

**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

January 2024

**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 1042) 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 triaxial accelerometers and velocities, 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 2021 VW ID.4 (US or EU) or 2023 Nissan Altima (US, CC) 3-point seatbelt.

Section 2 contains the left hand side views of the dummy. Section 3 contains the right hand side views of the dummy. Section 4 contains the dummy certification information.

SECTION 2
LEFT HAND TEST SUMMARY

TEST DUMMY INFORMATION

Description	Position # 4
ATD Type/Serial No.	Hybrid III 50th/1042
Belt Types	2021 VW ID.4
Regulation	US, EU
Positions	LH

CAMERA POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Origin	mm	0.00	0.00	0.00
N1 Front	mm	1,775.05	12.82	-417.15
N3 Left Oblique	mm	1,305.65	-1,570.74	-420.23
N5 Left Side	mm	103.28	-1,616.96	-357.62

DUMMY POSITIONING

BELT: 2021 VW ID.4 – US – LH

TRC Test Number: S240110-1

VRTC Test Number: ECER16_23



DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
SBLC Target	mm	-44.60	-177.94	-584.97
Left Head CG	mm	196.42	-81.96	-759.70
Pre Top String Pot	mm	-129.31	-3.78	-513.45
Pre Bottom String Pot	mm	-52.23	5.84	-114.60
LH Shoulder	mm	39.75	-200.22	-514.63
Dummy Top String Pot	mm	-14.95	-173.58	-520.01
Dummy Bottom String Pot	mm	28.32	-133.83	-122.10
LH H-Point	mm	123.87	-262.09	-105.24
LH Knee	mm	548.54	-149.17	-161.12
LH Ankle	mm	812.68	-128.93	56.97
BON	mm	263.08	-10.40	-743.07
Top Head CG	mm	197.05	-11.97	-869.14
Right Head CG	mm	197.68	63.11	-767.55
RH Shoulder	mm	51.53	205.61	-526.88
RH Knee	mm	564.56	157.92	-155.43
RH Ankle	mm	824.05	120.95	54.12
Pre Inboard SB Anchor	mm	33.66	223.49	51.72
Pre Outboard SB Anchor	mm	90.39	-230.79	20.89
Pre Retractor	mm	-447.81	-247.04	-627.74
Shoulder Belt Upper	mm	203.42	0.65	-521.44
Shoulder Belt Lower	mm	220.73	-0.51	-433.79
Lap Belt Upper	mm	210.49	0.77	-240.79
Lap Belt Lower	mm	225.36	1.70	-198.04
LH H-Point Projected	mm	124.79	-158.37	-104.85
Left Shoulder Front	mm	92.92	-154.17	-532.16

DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED

DUMMY INJURY

HIC (36 ms)	194
HIC (15 ms)	102
BrIC	0.60
NIJ Max	0.27
Chest Clip (3 ms)	32.1
Chest Deflection (mm)	38.9
Torso String Pot (mm)	263
Pelvis String Pot (mm)	128

DUMMY POSITIONING

BELT: 2021 VW ID.4 – EU – LH

TRC Test Number: S240111-1

VRTC Test Number: ECER16_24



DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
SBLC Target	mm	-70.08	-192.72	-583.37
Left Head CG	mm	189.89	-76.43	-766.36
Pre Top String Pot	mm	-140.57	0.37	-517.88
Pre Bottom String Pot	mm	-68.19	0.56	-112.74
LH Shoulder	mm	42.74	-201.59	-521.11
Dummy Top String Pot	mm	-16.07	-175.55	-523.65
Dummy Bottom String Pot	mm	28.35	-141.41	-123.58
LH H-Point	mm	125.86	-268.67	-105.71
LH Knee	mm	549.59	-148.32	-161.88
LH Ankle	mm	813.52	-135.22	57.86
BON	mm	257.52	-5.35	-747.30
Top Head CG	mm	191.42	-2.56	-872.66
Right Head CG	mm	192.38	68.26	-768.62
RH Shoulder	mm	54.95	204.17	-525.57
RH Knee	mm	568.21	151.65	-153.55
RH Ankle	mm	828.72	125.72	57.77
Pre Inboard SB Anchor	mm	34.09	223.38	51.66
Pre Outboard SB Anchor	mm	90.91	-230.99	20.08
Pre Retractor	mm	-447.71	-246.64	-627.32
Shoulder Belt Upper	mm	204.97	-0.23	-505.49
Shoulder Belt Lower	mm	215.51	-0.25	-414.92
Lap Belt Upper	mm	213.93	0.39	-232.80
Lap Belt Lower	mm	223.82	0.54	-185.31
LH H-Point Projected	mm	125.19	-173.28	-106.91
Left Shoulder Front	mm	90.99	-154.44	-536.40
Dummy Bottom String Pot Front	mm	182.27	-179.45	-108.21

DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED

DUMMY INJURY

HIC (36 ms)	302
HIC (15 ms)	177
BrIC	0.68
NIJ Max	0.44
Chest Clip (3 ms)	32.4
Chest Deflection (mm)	38.9
Torso String Pot (mm)	329
Pelvis String Pot (mm)	128

SECTION 3
RIGHT HAND TEST SUMMARY

TEST DUMMY INFORMATION

Description	Position # 6
ATD Type/Serial No.	Hybrid III 50th/1042
Belt Types	2023 Nissan Altima
Regulation	US, CC
Positions	RH

CAMERA POSITIONING FARO MEASUREMENTS

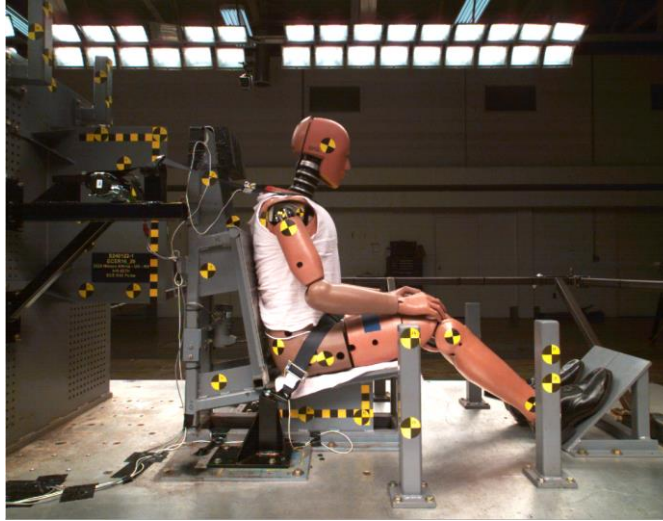
Description	Units	X	Y	Z
Origin	mm	0.00	0.00	0.00
N1 Front	mm	1,775.15	13.10	-417.59
N3 Right Oblique	mm	1,308.84	1,584.54	-424.94
N5 Right Side	mm	212.96	1,577.11	-355.32

DUMMY POSITIONING

BELT: 2023 Nissan Altima – US – RH

TRC Test Number: S240122-1

VRTC Test Number: ECER16_29



DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
SBLC Target	mm	-57.44	165.05	-611.20
BON	mm	251.93	-1.43	-750.57
Top Head CG	mm	214.73	-0.46	-858.83
Right Head CG	mm	183.34	71.44	-764.84
RH Shoulder	mm	49.84	208.78	-521.20
Right Shoulder Front	mm	97.27	153.99	-532.95
Pre Top String Pot	mm	-143.44	4.69	-518.63
Pre Bottom String Pot	mm	-52.53	7.76	-109.51
Dummy Top String Pot	mm	-5.15	173.83	-510.26
Dummy Bottom String Pot	mm	30.26	160.82	-118.22
Dummy Bottom String Pot Front	mm	179.10	199.33	-87.42
RH H-Point	mm	129.22	283.44	-108.39
RH H-Point Projected	mm	130.33	196.52	-98.92
Pre Outboard SB Anchor	mm	8.34	199.14	6.53
Pre Retractor	mm	-544.78	216.78	-646.20
RH Knee	mm	568.70	158.38	-150.88
RH Ankle	mm	824.32	130.13	64.68
Left Head CG	mm	184.08	-72.41	-766.73
LH Shoulder	mm	40.99	-196.83	-517.94
Pre Inboard SB Anchor	mm	-21.13	-165.27	-18.97
LH Knee	mm	552.09	-143.50	-161.49
LH Ankle	mm	813.53	-138.39	57.89
Shoulder Belt Upper	mm	177.91	-0.46	-549.35
Shoulder Belt Lower	mm	209.33	-0.32	-467.63
Lap Belt Upper	mm	210.77	-0.47	-237.26
Lap Belt Lower	mm	222.54	-0.01	-189.49

DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED

DUMMY INJURY

HIC (36 ms)	133
HIC (15 ms)	78
BrIC	0.57
NIJ Max	0.33
Chest Clip (3 ms)	27.6
Chest Deflection (mm)	27.4
Torso String Pot (mm)	307
Pelvis String Pot (mm)	138

DUMMY POSITIONING

BELT: 2023 Nissan Altima – CC – RH

TRC Test Number: S240122-2

VRTC Test Number: ECER16_30



DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
SBLC Target	mm	-53.56	189.72	-600.54
BON	mm	256.15	2.58	-750.03
Top Head CG	mm	218.75	2.09	-857.03
Right Head CG	mm	185.38	74.30	-761.98
RH Shoulder	mm	46.01	208.11	-518.64
Right Shoulder Front	mm	96.44	154.37	-530.42
Pre Top String Pot	mm	-142.56	4.81	-518.01
Pre Bottom String Pot	mm	-54.06	8.70	-111.31
Dummy Top String Pot	mm	-6.99	172.79	-508.68
Dummy Bottom String Pot	mm	27.07	161.95	-116.25
Dummy Bottom String Pot Front	mm	176.10	201.11	-87.60
RH H-Point	mm	125.00	284.86	-107.49
RH H-Point Projected	mm	128.13	198.12	-98.42
Pre Outboard SB Anchor	mm	8.62	198.76	7.77
Pre Retractor	mm	-544.35	217.70	-644.90
RH Knee	mm	566.70	157.27	-151.08
RH Ankle	mm	821.79	130.27	64.77
Left Head CG	mm	189.13	-70.57	-764.17
LH Shoulder	mm	40.83	-196.16	-516.83
Pre Inboard SB Anchor	mm	-21.73	-165.50	-19.77
LH Knee	mm	551.75	-142.70	-169.58
LH Ankle	mm	809.44	-137.17	54.39
Shoulder Belt Upper	mm	208.43	0.85	-475.36
Shoulder Belt Lower	mm	215.47	0.14	-394.14
Lap Belt Upper	mm	209.54	0.31	-238.64
Lap Belt Lower	mm	222.01	1.01	-191.48

DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED

DUMMY INJURY

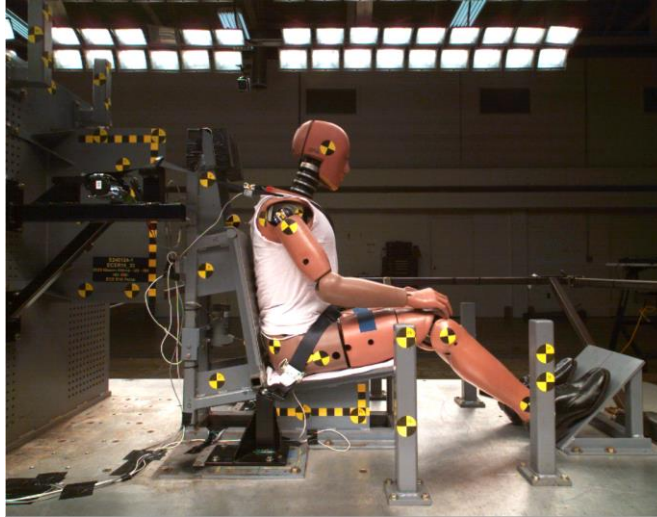
HIC (36 ms)	226
HIC (15 ms)	100
BrIC	0.64
NIJ Max	0.37
Chest Clip (3 ms)	29.5
Chest Deflection (mm)	32.3
Torso String Pot (mm)	383
Pelvis String Pot (mm)	122

DUMMY POSITIONING

BELT: 2023 Nissan Altima – US – RH

TRC Test Number: S240124-1

VRTC Test Number: ECER16_33



DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
SBLC Target	mm	-46.72	184.71	-609.66
BON	mm	261.49	-2.66	-748.73
Top Head CG	mm	226.18	-6.07	-855.58
Right Head CG	mm	192.33	69.15	-763.23
RH Shoulder	mm	53.18	208.12	-522.09
Right Shoulder Front	mm	102.28	152.68	-534.06
Pre Top String Pot	mm	-137.37	3.96	-520.27
Pre Bottom String Pot	mm	-75.24	9.74	-115.17
Dummy Top String Pot	mm	-0.67	171.13	-514.51
Dummy Bottom String Pot	mm	28.95	165.38	-119.59
Dummy Bottom String Pot Front	mm	176.19	204.91	-87.97
RH H-Point	mm	127.19	288.45	-110.02
RH H-Point Projected	mm	128.47	202.34	-99.16
Pre Outboard SB Anchor	mm	6.83	198.05	6.51
Pre Retractor	mm	-544.82	215.64	-646.26
RH Knee	mm	566.72	163.76	-152.01
RH Ankle	mm	821.10	140.42	64.60
Left Head CG	mm	193.81	-77.00	-762.28
LH Shoulder	mm	43.70	-197.92	-512.83
Pre Inboard SB Anchor	mm	-20.77	-163.98	-18.73
LH Knee	mm	546.31	-139.19	-166.92
LH Ankle	mm	805.68	-129.71	57.87
Shoulder Belt Upper	mm	212.00	0.22	-475.78
Shoulder Belt Lower	mm	218.15	0.74	-390.98
Lap Belt Upper	mm	209.88	-0.14	-238.58

DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED

DUMMY INJURY

HIC (36 ms)	186
HIC (15 ms)	125
BrIC	0.65
NIJ Max	0.37
Chest Clip (3 ms)	26.2
Chest Deflection (mm)	35.4
Torso String Pot (mm)	339
Pelvis String Pot (mm)	127

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:

H3 50th Male
Serial No. 1042
Certification No. 04



Transportation Research Center Inc.
P.O. Box B-67
10820 St. Rt. 347
East Liberty, OH 43319-0367

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Introduction

Customer Name: VRTC
Customer Contact: Bryan Crabtree
Email: Bryan.Crabtree.CTR@dot.gov
Phone: (937) 666-2011
Date Received: December 14, 2023
Date Completed: January 03, 2024

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 Received: 12/14/2023

Testing Conducted by: 
Robert Benavides

Date: 1/03/2024

Testing Approved by: 
Ian Sharp

Date: 1/03/2024



Appendix A – Incoming Inspection





TRC ATD Laboratory As Received Inspection Report

Name: Robert Benavides

Date: 12/14/2023

Customer: VRTC

ATD S/N: 1042

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: 12/14/2023

Customer: VRTC

ATD S/N: 1042

1

2

3

4

5

6





TRC ATD Laboratory Inspection Report Action Items

Name: Robert Benavides

Date: 12/14/2023

Customer: VRTC

ATD S/N: 1042

Action #1	Thorax test failed. Jacket S/N: 2842 Rib Set S/N: 1172
Resolution #1	Replaced jacket and rib set. Jacket S/N: EY4394 Rib Set S/N: 10348
Action #2	
Resolution #2	
Action #3	
Resolution #3	
Comments	



Appendix B – Test Results



Transportation Research Center Inc.

Front Head Drop

HIII 50th Serial No. 1042 Certification No. 4-1

Test Date: 12/19/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	20.6 °C	Yes
Relative Humidity	10 - 70 %	36 %	Yes
Peak Head Resultant Acceleration	225 - 275 g	243.2 g	Yes
Peak Head Lateral Acceleration	(-15) - 15 g	-4.0 g	Yes
Is Acceleration Curve Unimodal within 10% of Peak?	< 10 %	1.90 %	Yes

Test meets specifications.

Condition: Used

Comments:

Head Skin S/N: 8171

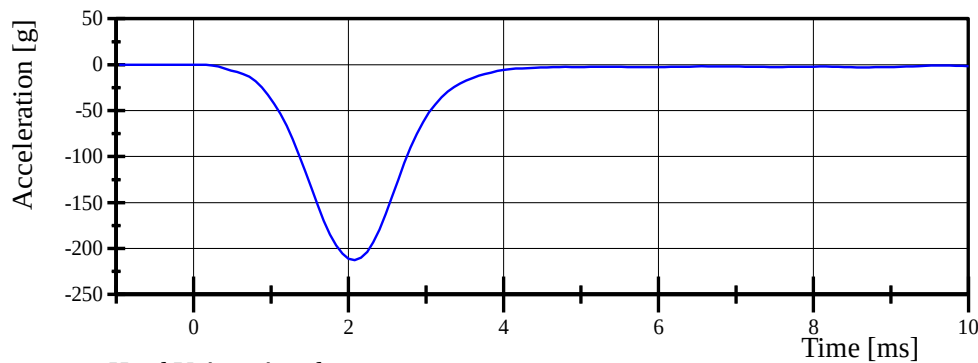
Transportation Research Center Inc.

Front Head Drop

HIII 50th Serial No. 1042 Certification No. 4-1

Test Date: 12/19/2023

Head X-Axis Acceleration

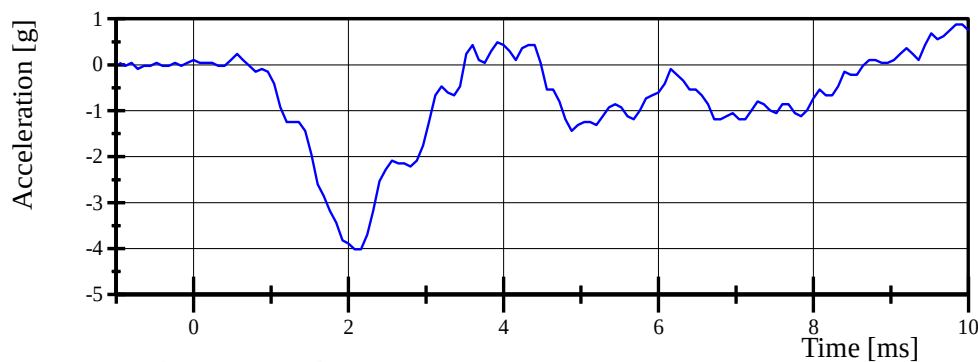


Filter Class: CFC_1000

Max: 0.1 g at -0.8 ms

Min: -212.6 g at 2.1 ms

Head Y-Axis Acceleration

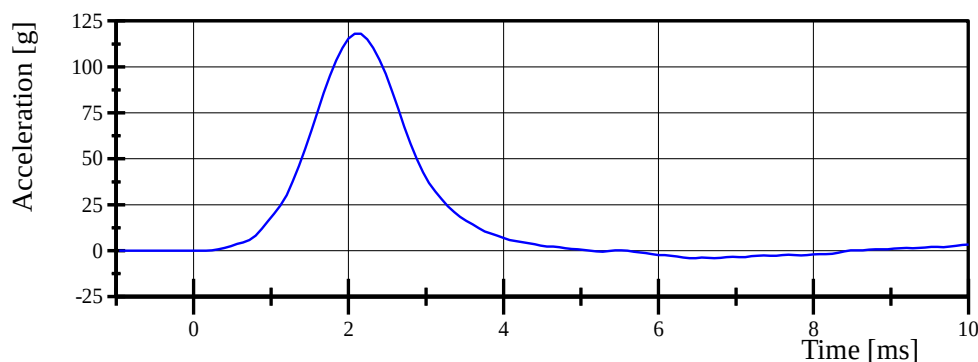


Filter Class: CFC_1000

Max: 0.9 g at 9.8 ms

Min: -4.0 g at 2.1 ms

Head Z-Axis Acceleration

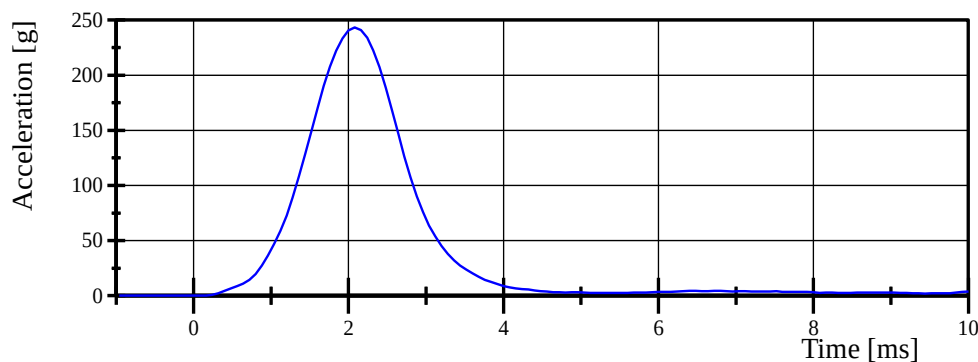


Filter Class: CFC_1000

Max: 118.0 g at 2.1 ms

Min: -4.1 g at 6.4 ms

Head Resultant Acceleration



Filter Class: CFC_1000

Max: 243.2 g at 2.1 ms

Min: 0.0 g at -0.6 ms

Transportation Research Center Inc.

Neck Flexion

HIII 50th Serial No. 1042 Certification No. 4-4

Test Date: 12/20/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.4 °C	Yes
Relative Humidity	10 - 70 %	34 %	Yes
Pendulum Velocity	6.89 - 7.13 m/s	7.119 m/s	Yes
Pendulum Acceleration Decay Crossing -5g	34 - 42 ms	39.8 ms	Yes
Pendulum Acceleration at 10ms	(-22.5) - (-27.5) g	-24.29 g	Yes
at 20ms	(-17.6) - (-22.6) g	-20.55 g	Yes
at 30ms	(-12.5) - (-18.5) g	-15.70 g	Yes
> 30ms	>= (-29.0) g	-15.70 g	Yes
Total Head D-Plane Rotation Peak	(-64) - (-78) °	-66.2 °	Yes
Time of Peak	57 - 64 ms	57.3 ms	Yes
Decay to 0°	113 - 128 ms	117.7 ms	Yes
Total Neck Occipital Condyles Moment Peak	88.1 - 108.4 N·m	95.90 N·m	Yes
Time of Peak	47 - 58 ms	51.1 ms	Yes
Decay to 0 N·m	97 - 107 ms	99.1 ms	Yes

Test meets specifications.

Condition: Used

Comments:

Neck S/N: 10048

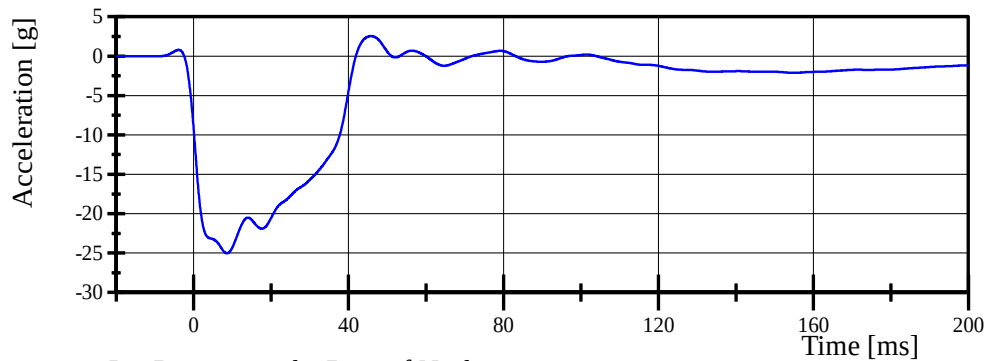
Transportation Research Center Inc.

Neck Flexion

HIII 50th Serial No. 1042 Certification No. 4-4

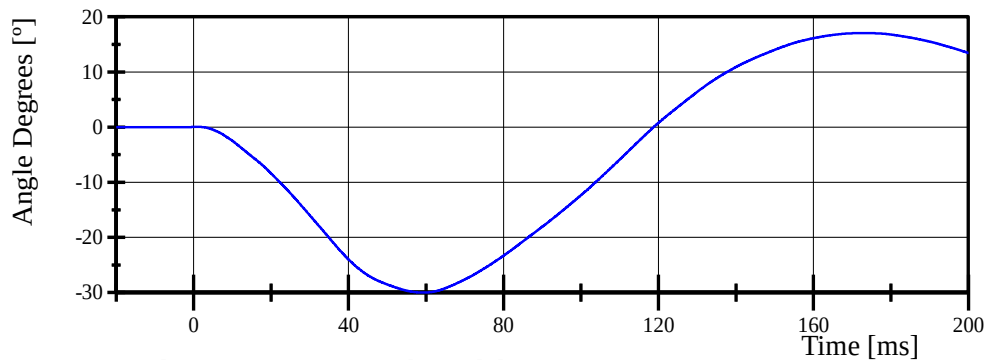
Test Date: 12/20/2023

Pendulum Acceleration



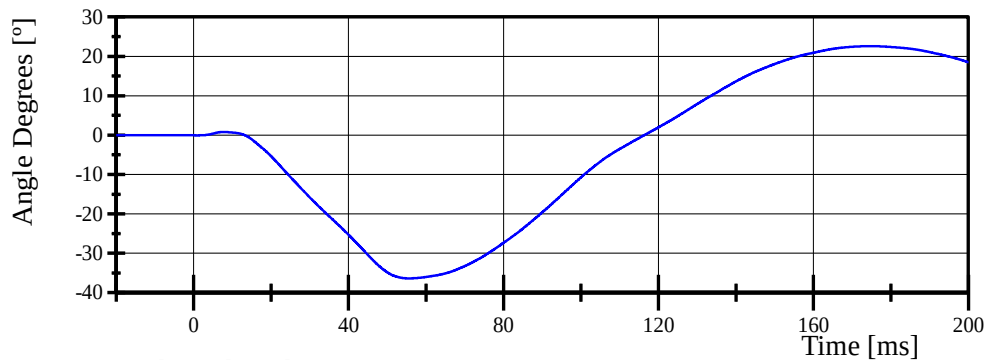
Filter Class: CFC_60
Max: 2.5 g at 45.8 ms
Min: -25.0 g at 8.6 ms

Pot Rotation at the Base of Neck



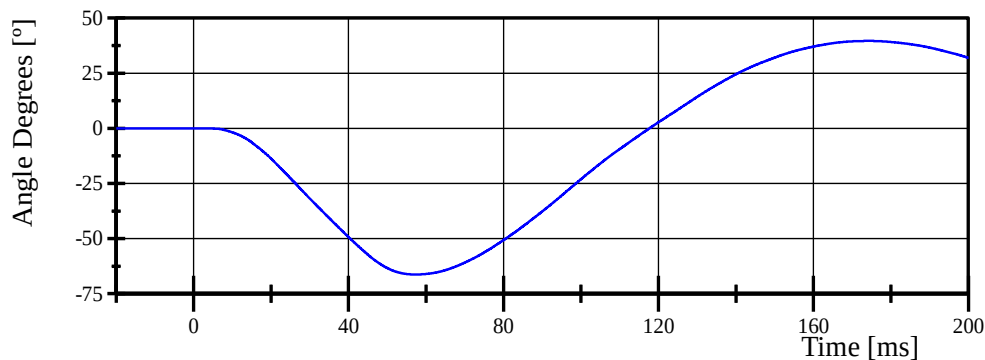
Filter Class: CFC_60
Max: 17.0 ° at 173.0 ms
Min: -30.0 ° at 59.3 ms

Head Rotation at Occypital Condyles



Filter Class: CFC_60
Max: 22.6 ° at 174.8 ms
Min: -36.4 ° at 55.6 ms

Total Head D-Plane Rotation



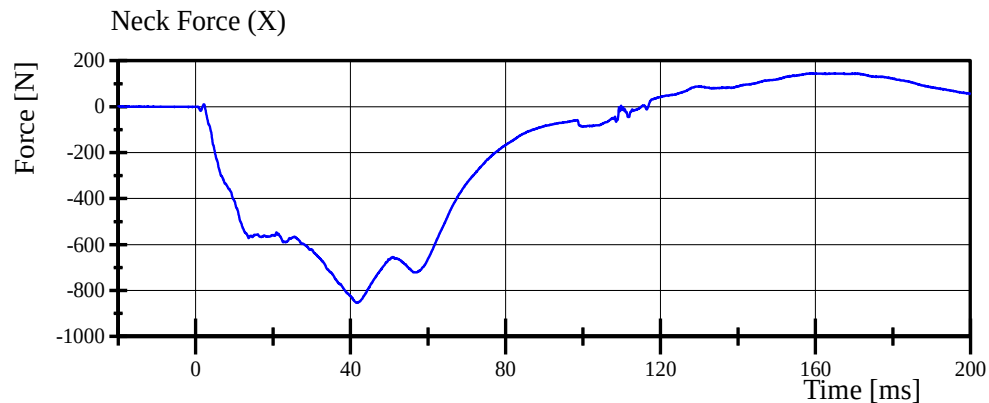
Filter Class: CFC_60
Max: 39.6 ° at 174.4 ms
Min: -66.2 ° at 57.3 ms

Transportation Research Center Inc.

Neck Flexion

HIII 50th Serial No. 1042 Certification No. 4-4

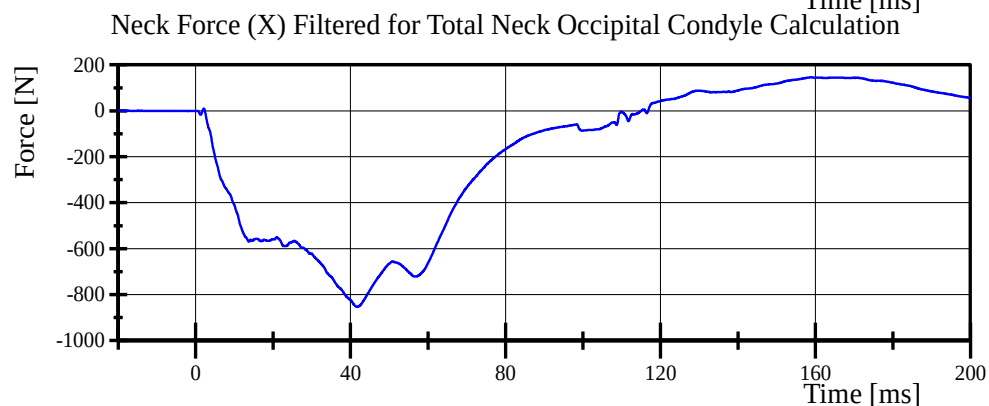
Test Date: 12/20/2023



Filter Class: CFC_1000

Max: 145.6 N at 158.7 ms

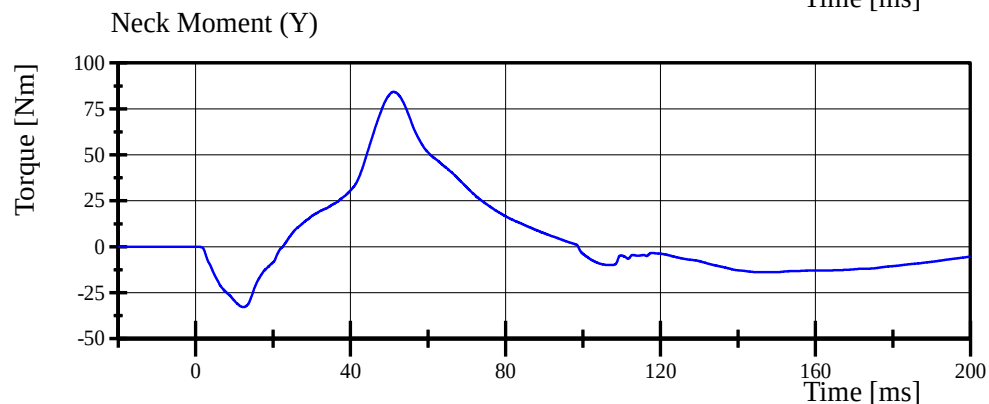
Min: -853.6 N at 41.7 ms



Filter Class: CFC_600

Max: 145.2 N at 158.7 ms

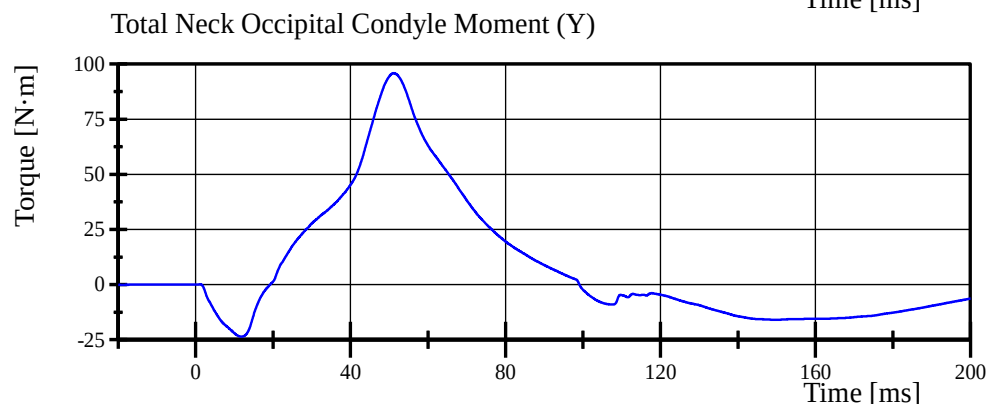
Min: -853.4 N at 41.7 ms



Filter Class: CFC_600

Max: 84.3 Nm at 51.1 ms

Min: -32.8 Nm at 12.4 ms



Filter Class: Without_(Consta

Max: 95.9 N·m at 51.1 ms

Min: -23.6 N·m at 11.8 ms

Transportation Research Center Inc.

Neck Extension

HIII 50th Serial No. 1042 Certification No. 4-1

Test Date: 12/20/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	20.7 °C	Yes
Relative Humidity	10 - 70 %	35 %	Yes
Pendulum Velocity	(-5.95) - (-6.18) m/s	-6.042 m/s	Yes
Pendulum Acceleration Decay Crossing 5g	38 - 46 ms	40.7 ms	Yes
Pendulum Acceleration at 10ms	17.2 - 21.2 g	18.56 g	Yes
at 20ms	14.0 - 19.0 g	17.49 g	Yes
at 30ms	11.0 - 16.0 g	14.50 g	Yes
> 30ms	<= 22.0 g	14.50 g	Yes
Total Head D-Plane Rotation Peak	81 - 106 °	90.2 °	Yes
Time of Peak	72 - 82 ms	77.7 ms	Yes
Decay to 0°	147 - 174 ms	162.2 ms	Yes
Total Neck Occipital Condyles Moment Peak	(-52.9) - (-80) N·m	-56.75 N·m	Yes
Time of Peak	65 - 79 ms	71.2 ms	Yes
Decay to 0 N·m	120 - 148 ms	141.7 ms	Yes

Test meets specifications.

Condition: Used

Comments:

Neck S/N: 10048

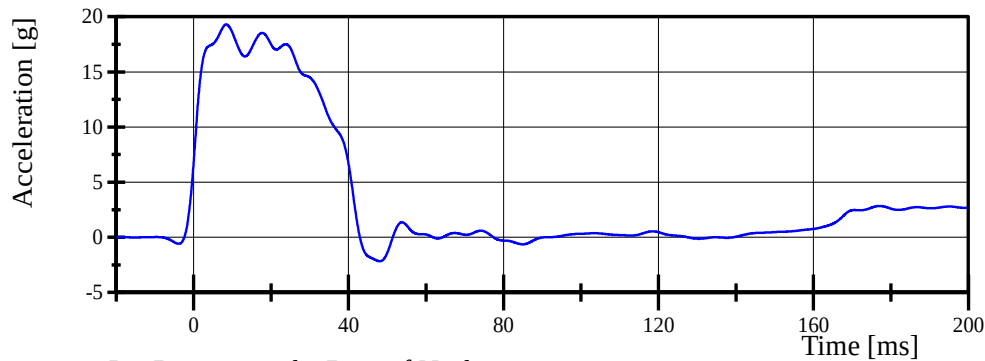
Transportation Research Center Inc.

Neck Extension

HIII 50th Serial No. 1042 Certification No. 4-1

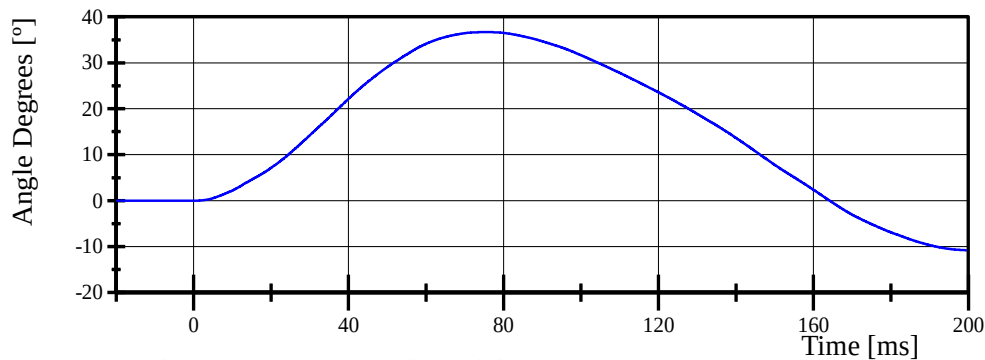
Test Date: 12/20/2023

Pendulum Acceleration



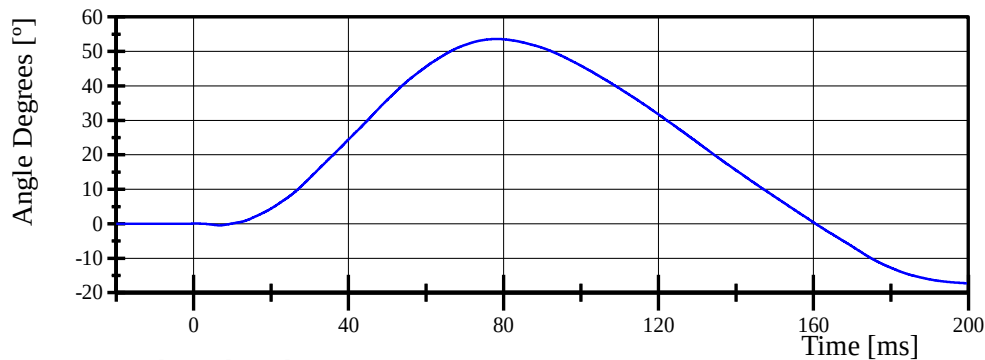
Filter Class: CFC_60
Max: 19.3 g at 8.4 ms
Min: -2.2 g at 48.1 ms

Pot Rotation at the Base of Neck



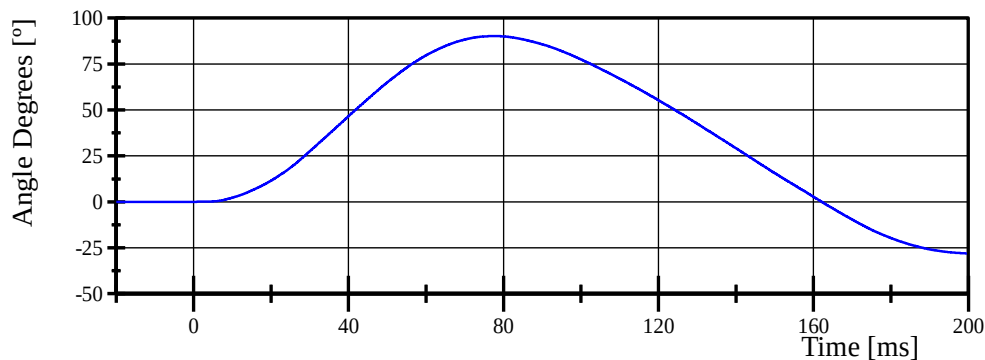
Filter Class: CFC_60
Max: 36.7 ° at 75.5 ms
Min: -10.8 ° at 199.7 ms

Head Rotation at Occypital Condyles



Filter Class: CFC_60
Max: 53.6 ° at 78.2 ms
Min: -17.3 ° at 199.7 ms

Total Head D-Plane Rotation



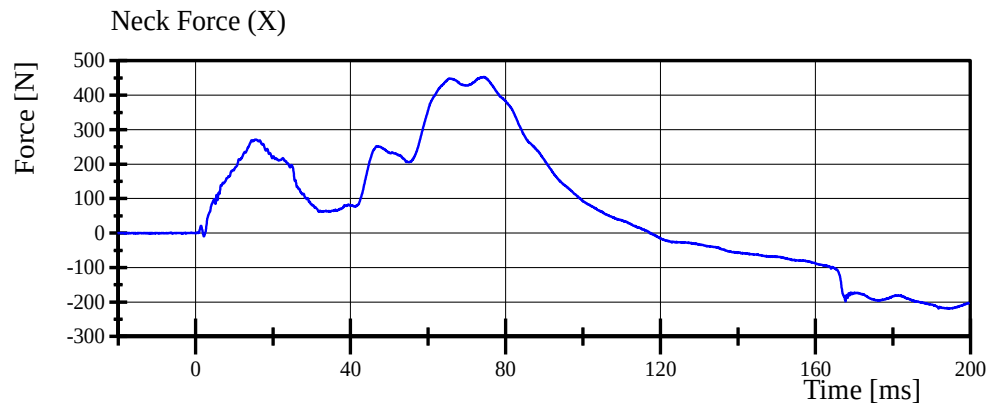
Filter Class: CFC_60
Max: 90.2 ° at 77.7 ms
Min: -28.1 ° at 199.7 ms

Transportation Research Center Inc.

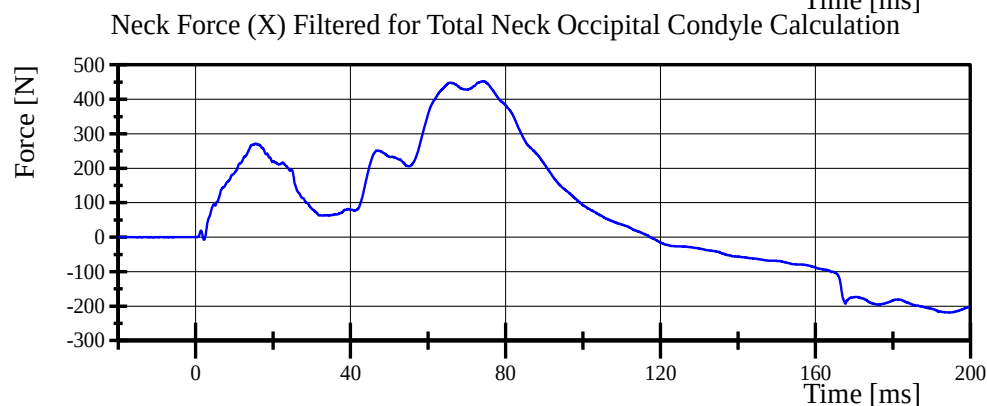
Neck Extension

HIII 50th Serial No. 1042 Certification No. 4-1

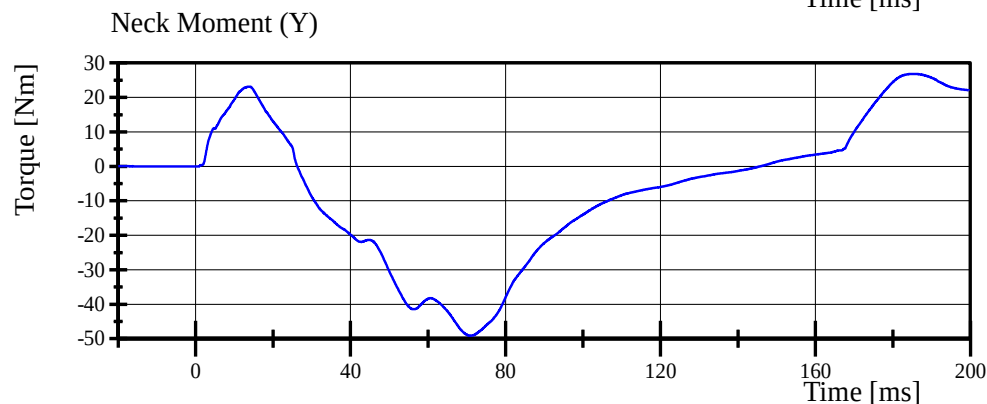
Test Date: 12/20/2023



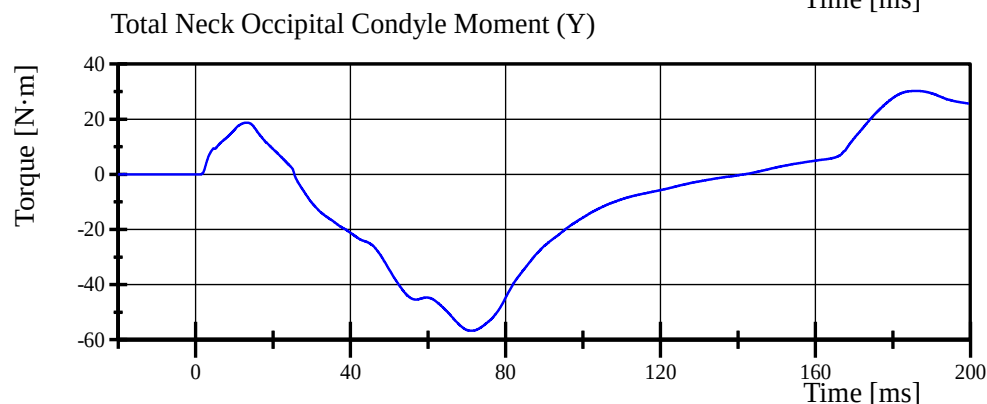
Filter Class: CFC_1000
Max: 452.9 N at 74.5 ms
Min: -219.1 N at 194.5 ms



Filter Class: CFC_600
Max: 452.5 N at 74.5 ms
Min: -218.7 N at 194.5 ms



Filter Class: CFC_600
Max: 26.8 Nm at 185.2 ms
Min: -49.1 Nm at 71.0 ms



Filter Class: Without_(Consta
Max: 30.3 N·m at 186.2 ms
Min: -56.7 N·m at 71.2 ms

Transportation Research Center Inc.

Front Thorax

HIII 50th Serial No. 1042 Certification No. 4-7

Test Date: 12/22/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	20.9 °C	Yes
Relative Humidity	10 - 70 %	36 %	Yes
Probe Velocity	6.59 - 6.83 m/s	6.825 m/s	Yes
Probe Force Peak	(-5,160) - (-5,894) N	-5,761.5 N	Yes
Maximum Chest Compression	(-63.5) - (-72.6) mm	-64.26 mm	Yes
Internal Hysteresis	69 - 85 %	73.6 %	Yes

Test meets specifications.

Condition: New

Comments:

Jacket S/N: EY4394

Rib Set S/N: 10348

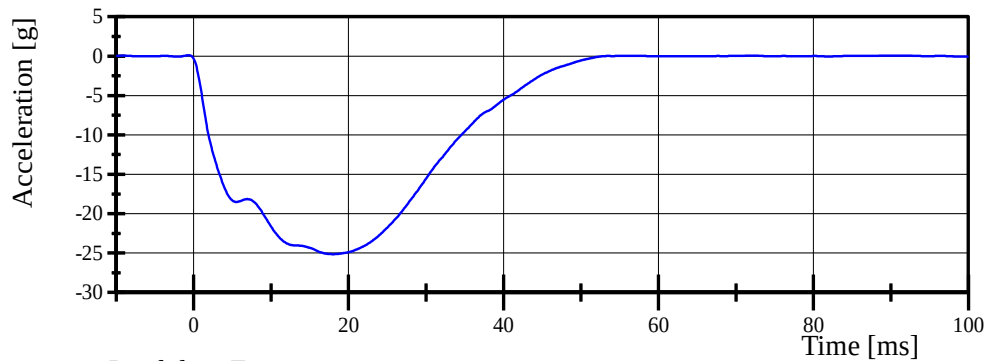
Transportation Research Center Inc.

Front Thorax

HIII 50th Serial No. 1042 Certification No. 4-7

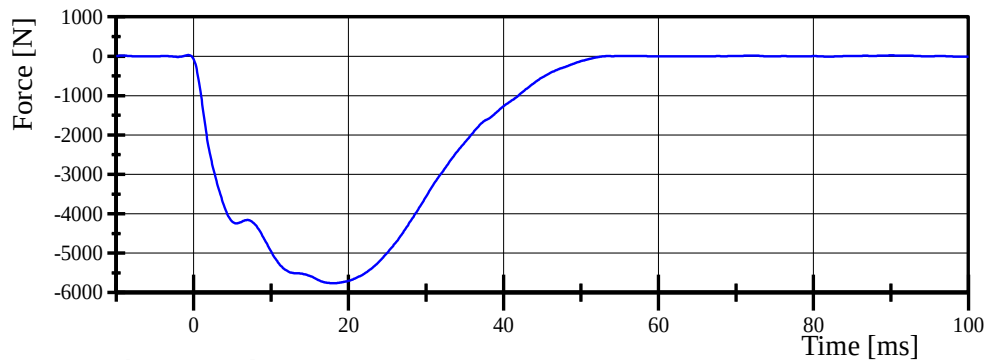
Test Date: 12/22/2023

Pendulum Acceleration



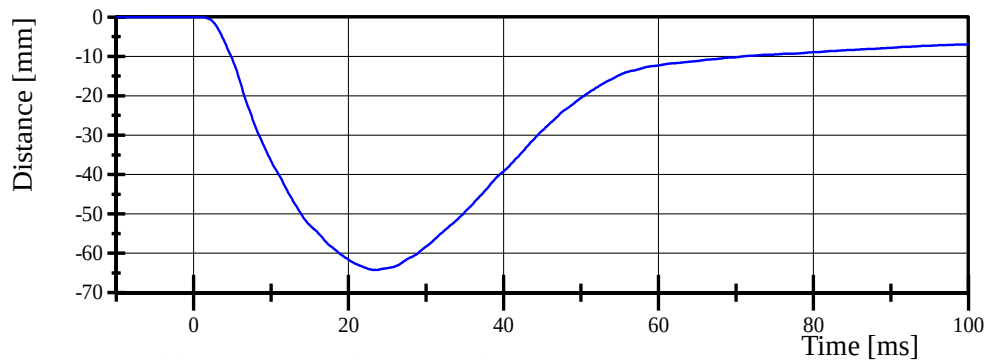
Filter Class: CFC_180
Max: 0.1 g at -0.6 ms
Min: -25.1 g at 18.0 ms

Pendulum Force



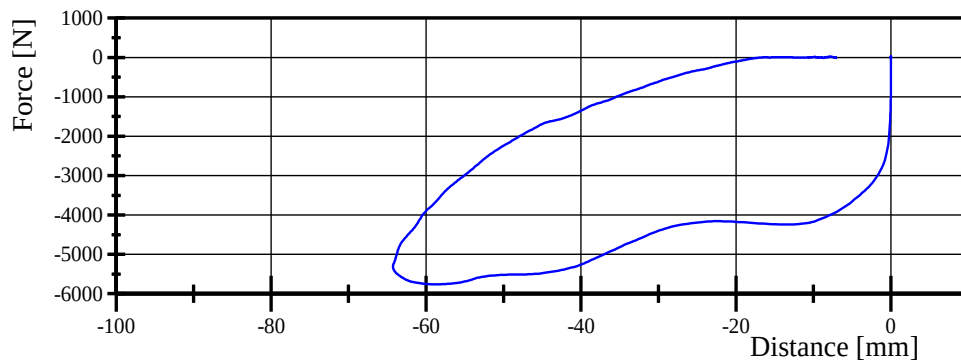
Filter Class: CFC_180
Max: 27.9 N at -0.6 ms
Min: -5,761.5 N at 18.0 ms

Thorax Displacement X-Axis



Filter Class: CFC_600
Max: 0.0 mm at -6.2 ms
Min: -64.3 mm at 23.4 ms

Pendulum Force vs. Thorax Displacement X-Axis



Filter Class: CFC_180
Max: 27.9 N at -0.0 mm
Min: -5,761.5 N at -58.6 mm

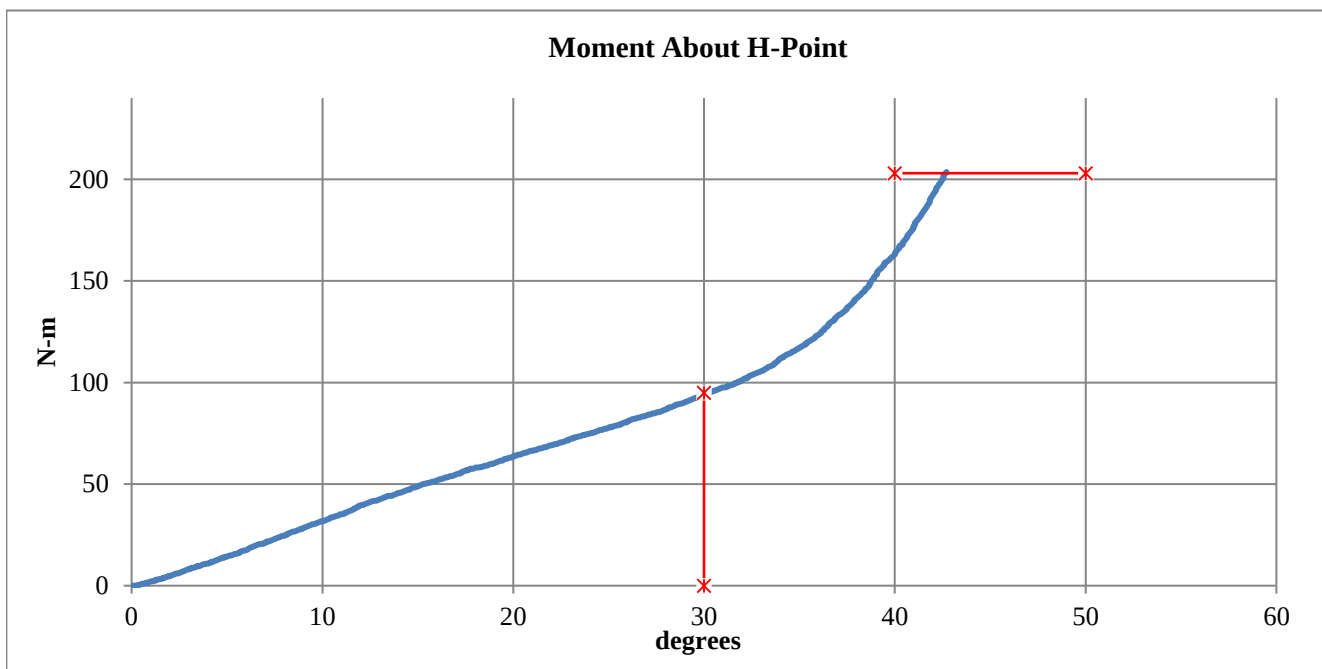
Transportation Research Center Inc.

Hybrid III 50th Male Hip Range of Motion

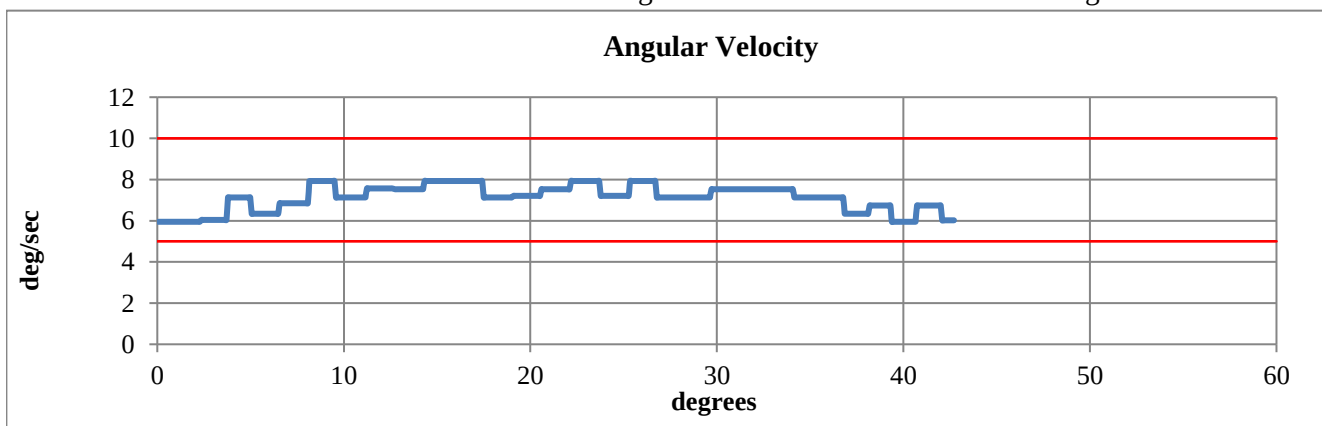


Serial Number: 1042 Date: 20-Dec-2023
Side Tested: Left Hip Time: 10:23
Test Number: 1

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	93.92	N-m	Pass
Angle at 203 Nm	40	-	50	42.71	deg	Pass
Average Velocity	5	-	10	7.09	deg/sec	Pass



Max: 7.93 deg/sec Min: 5.95 deg/sec



Comments:

Pelvis S/N: EX0666

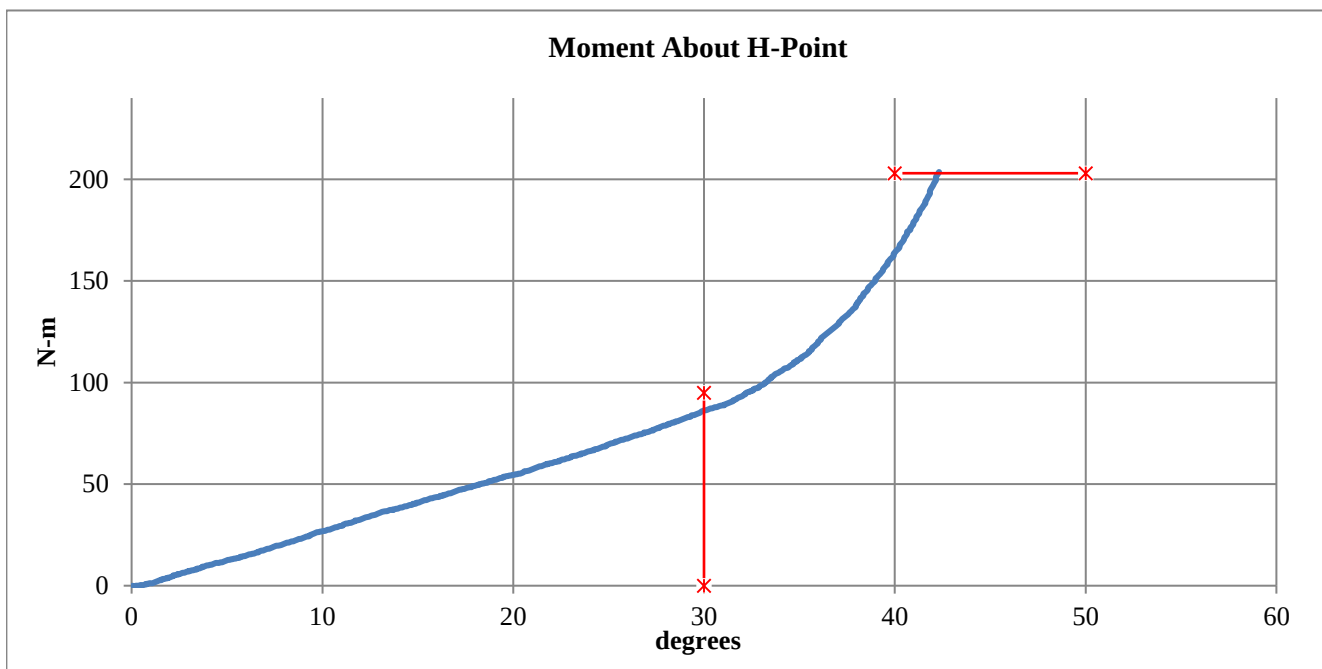
Transportation Research Center Inc.

Hybrid III 50th Male Hip Range of Motion

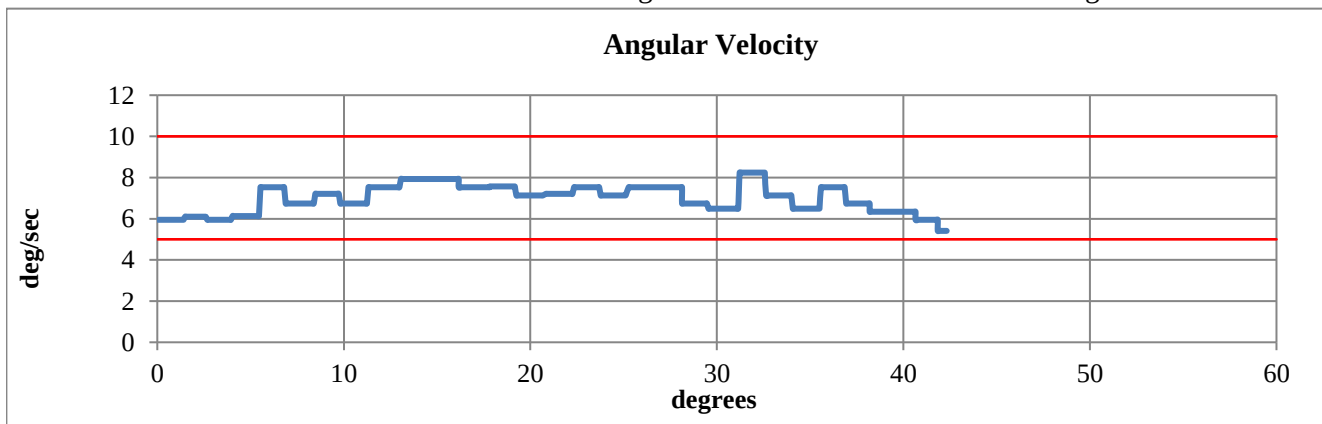


Serial Number: 1042 Date: 20-Dec-2023
Side Tested: Right Hip Time: 10:35
Test Number: 1

TEST PARAMETER	SPECIFICATION			TEST RESULTS		
Temperature	18.9	-	25.6	21.4	°C	Pass
Humidity	10	-	70	36	%	Pass
Moment at 30°	0	≤	94.9	86.35	N-m	Pass
Angle at 203 Nm	40	-	50	42.32	deg	Pass
Average Velocity	5	-	10	6.97	deg/sec	Pass



Max: 8.24 deg/sec Min: 5.41 deg/sec



Comments:

Pelvis S/N: EX0666

Transportation Research Center Inc.

Hybrid III 50th Male Torso Flexion



Customer: NHTSA

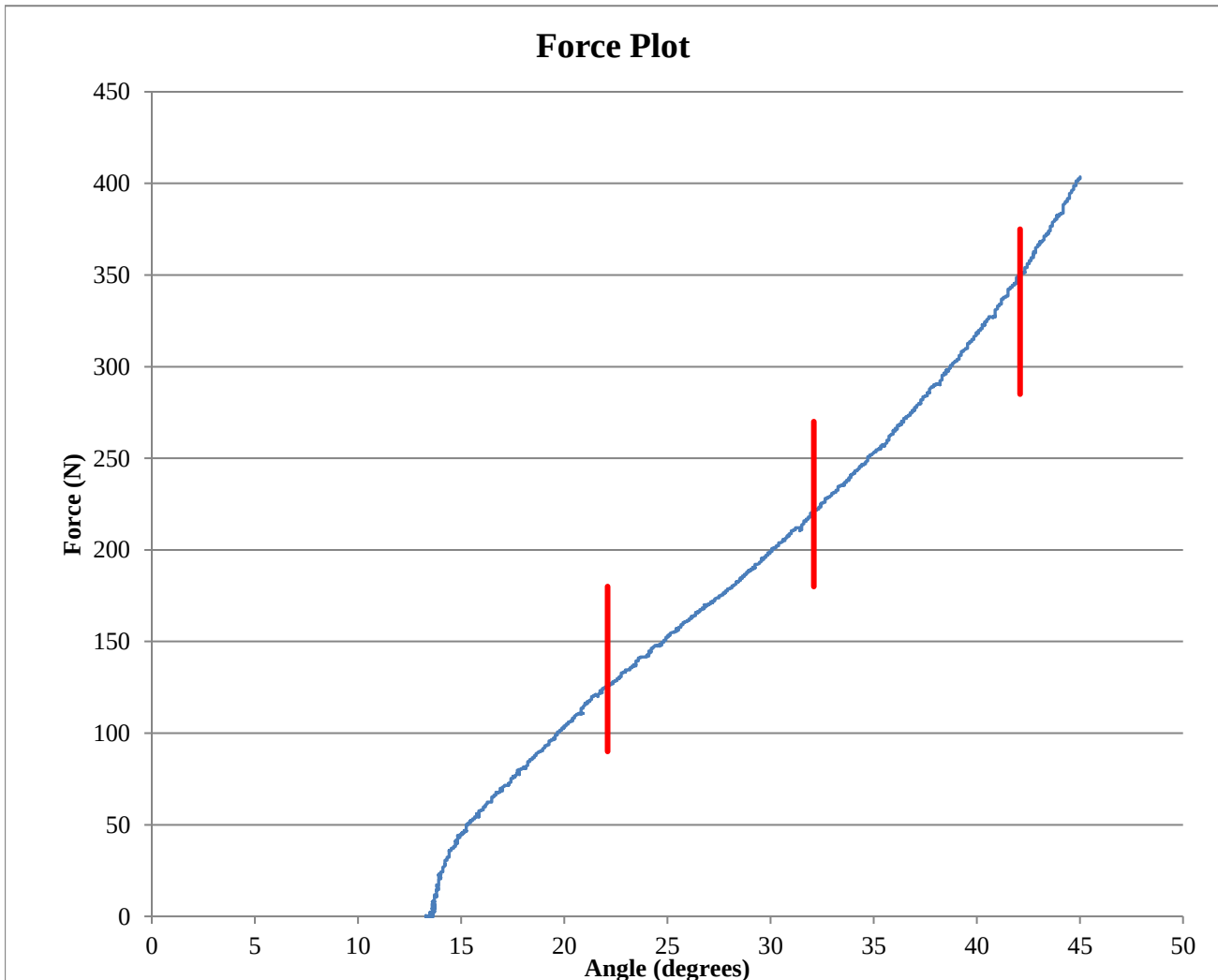
Serial Number: 1042

Test Number: 1

Date: 1/3/2024

Time: 10:27

TEST PARAMETER	SPECIFICATION			TEST RESULTS		
Temperature	18.9	-	25.6	21.4	°C	Pass
Humidity	10	-	70	35	%	Pass
Average Angular Rate	0.5	-	1.5	0.84	deg/sec	Pass
Initial Angle	11.1	-	15.1	13.29	deg	Pass
Force at 22.1°	90	-	180	125.92	N	Pass
Force at 32.1°	180	-	270	221.17	N	Pass
Force at 42.1°	285	-	375	349.78	N	Pass



Components:

Jacket S/N: NA

Abdomen S/N: NA

Lumbar S/N: DML00013

Comments:

Transportation Research Center Inc.

Left Knee Femur Response Test

HIII 50th Serial No. 1042 Certification No. 4-2

Test Date: 12/19/2023

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.5 °C	21.4 °C	Yes
Relative Humidity	10 - 70 %	34 %	Yes
Probe Velocity	2.07 - 2.13 m/s	2.092 m/s	Yes
Peak Femur Force	(-4,715.2) - (-5,782.6) N	-5,746.00 N	Yes

Test meets specifications.

Condition: Used

Comments:

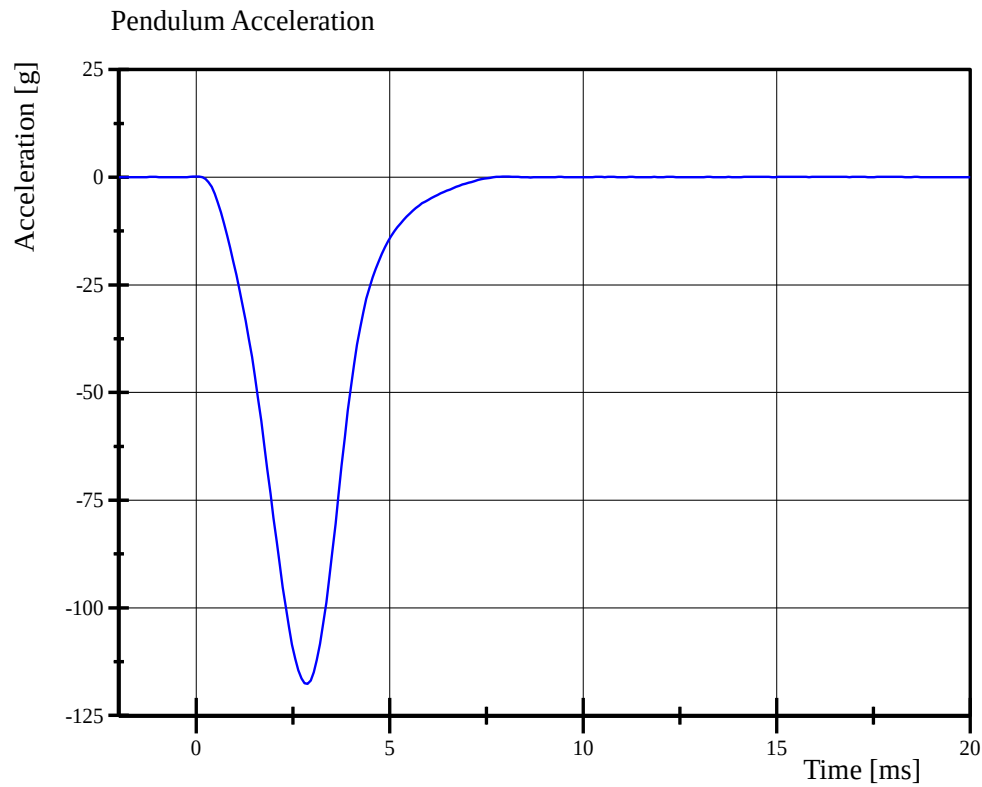
Knee Skin S/N: 2659

Transportation Research Center Inc.

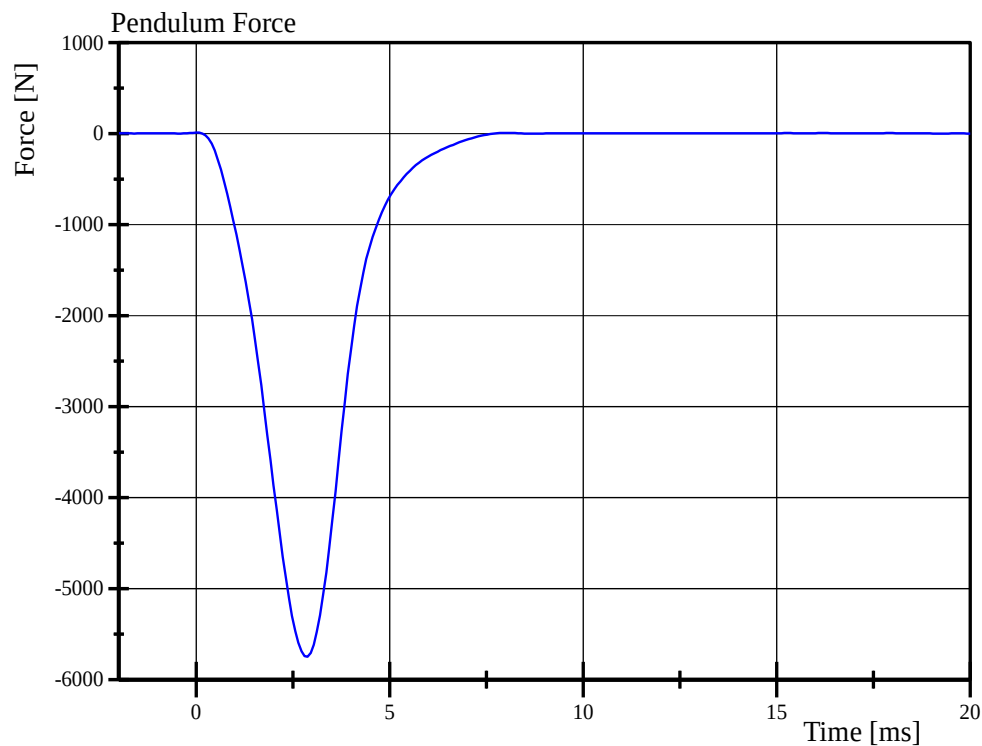
Left Knee Femur Response Test

HIII 50th Serial No. 1042 Certification No. 4-2

Test Date: 12/19/2023



Filter Class: CFC_600
Max: 0.2 g at 0.0 ms
Min: -117.7 g at 2.9 ms



Filter Class: CFC_600
Max: 9.2 N at 0.0 ms
Min: -5,746.0 N at 2.9 ms

Transportation Research Center Inc.

Right Knee Femur Response Test

HIII 50th Serial No. 1042 Certification No. 4-3

Test Date: 12/19/2023

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.5 °C	21.0 °C	Yes
Relative Humidity	10 - 70 %	36 %	Yes
Probe Velocity	2.07 - 2.13 m/s	2.092 m/s	Yes
Peak Femur Force	(-4,715.2) - (-5,782.6) N	-5,517.34 N	Yes

Test meets specifications.

Condition: Used

Comments:

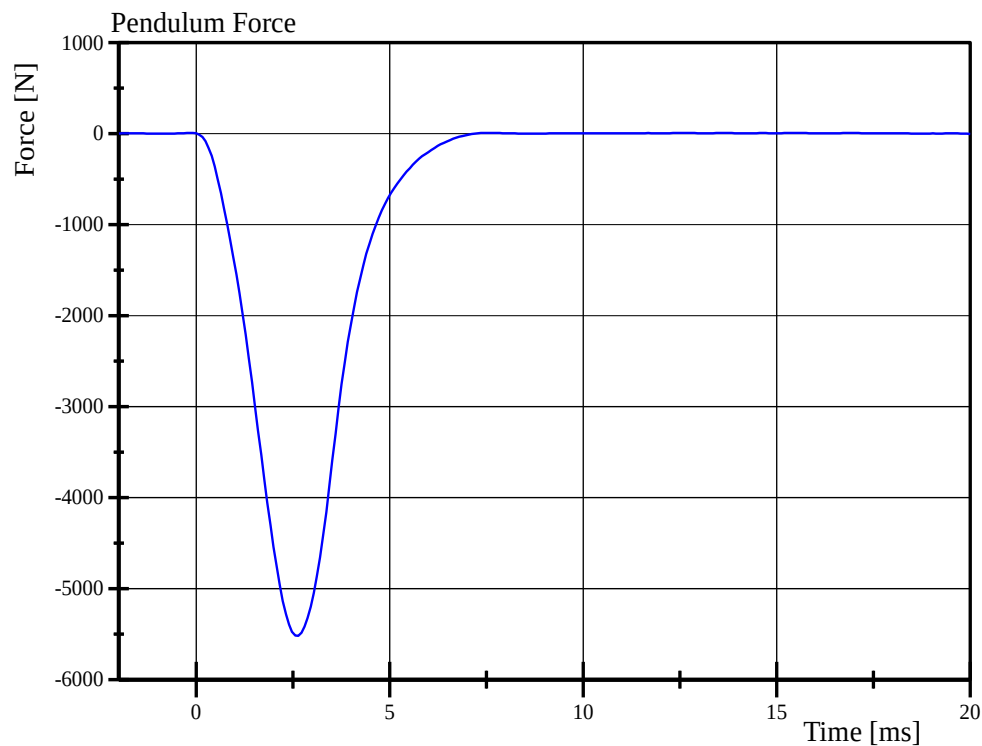
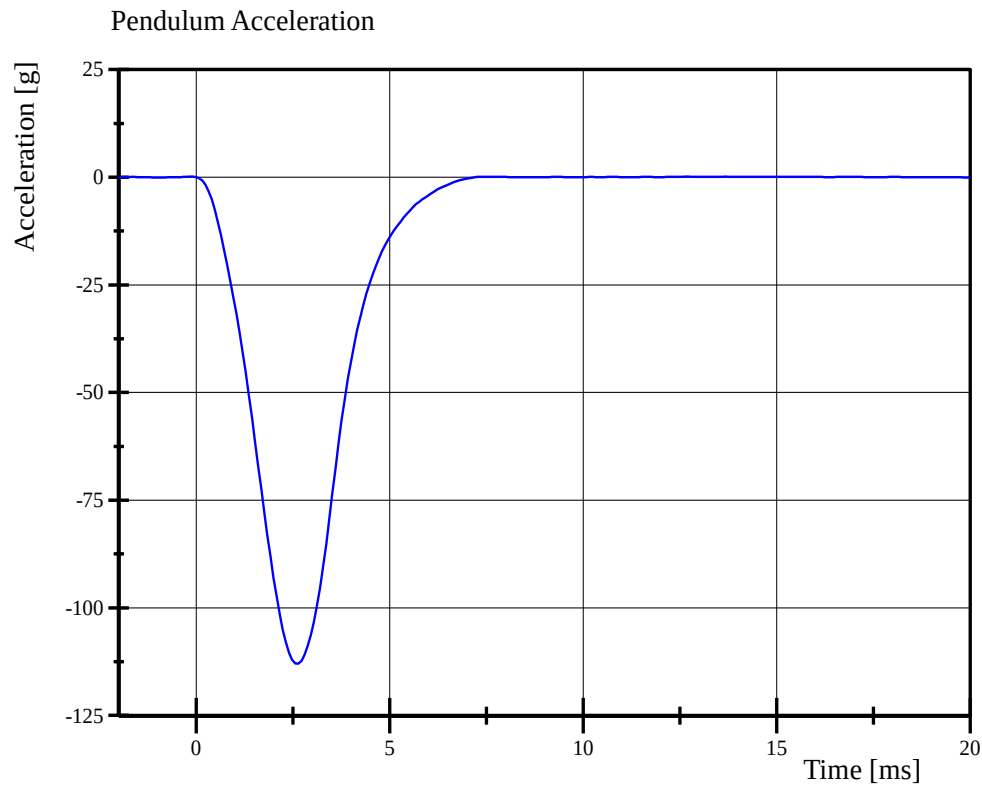
Knee Skin S/N: 3130

Transportation Research Center Inc.

Right Knee Femur Response Test

HIII 50th Serial No. 1042 Certification No. 4-3

Test Date: 12/19/2023



Appendix C – Quality Assurance



Quality Assurance



ATD Assembly & Final Inspection

ATD Type: Hybrid III 50th Percentile Male

ATD Serial Number: 1042

Assembled by: *Rust Bando*

Date Inspected: 1/3/2024