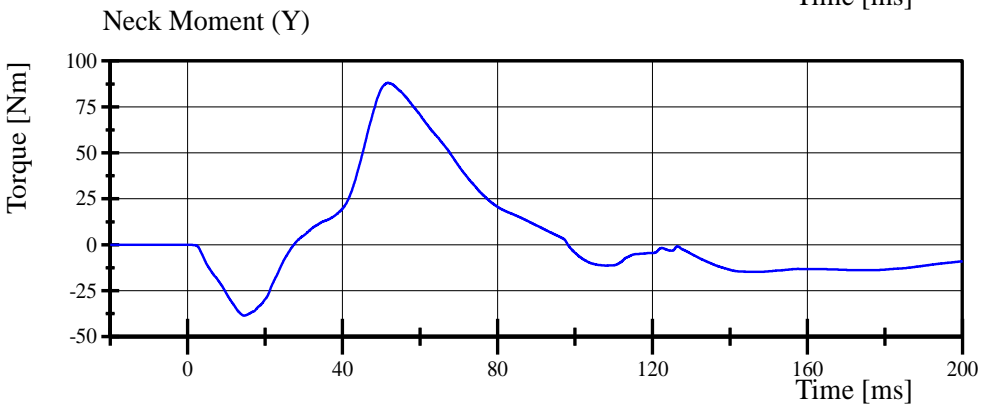
Test Date: 5/19/2020



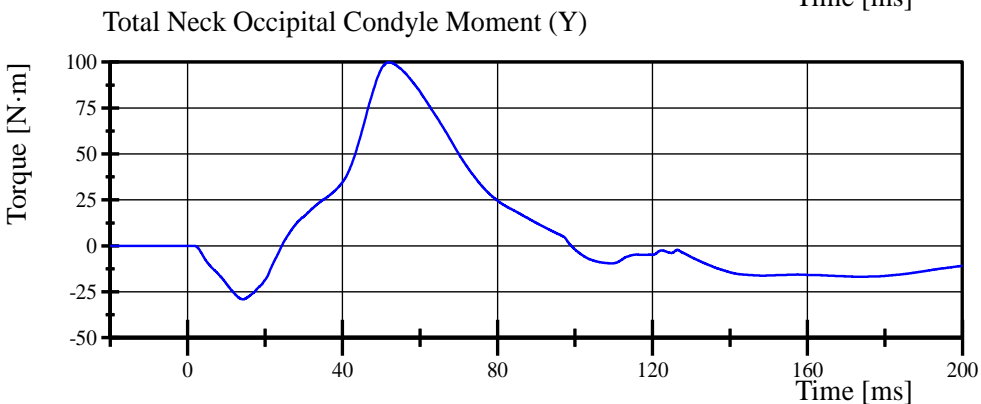
Filter Class: CFC_1000
Max: 162.5 N at 173.9 ms
Min: -866.6 N at 41.5 ms



Filter Class: CFC_600
Max: 162.3 N at 174.0 ms
Min: -866.2 N at 41.6 ms



Filter Class: CFC_600
Max: 88.1 Nm at 51.7 ms
Min: -38.5 Nm at 14.6 ms



Filter Class: Without_(Constar
Max: 99.9 N·m at 51.9 ms
Min: -29.0 N·m at 14.3 ms

Transportation Research Center Inc.

Neck Extension

HIII 50th Serial No. 045 Certification No. 50-1

Test Date: 5/19/2020

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.2 °C	Yes
Relative Humidity	10 - 70 %	59 %	Yes
Pendulum Velocity	(-5.95) - (-6.18) m/s	-5.964 m/s	Yes
Pendulum Acceleration Decay Crossing 5g	38 - 46 ms	44.2 ms	Yes
Pendulum Acceleration at 10ms	17.2 - 21.2 g	17.66 g	Yes
Pendulum Acceleration at 20ms	14.0 - 19.0 g	15.28 g	Yes
Pendulum Acceleration at 30ms	11.0 - 16.0 g	12.54 g	Yes
Pendulum Acceleration > 30ms	<= 22.0 g	12.68 g	Yes
Total Head D-Plane Rotation Peak	81 - 106 °	98.8 °	Yes
Time of Peak	72 - 82 ms	77.5 ms	Yes
Total Head D-Plane Rotation Decay to 0°	147 - 174 ms	160.4 ms	Yes
Total Neck Occipital Condyles Moment Peak	(-52.9) - (-80) N·m	-66.54 N·m	Yes
Time of Peak	65 - 79 ms	72.8 ms	Yes
Total Neck Occipital Condyles Moment Decay to 0 N·m	120 - 148 ms	145.0 ms	Yes

Test meets specifications.

Condition: Used

Comments:

Neck S/N: N/A

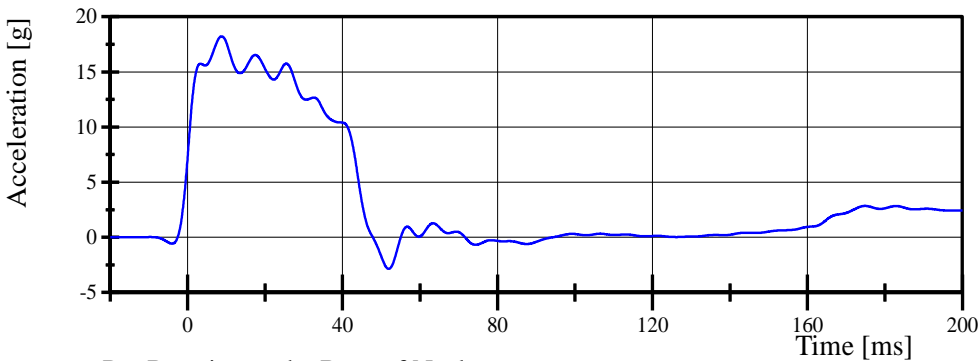
Transportation Research Center Inc.

Neck Extension

HIII 50th Serial No. 045 Certification No. 50-1

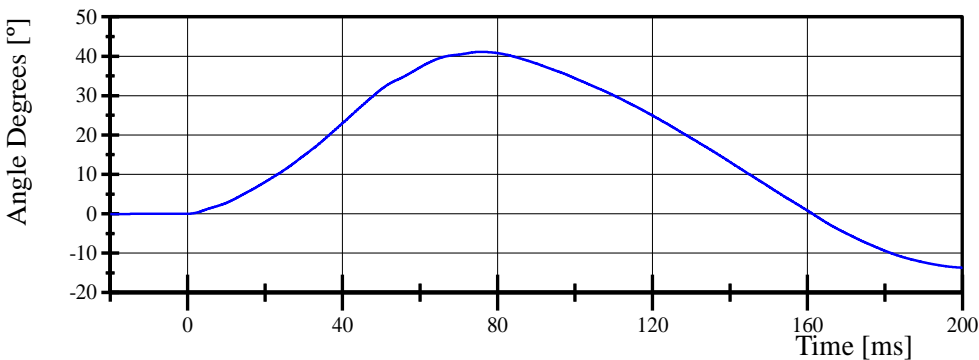
Test Date: 5/19/2020

Pendulum Acceleration



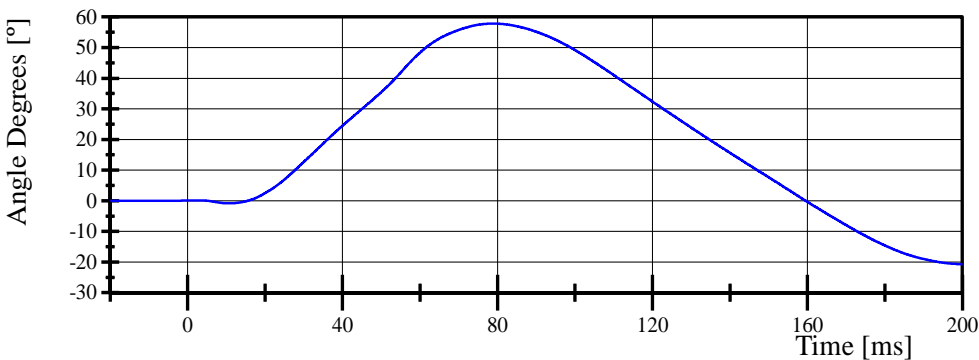
Filter Class: CFC_60
Max: 18.2 g at 8.8 ms
Min: -2.9 g at 51.9 ms

Pot Rotation at the Base of Neck



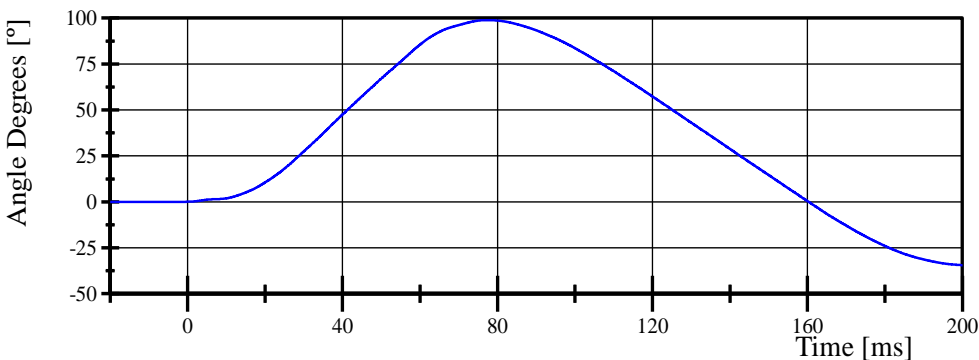
Filter Class: CFC_60
Max: 41.1 ° at 75.8 ms
Min: -13.7 ° at 200.0 ms

Head Rotation at Occypital Condyles



Filter Class: CFC_60
Max: 57.8 ° at 78.9 ms
Min: -20.7 ° at 200.0 ms

Total Head D-Plane Rotation



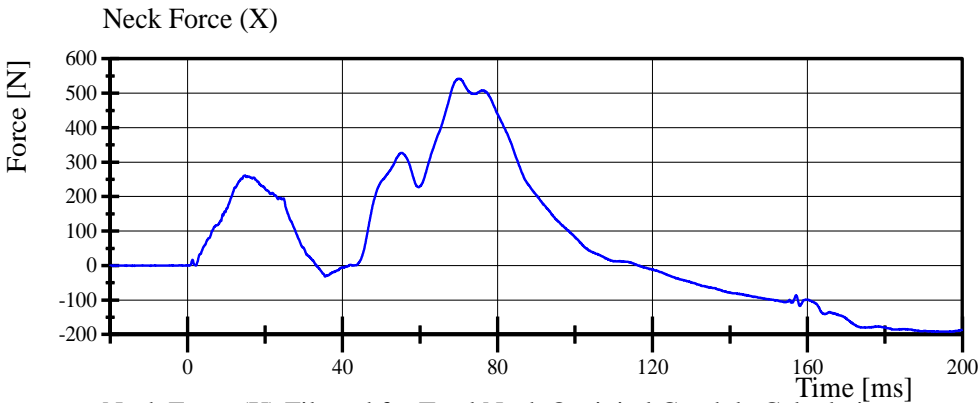
Filter Class: CFC_60
Max: 98.8 ° at 77.5 ms
Min: -34.4 ° at 200.0 ms

Transportation Research Center Inc.

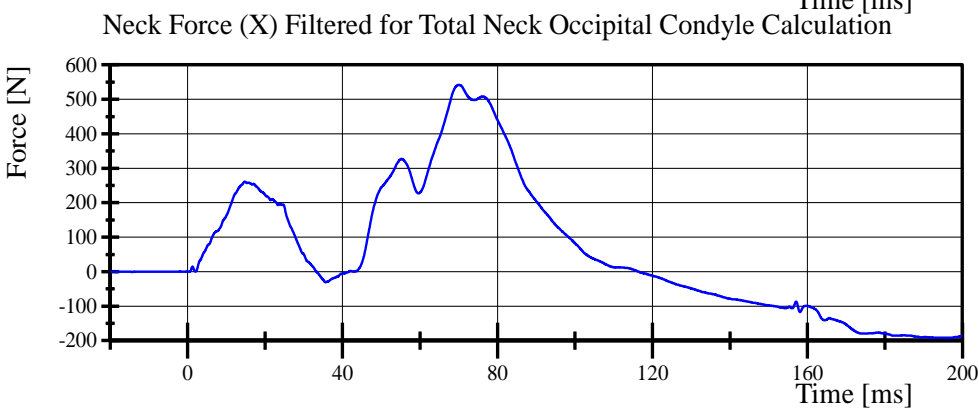
Neck Extension

HIII 50th Serial No. 045 Certification No. 50-1

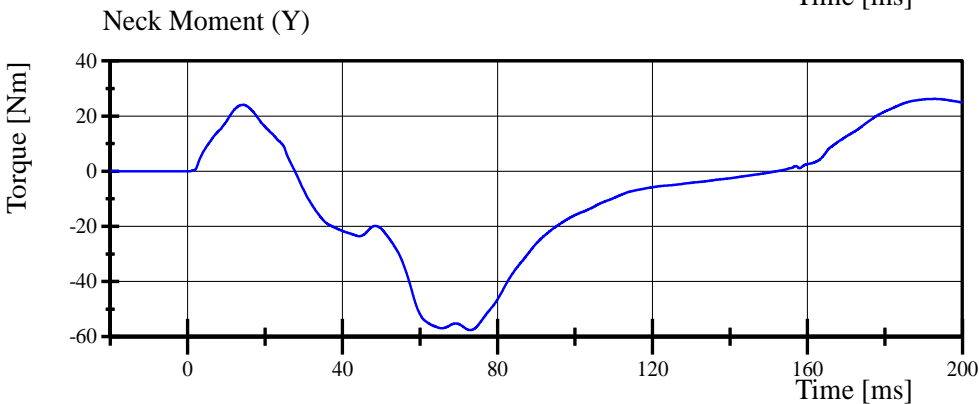
Test Date: 5/19/2020



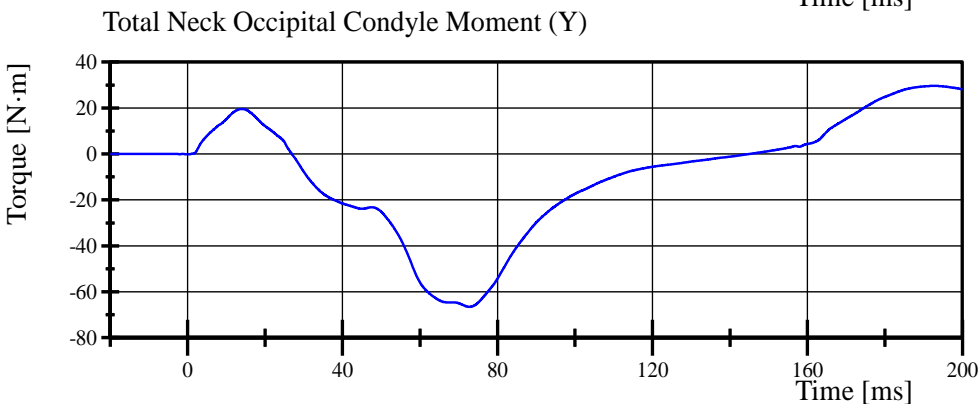
Filter Class: CFC_1000
Max: 542.0 N at 69.9 ms
Min: -192.0 N at 195.1 ms



Filter Class: CFC_600
Max: 541.9 N at 70.0 ms
Min: -191.9 N at 195.9 ms



Filter Class: CFC_600
Max: 26.2 Nm at 192.8 ms
Min: -57.6 Nm at 72.9 ms



Filter Class: Without_(Constar
Max: 29.6 N·m at 192.9 ms
Min: -66.5 N·m at 72.8 ms

Transportation Research Center Inc.

Front Thorax

HIII 50th Serial No. 045 Certification No. 50-1

Test Date: 5/20/2020

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.4 °C	Yes
Relative Humidity	10 - 70 %	43 %	Yes
Probe Velocity	6.59 - 6.83 m/s	6.713 m/s	Yes
Probe Force Peak	(-5,160) - (-5,894) N	-5,604.0 N	Yes
Maximum Chest Compression	(-63.5) - (-72.6) mm	-64.52 mm	Yes
Internal Hysteresis	69 - 85 %	75.2 %	Yes

Test meets specifications.

Condition: Used

Comments:

Jacket S.N: 2846

Rib Set: RS4365

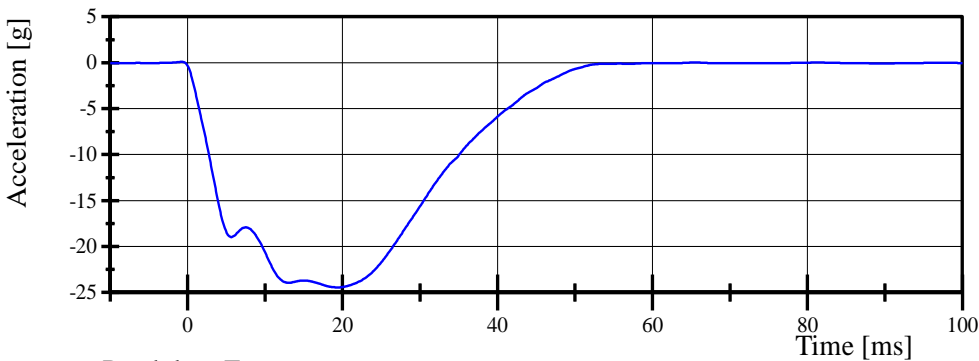
Transportation Research Center Inc.

Front Thorax

HIII 50th Serial No. 045 Certification No. 50-1

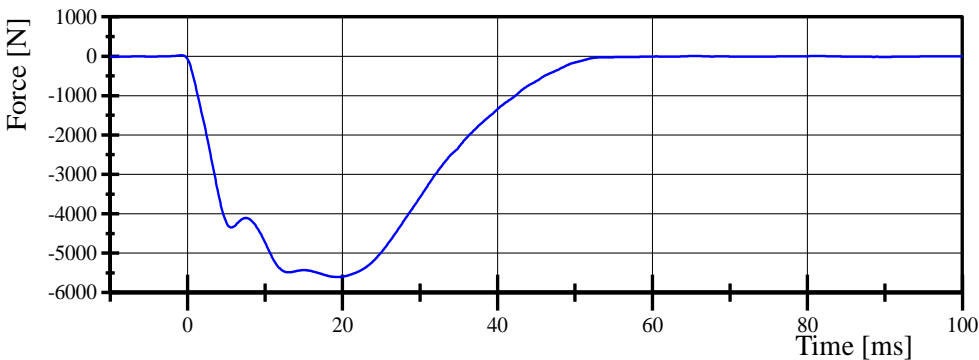
Test Date: 5/20/2020

Pendulum Acceleration



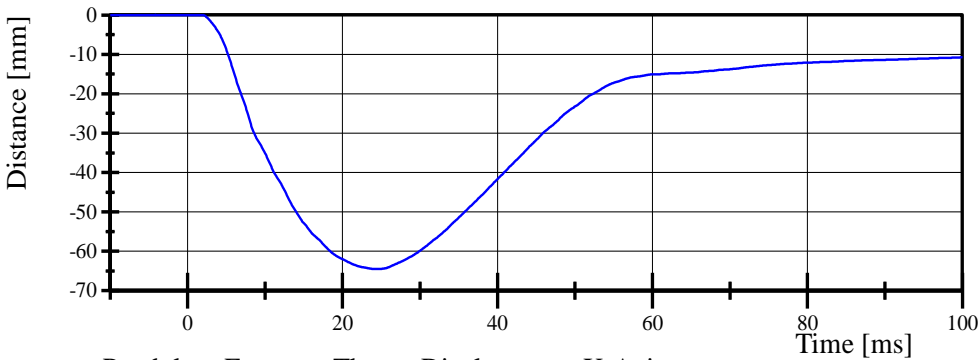
Filter Class: CFC_180
Max: 0.1 g at -0.8 ms
Min: -24.5 g at 19.4 ms

Pendulum Force



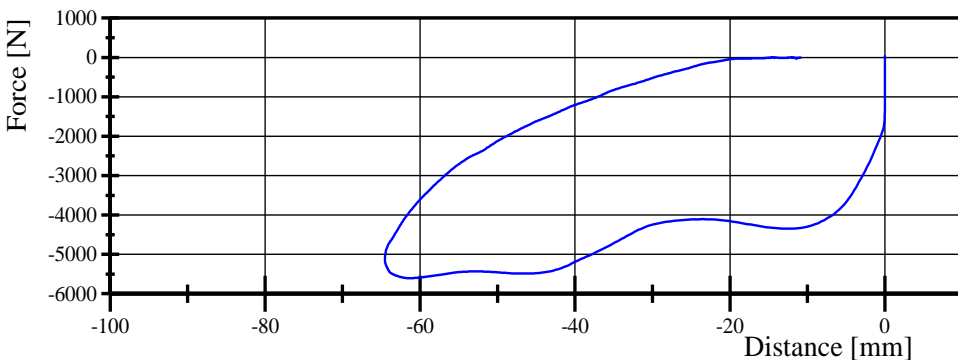
Filter Class: CFC_180
Max: 22.8 N at -0.8 ms
Min: -5,604.0 N at 19.4 ms

Thorax Displacement X-Axis



Filter Class: CFC_600
Max: 0.0 mm at -4.2 ms
Min: -64.5 mm at 24.3 ms

Pendulum Force vs. Thorax Displacement X-Axis



Filter Class: CFC_180
Max: 22.8 N at 0.0 mm
Min: -5,604.0 N at -61.3 mm

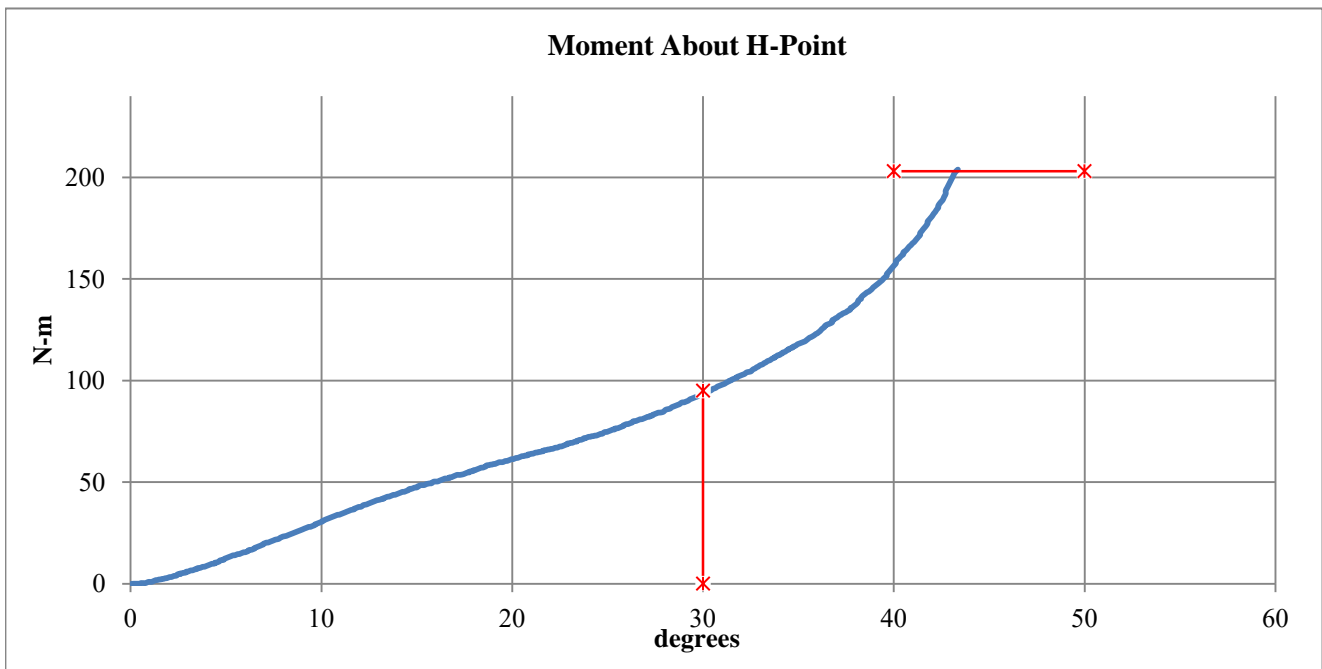
Transportation Research Center Inc.

Hybrid III 50th Male Hip Range of Motion

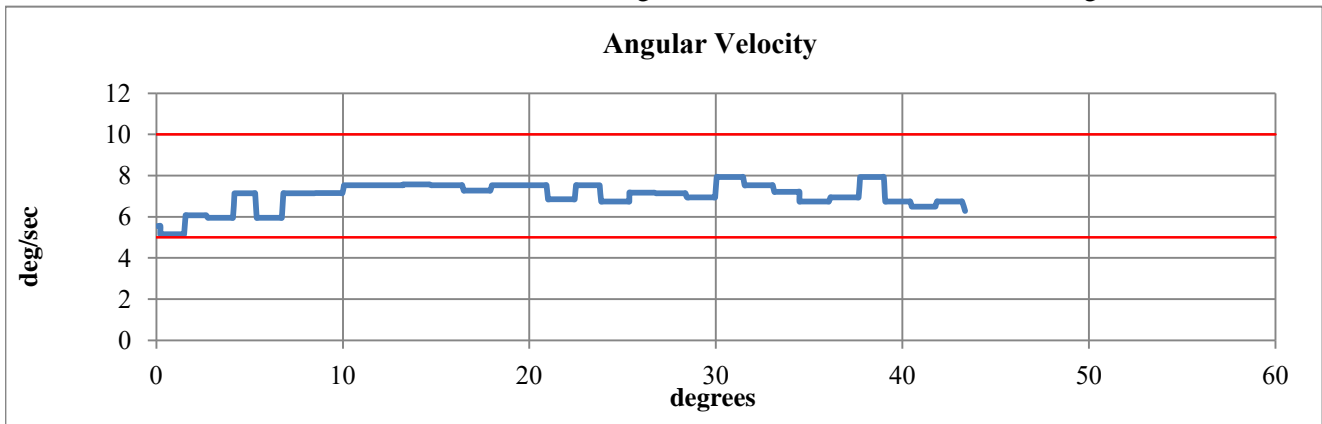


Serial Number: 045 Date: 19-May-2020
 Side Tested: Left Hip Time: 14:52
 Test Number: 1

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature	18.9 - 25.6	21 °C Pass
Humidity	10 - 70	57 % Pass
Moment at 30°	0 ≤ 94.9	93.72 N-m Pass
Angle at 203 Nm	40 - 50	43.36 deg Pass
Average Velocity	5 - 10	7.01 deg/sec Pass



Max: 7.93 deg/sec Min: 5.15 deg/sec



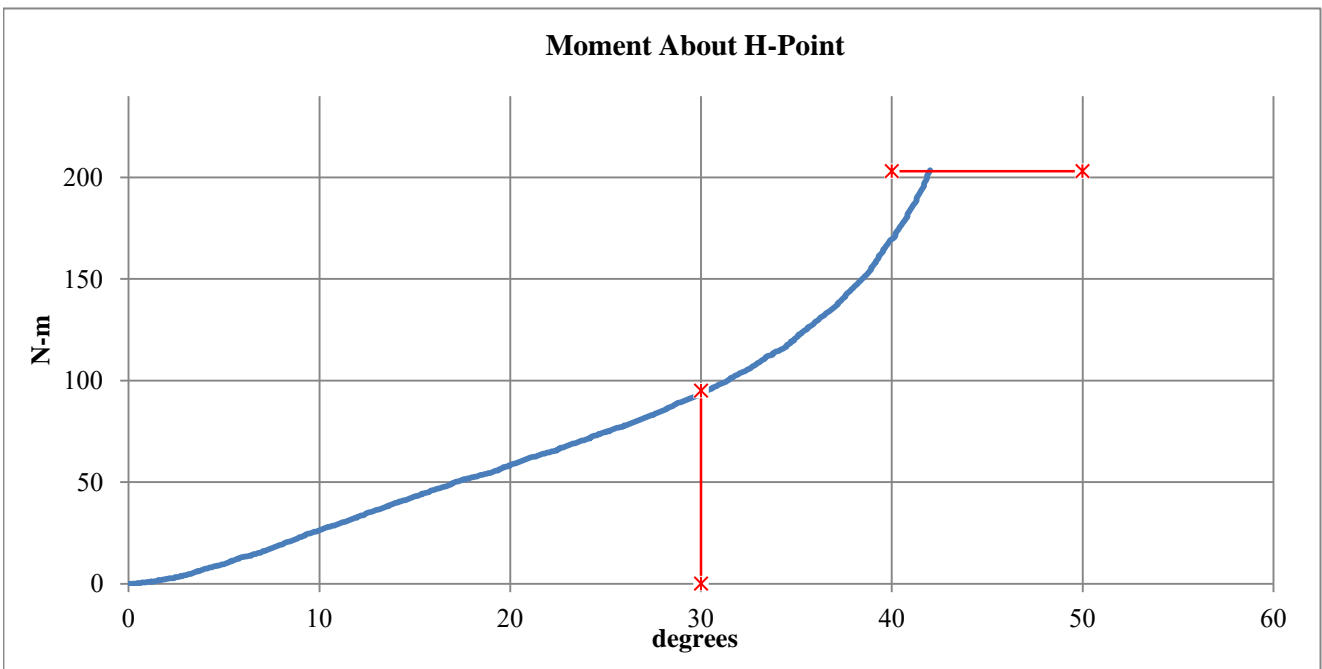
Transportation Research Center Inc.

Hybrid III 50th Male Hip Range of Motion

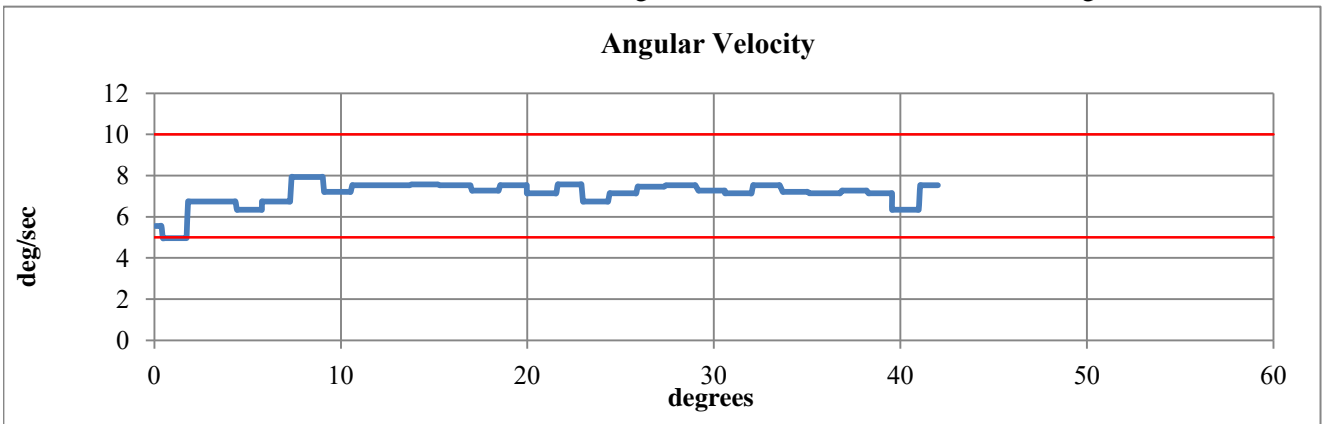


Serial Number: 045 Date: 20-May-2020
 Side Tested: Right Hip Time: 7:48
 Test Number: 1

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature	18.9 - 25.6	21.3 °C Pass
Humidity	10 - 70	43 % Pass
Moment at 30°	0 ≤ 94.9	93.42 N-m Pass
Angle at 203 Nm	40 - 50	42.01 deg Pass
Average Velocity	5 - 10	7.11 deg/sec Pass



Max: 7.93 deg/sec Min: 4.96 deg/sec



Transportation Research Center Inc.

Left Knee Femur Response Test
HIII 50th Serial No. 045 Certification No. 50-1
Test Date: 5/19/2020

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.5 °C	21.1 °C	Yes
Relative Humidity	10 - 70 %	59 %	Yes
Probe Velocity	2.07 - 2.13 m/s	2.108 m/s	Yes
Peak Femur Force	(-4,715.2) - (-5,782.6) N	-5,258.67 N	Yes

Test meets specifications.

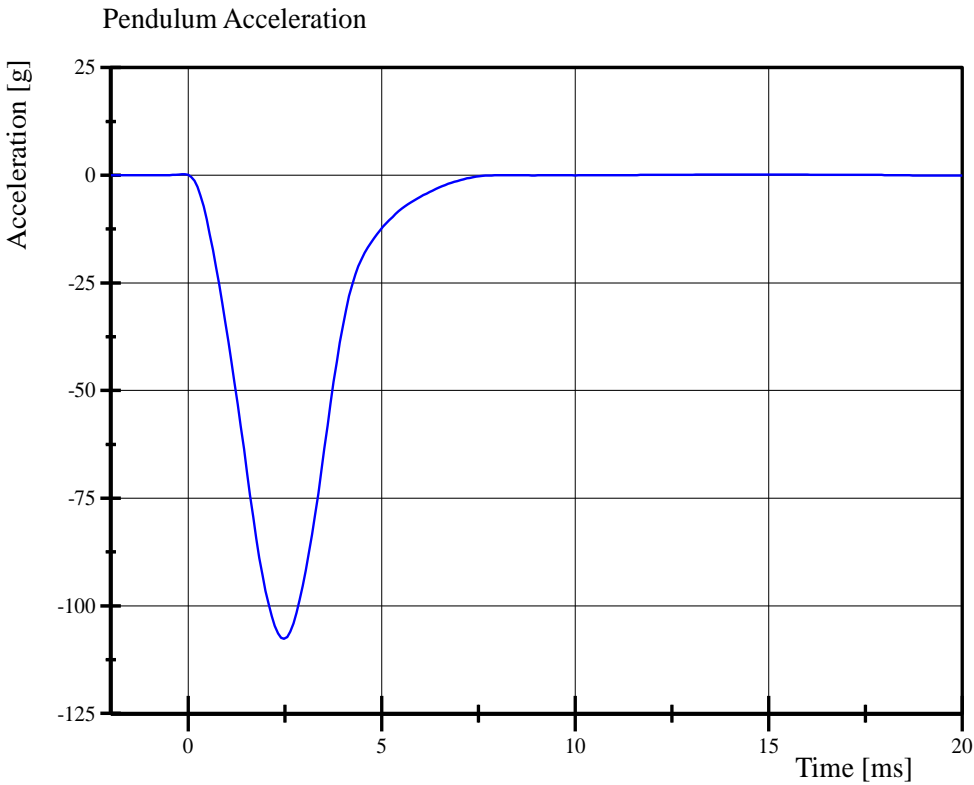
Condition: Used

Comments:

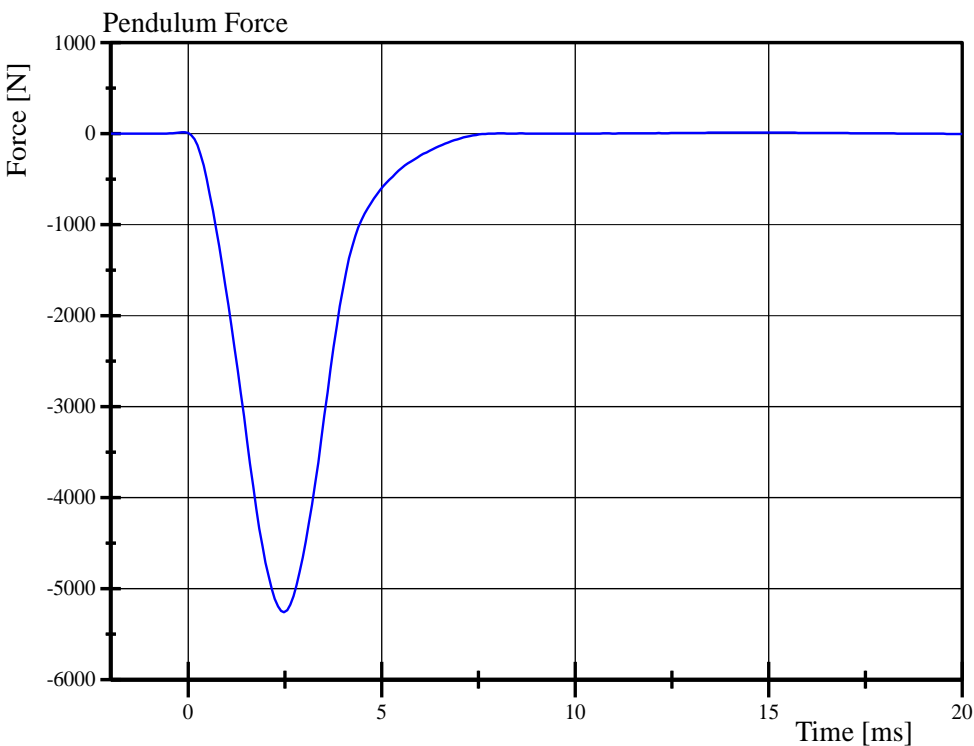
Knee Skin S/N: 079

Transportation Research Center Inc.

Left Knee Femur Response Test
HIII 50th Serial No. 045 Certification No. 50-1
Test Date: 5/19/2020



Filter Class: CFC_600
Max: 0.2 g at -0.1 ms
Min: -107.7 g at 2.5 ms



Filter Class: CFC_600
Max: 12.1 N at -0.1 ms
Min: -5,258.7 N at 2.5 ms

Transportation Research Center Inc.

Right Knee Femur Response Test

HIII 50th Serial No. 045 Certification No. 50-1

Test Date: 5/19/2020

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.5 °C	21.4 °C	Yes
Relative Humidity	10 - 70 %	58 %	Yes
Probe Velocity	2.07 - 2.13 m/s	2.109 m/s	Yes
Peak Femur Force	(-4,715.2) - (-5,782.6) N	-5,007.79 N	Yes

Test meets specifications.

Condition: Used

Comments:

Knee Skin S/N: 079

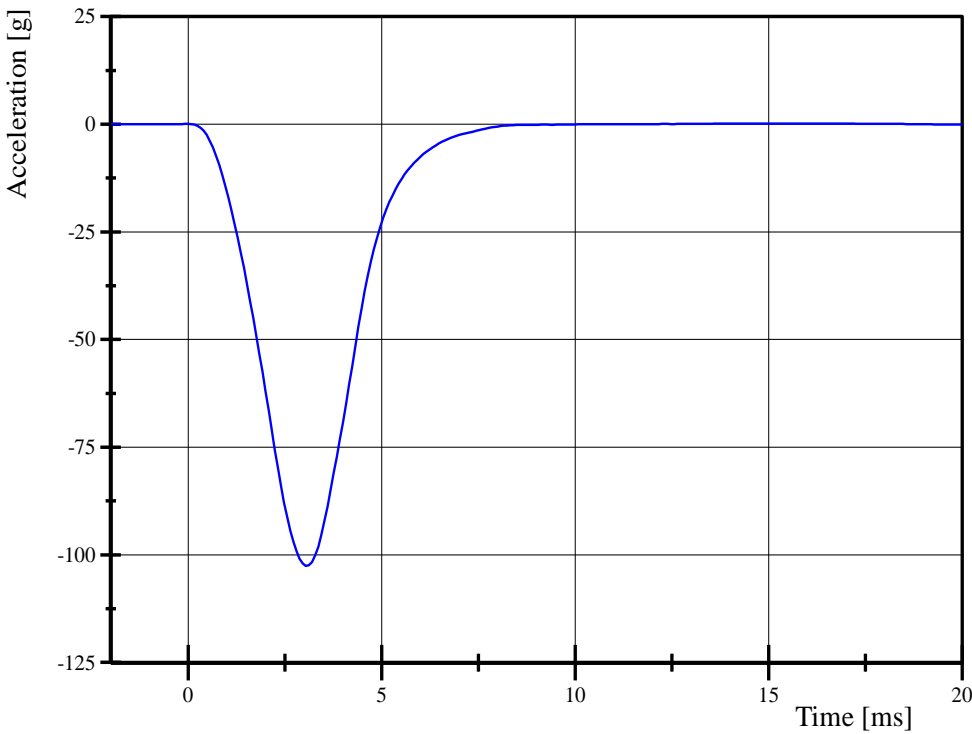
Transportation Research Center Inc.

Right Knee Femur Response Test

HIII 50th Serial No. 045 Certification No. 50-1

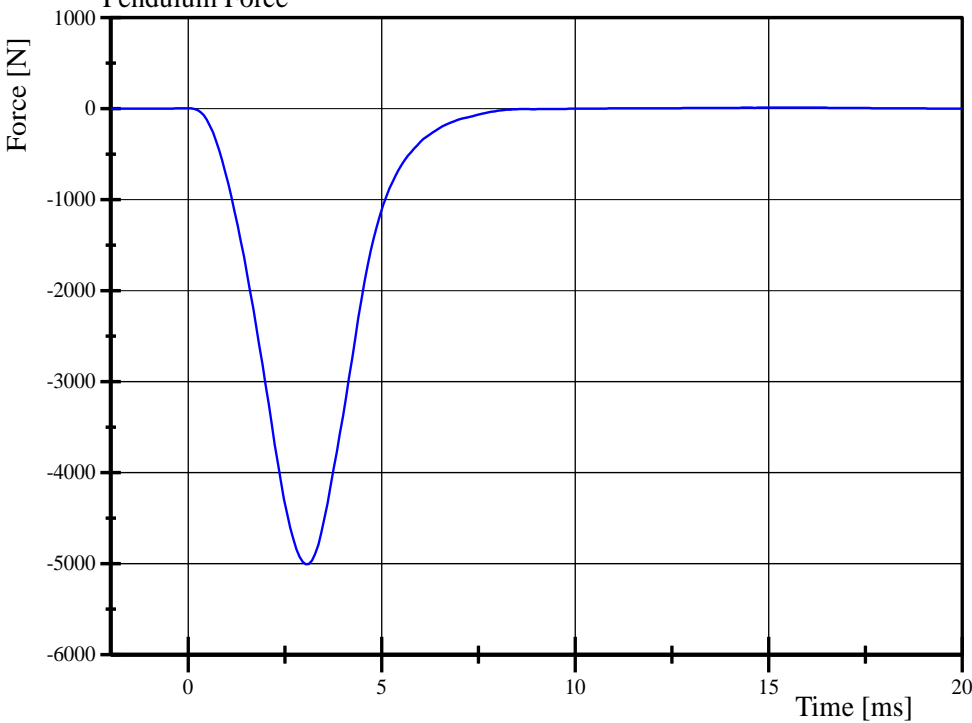
Test Date: 5/19/2020

Pendulum Acceleration



Filter Class: CFC_600
Max: 0.2 g at 15.0 ms
Min: -102.5 g at 3.0 ms

Pendulum Force

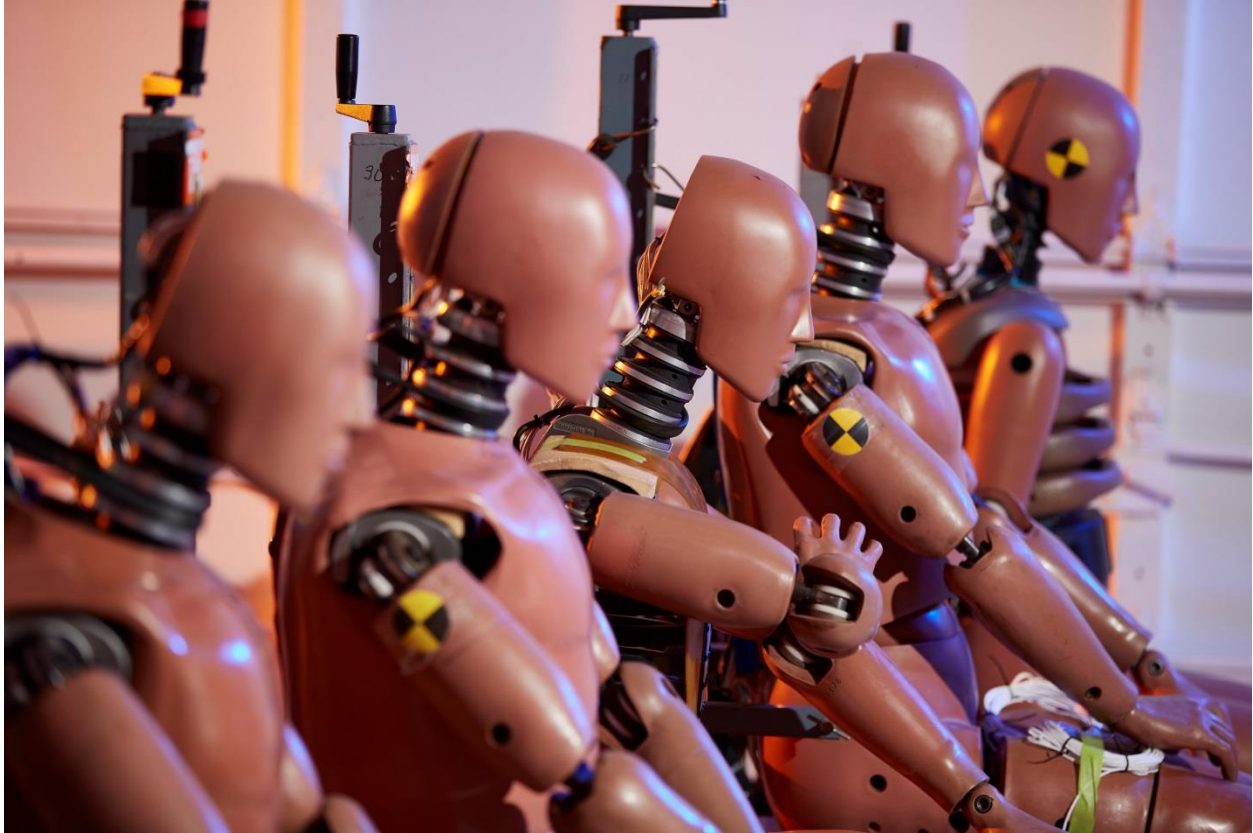


Filter Class: CFC_600
Max: 10.2 N at 15.0 ms
Min: -5,007.8 N at 3.0 ms

Appendix C – Quality Assurance



Quality Assurance



ATD Assembly & Final Inspection

ATD Type: Hybrid III 50th Percentile
Male

ATD Serial Number: 045

Assembled by: *Rust Beards*

Inspected by: *Rust Beards*

Date Inspected: 05/20/2020