

**Vehicle Research and Test Center
FMVSS 213 Testing
Hybrid III 6-Year-Old**

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



Summary Report

August 2023

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

SECTION 1
PURPOSE AND SUMMARY FOR HYBRID III 6-YEAR-OLD

The purpose of this test series was to evaluate buck durability and ATD responses when installing varies CRSs with a 2 point belt configuration.

SUMMARY

A Hybrid III 6-year-old dummy (serial number 027) was secured in the right rear occupant position (position 3 or P3) in a forward-facing child restraint system (CRS). The Hybrid III 6-year-old was instrumented with head, chest, and pelvic triaxial accelerometers, upper neck, lower neck, and lumbar force and moment load cells, a displacement potentiometer, and a rate gyro in the chest. During this test series the dummy was restrained with a 2-point seatbelt (SB2PT).

Section 2 contains the testing performed using a forward-facing child restraint system (CRS) in the right rear seating position. Section 3 contains the dummy certification information.

SECTION 2
FORWARD FACING CRS TEST SUMMARY

TEST DUMMY INFORMATION

Description	Position # 3 CRS
ATD Type/Serial No.	Hybrid III 6-Year-Old/027
Restrain System	SB2PT
CRS Direction	Forward Facing
Foam Cushion	WB7

CAMERA POSITIONING FARO MEASUREMENTS

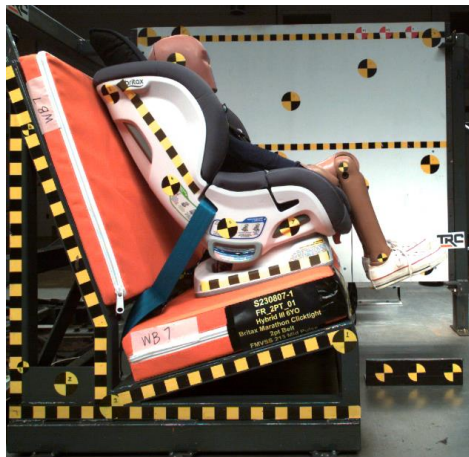
Description	Units	X	Y	Z
Origin	mm	0	0	0
PA Front	mm	536.60	924.64	-386.87
PA Side	mm	1848.67	-320.73	-515.91

DUMMY POSITIONING

CRS: Britax Marathon Clicktight – FF – 2PT Belt

TRC Test Number: S230807-1

VRTC Test Number: FR_2PT_01



DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Z point	mm	0.17	-0.68	-0.27
Center of the seat frame bottom	mm	615.29	-350.70	-103.52
CRS base center	mm	575.95	-345.40	-226.60
Center of seat frame back	mm	-120.78	-351.76	-679.46
Top of seat	mm	-45.11	-350.79	-707.53
Top of headrest	mm	-85.41	-349.09	-834.64
Top of the head	mm	118.73	-351.06	-848.20
Bridge of nose	mm	230.17	-347.23	-769.77
Head CG outboard	mm	153.93	-281.39	-761.50
Neck center	mm	195.60	-347.28	-662.87
Chest Clip	mm	266.46	-346.38	-622.39
Buckle	mm	443.04	-344.95	-443.07
Knee Outer	mm	604.81	-235.20	-462.67
Left top of knee	mm	587.94	-427.71	-503.16
Right top of knee	mm	591.98	-271.32	-504.86
Ankle Outer	mm	704.47	-243.29	-223.50
CRS 1	mm	20.82	-168.49	-648.11
CRS 4	mm	172.08	-165.64	-419.36
CRS 2	mm	314.73	-153.57	-313.34
CRS 3	mm	467.08	-160.49	-313.21

DUMMY INJURY

HIC (36 ms)	740
Chest Clip (3 ms)	50.6g
Head Excursion	750mm
Knee Excursion	824mm

SECTION 3
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 (6) Year Old
Serial No. 027
Certification No. 28



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) 666-4511
Date Received: June 1, 2023
Date Completed: June 5, 2023

Special Instruction: N/A

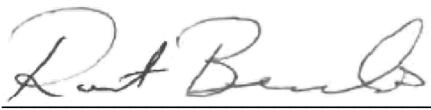
This Certification Report meets the requirements set forth by the ANSI National Accreditation Board ISO/IEC 17025:2017 accreditation under the scope of Mechanical Testing for Crash Test Dummy Certification Testing (ANAB Certificate #L2187). **This testing certification shall not be reproduced, except 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.

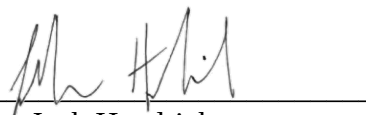
Each certification test was conducted by an authorized Transportation Research Center Inc. (TRC Inc.) employee within the requirements of the ISO/IEC 17025:2017 standards and adheres to CFR Part 572 Subparts B, E, N, O, P, R, T, U, V, SAE J2860, J2856, J2862; depending on ATD type. Any statements of 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: 06/01/2023

Testing Conducted by: 
Robert Benavides

Date: 06/05/2023

Testing Approved by: 
Josh Hendricks

Date: 06/08/2023



Appendix A – Incoming Inspection





TRC ATD Laboratory As Received Inspection Report

Name: Robert Benavides

Date: 6/2/2023

Customer: VRTC

ATD S/N: 027

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: 6/2/2023

Customer: VRTC

ATD S/N: 027

1

2

3

4

5

6





TRC ATD Laboratory Inspection Report Action Items

Name: Robert Benavides

Date: 6/2/2023

Customer: VRTC

ATD S/N: 027

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 6YO Serial No. 027 Certification No. 28-1

Test Date: 6/5/2023

Test Parameter	Specification	Test Results	Pass
Temperature	18.0 - 22.0 °C	21.0 °C	Yes
Relative Humidity	10 - 70 %	38 %	Yes
Peak Head Resultant Acceleration	245 - 300 g	254.0 g	Yes
Peak Head Lateral Acceleration	(-15) - 15 g	-7.3 g	Yes
Is Acceleration Curve Unimodal	< 10 %	1.46 %	Yes

Test meets specifications.

Condition: Used

Comments:

Head Skin S/N: 916

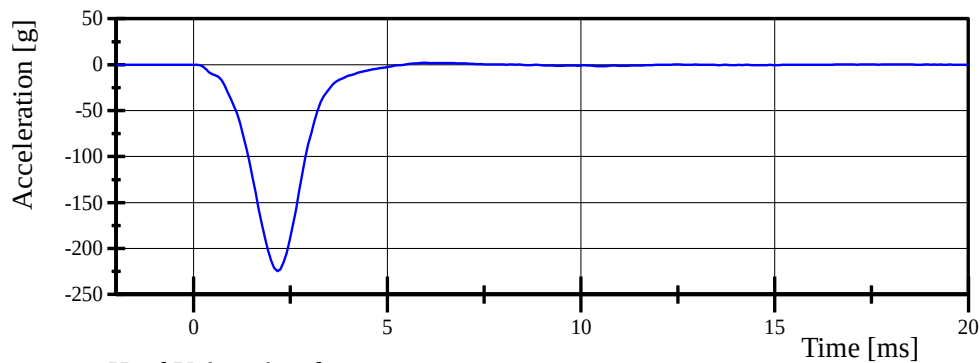
Transportation Research Center Inc.

Front Head Drop

HIH 6YO Serial No. 027 Certification No. 28-1

Test Date: 6/5/2023

Head X-Axis Acceleration

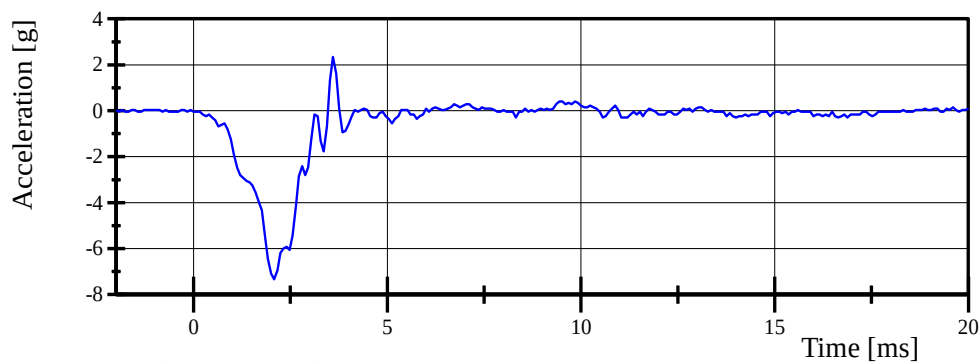


Filter Class: CFC_1000

Max: 2.2 g at 6.0 ms

Min: -224.6 g at 2.2 ms

Head Y-Axis Acceleration

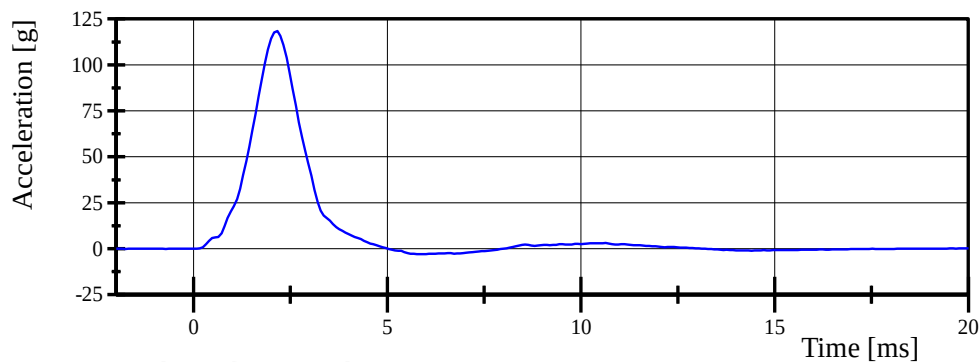


Filter Class: CFC_1000

Max: 2.3 g at 3.6 ms

Min: -7.3 g at 2.1 ms

Head Z-Axis Acceleration

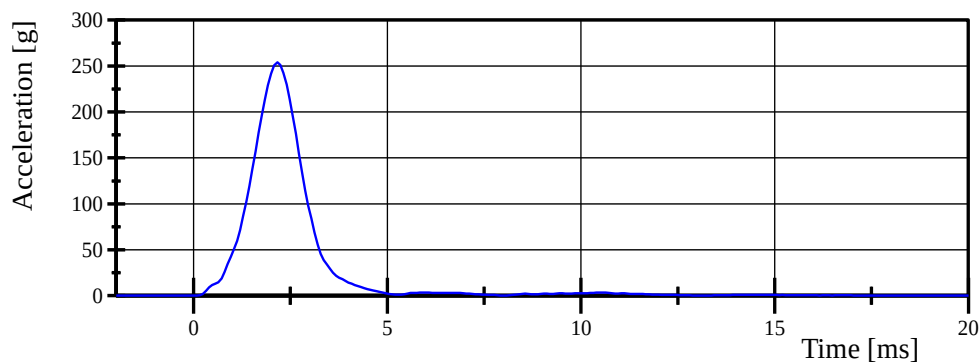


Filter Class: CFC_1000

Max: 118.3 g at 2.2 ms

Min: -3.0 g at 5.9 ms

Head Resultant Acceleration



Filter Class: CFC_1000

Max: 254.0 g at 2.2 ms

Min: 0.0 g at -2.0 ms

Transportation Research Center Inc.

Neck Flexion

HIII 6YO Serial No. 027 Certification No. 28-1

Test Date: 6/5/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	20.8 °C	Yes
Relative Humidity	10 - 70 %	38 %	Yes
Pendulum Impact Velocity	4.83 - 5.07 m/s	4.885 m/s	Yes
Pendulum Integrated Velocity at 10ms	(-1.2) - (-1.6) m/s	-1.53 m/s	Yes
Pendulum Integrated Velocity at 20ms	(-2.4) - (-3.4) m/s	-2.94 m/s	Yes
Pendulum Integrated Velocity at 30ms	(-3.8) - (-5.0) m/s	-4.27 m/s	Yes
Total Head D-Plane Rotation	(-74) - (-92) °	-80.5 °	Yes
Peak Neck Occipital Condyles Moment Between -74° and -92° Rotation	27 - 33 Nm	29.6 Nm	Yes
Neck Occipital Condyles Moment Decay to 5 Nm	103 - 123 ms	114.2 ms	Yes

Test meets specifications.

Condition: Used

Comments:

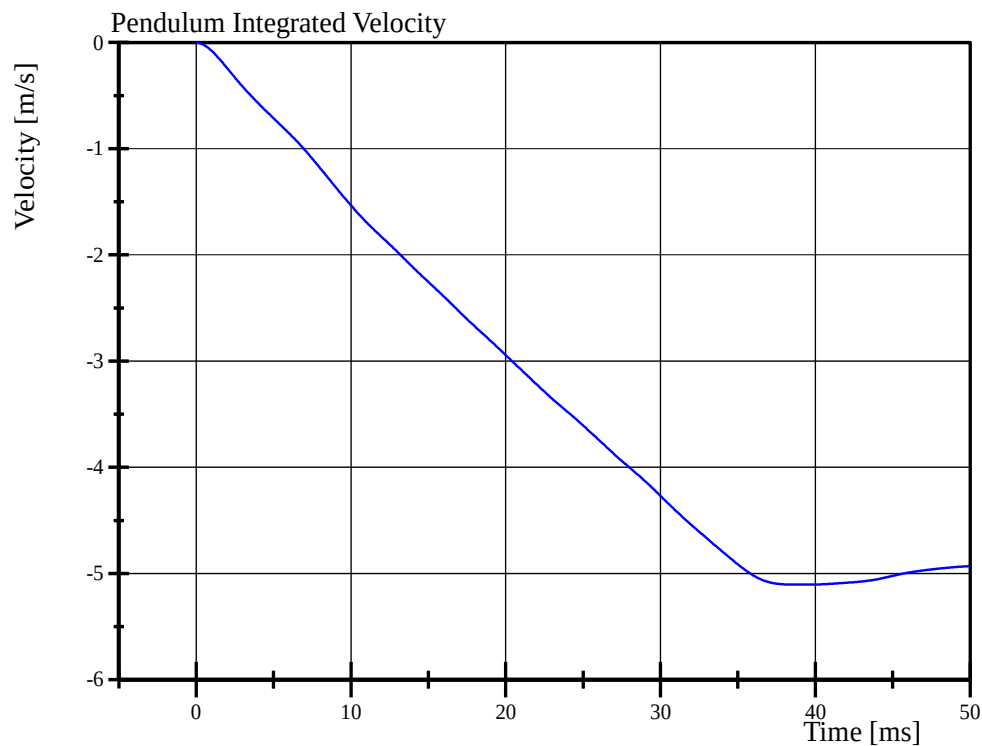
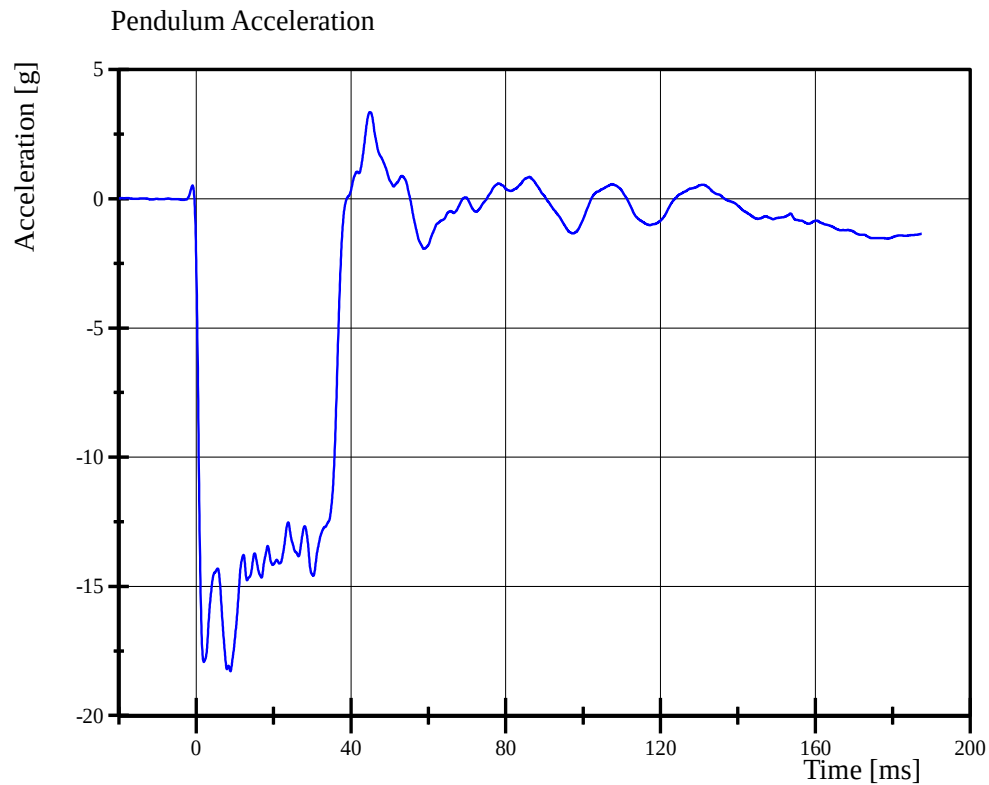
Neck S/N: N/A

Transportation Research Center Inc.

Neck Flexion

HIII 6YO Serial No. 027 Certification No. 28-1

Test Date: 6/5/2023



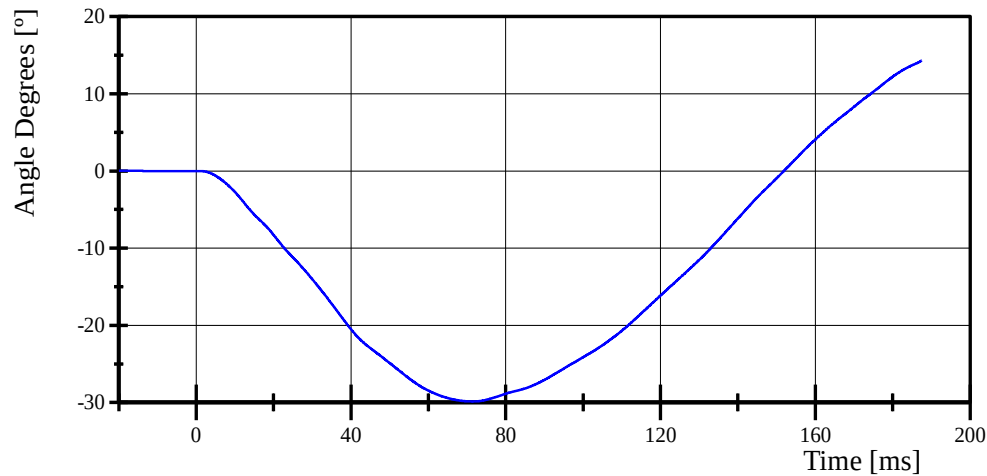
Transportation Research Center Inc.

Neck Flexion

HIII 6YO Serial No. 027 Certification No. 28-1

Test Date: 6/5/2023

Pot Rotation at the Base of Neck

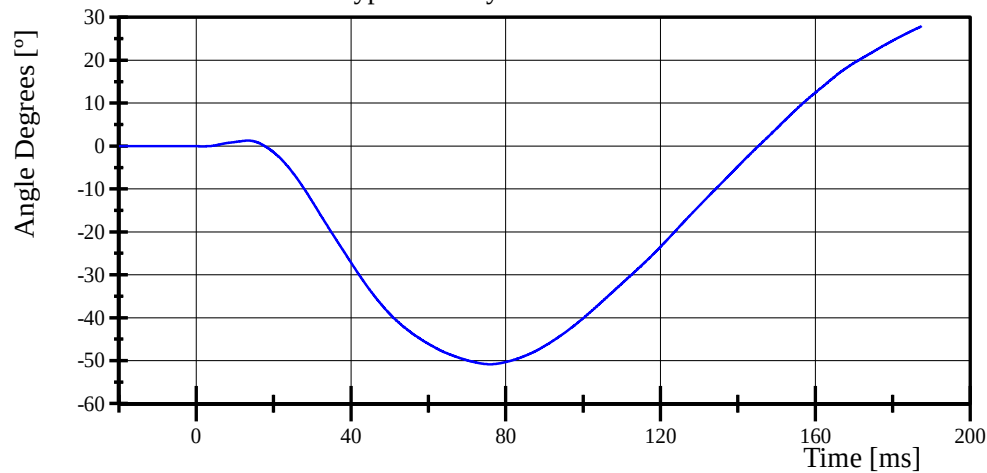


Filter Class: CFC_60

Max: 14.3 ° at 187.5 ms

Min: -29.9 ° at 71.4 ms

Head Rotation at Occypital Condyles

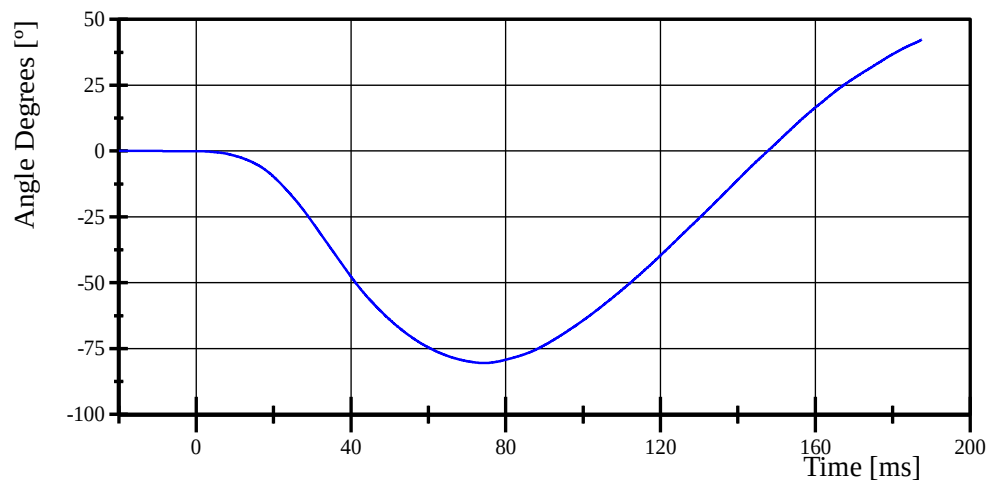


Filter Class: CFC_60

Max: 27.9 ° at 187.5 ms

Min: -50.9 ° at 76.0 ms

Total Head D-Plane Rotation



Filter Class: CFC_60

Max: 42.3 ° at 187.5 ms

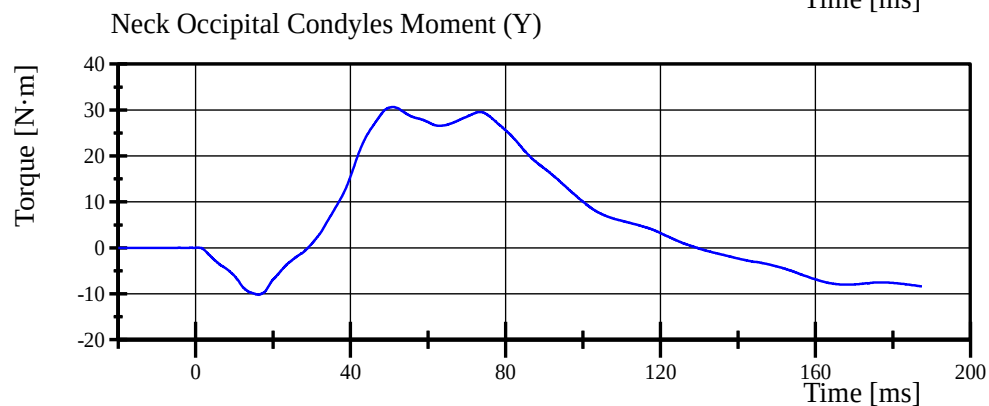
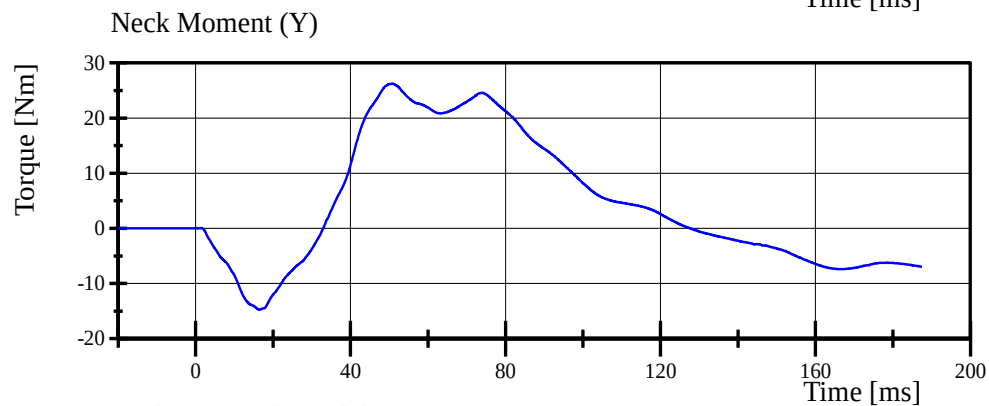
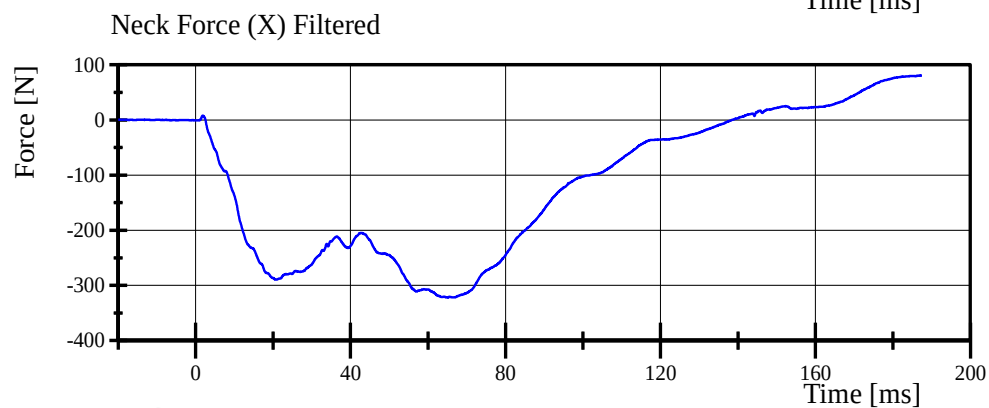
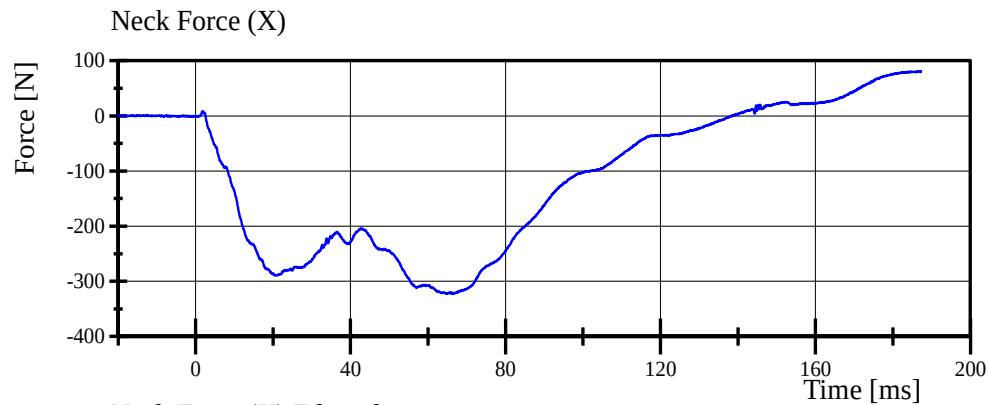
Min: -80.5 ° at 74.4 ms

Transportation Research Center Inc.

Neck Flexion

HIH 6YO Serial No. 027 Certification No. 28-1

Test Date: 6/5/2023



Transportation Research Center Inc.

Neck Extension

HIII 6YO Serial No. 027 Certification No. 28-1

Test Date: 6/5/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	20.8 °C	Yes
Relative Humidity	10 - 70 %	39 %	Yes
Pendulum Impact Velocity	4.18 - 4.42 m/s	4.375 m/s	Yes
Pendulum Integrated Velocity at 10ms	(-1.0) - (-1.4) m/s	-1.21 m/s	Yes
Pendulum Integrated Velocity at 20ms	(-2.2) - (-3.0) m/s	-2.45 m/s	Yes
Pendulum Integrated Velocity at 30ms	(-3.2) - (-4.2) m/s	-3.56 m/s	Yes
Total Head D-Plane Rotation	85 - 103 °	96.9 °	Yes
Peak Neck Occipital Condyles Moment Between 85° and 103° Rotation	(-19) - (-24) Nm	-20.8 Nm	Yes
Neck Occipital Condyles Moment Decay to 5 Nm	123 - 147 ms	138.6 ms	Yes

Test meets specifications.

Condition: Used

Comments:

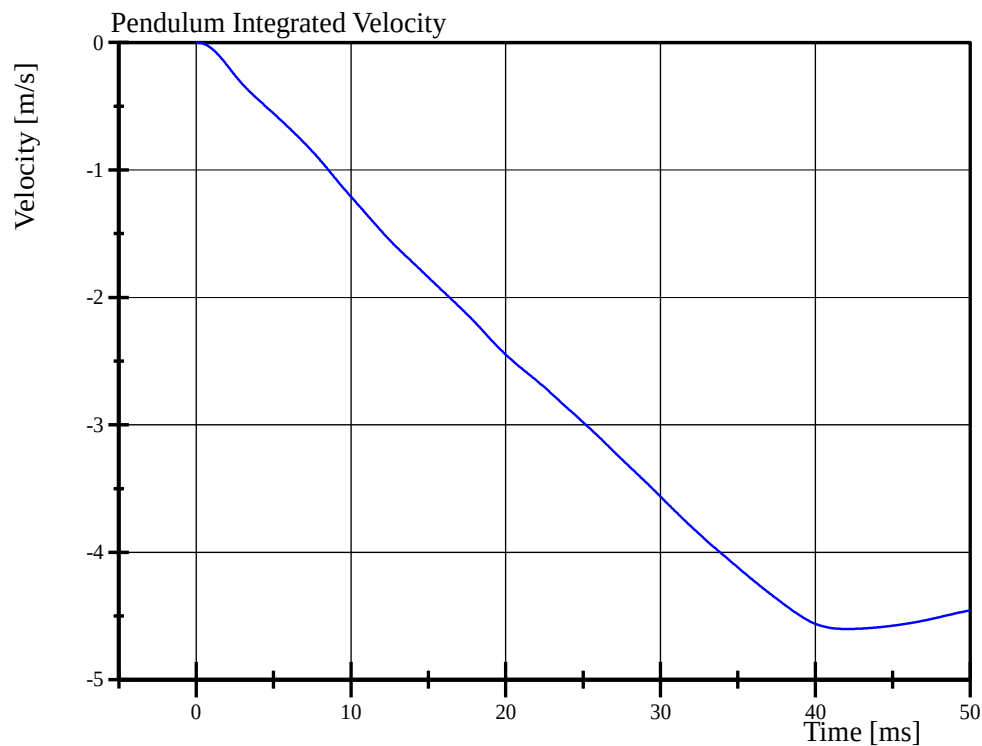
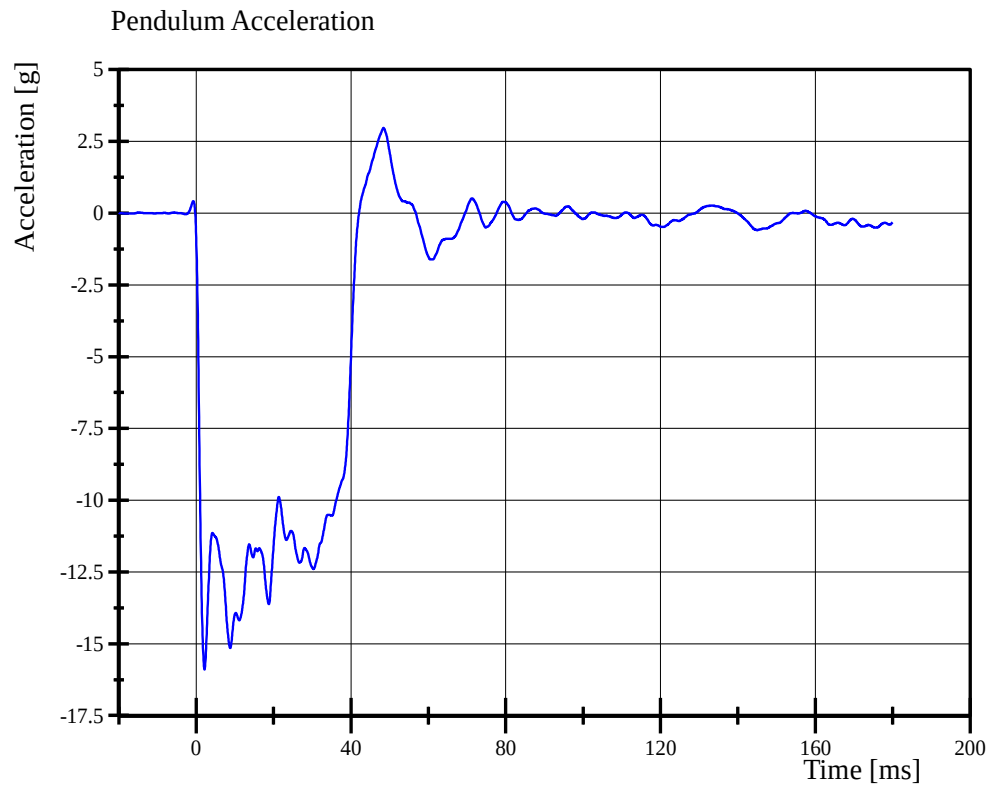
Neck S/N: N/A

Transportation Research Center Inc.

Neck Extension

HIII 6YO Serial No. 027 Certification No. 28-1

Test Date: 6/5/2023



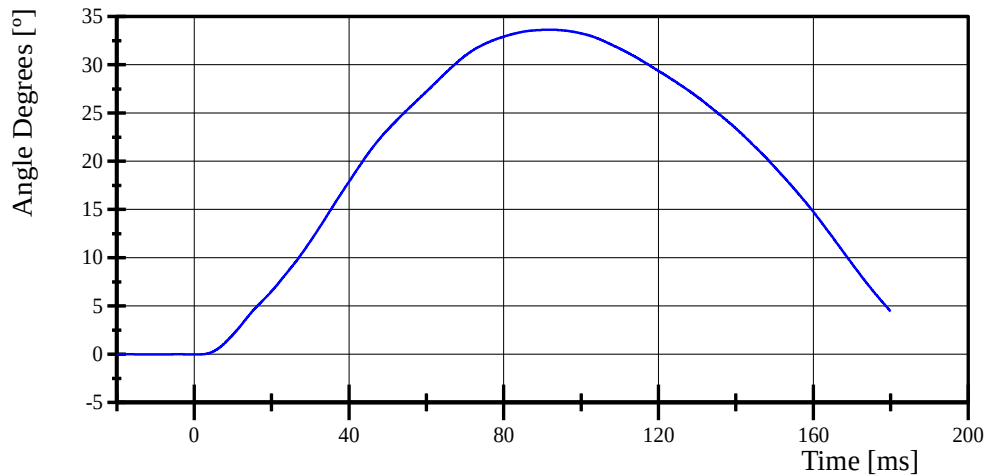
Transportation Research Center Inc.

Neck Extension

HIII 6YO Serial No. 027 Certification No. 28-1

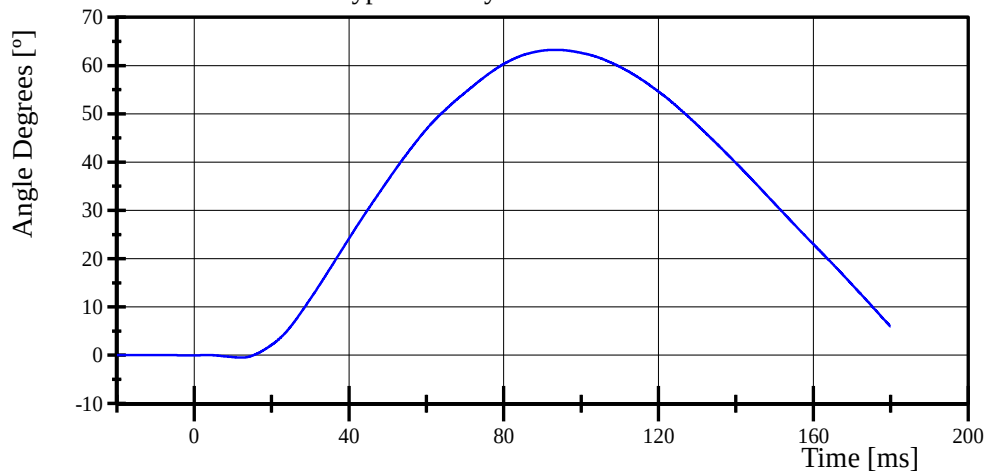
Test Date: 6/5/2023

Pot Rotation at the Base of Neck



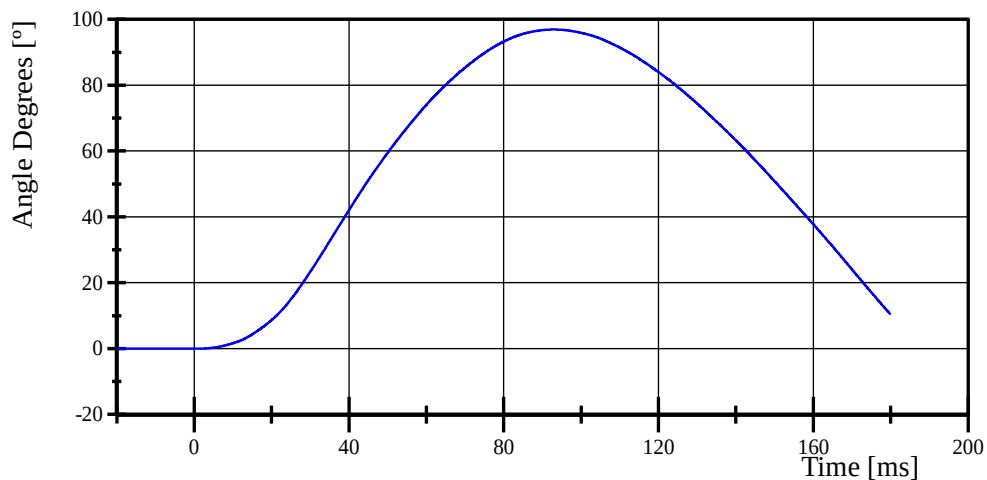
Filter Class: CFC_60
Max: 33.6 ° at 91.9 ms
Min: -0.0 ° at 0.6 ms

Head Rotation at Occypital Condyles



Filter Class: CFC_60
Max: 63.3 ° at 93.3 ms
Min: -0.5 ° at 12.2 ms

Total Head D-Plane Rotation



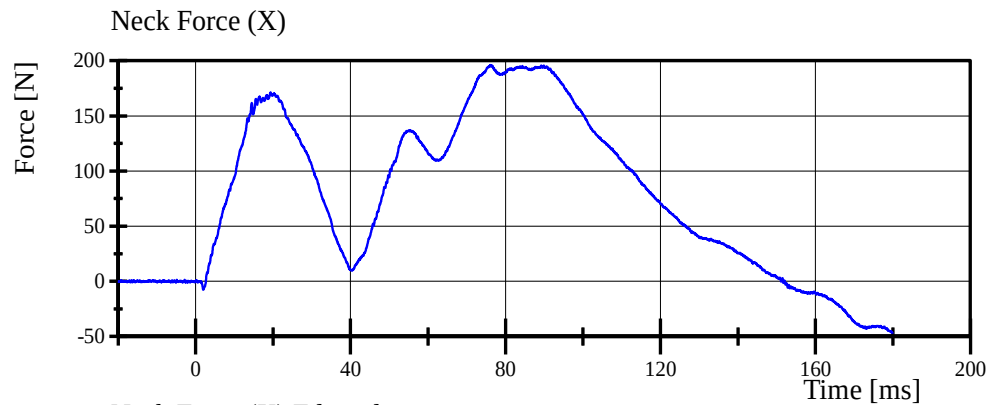
Filter Class: CFC_60
Max: 96.9 ° at 93.0 ms
Min: -0.0 ° at 0.2 ms

Transportation Research Center Inc.

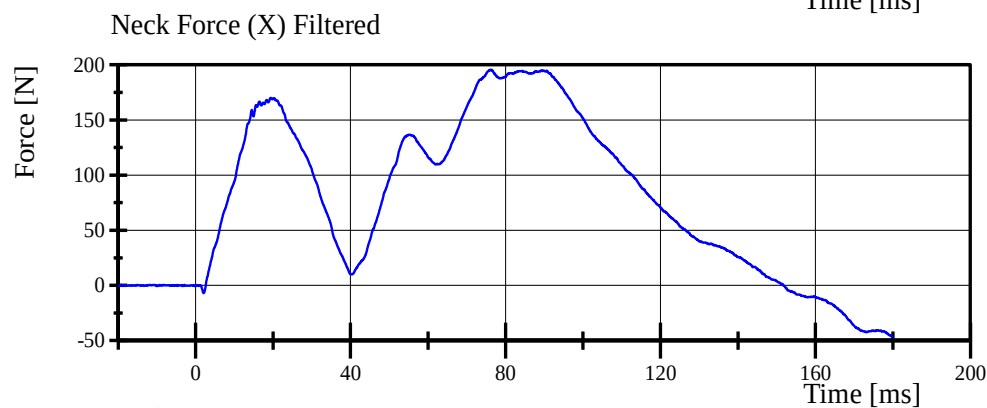
Neck Extension

HIH 6YO Serial No. 027 Certification No. 28-1

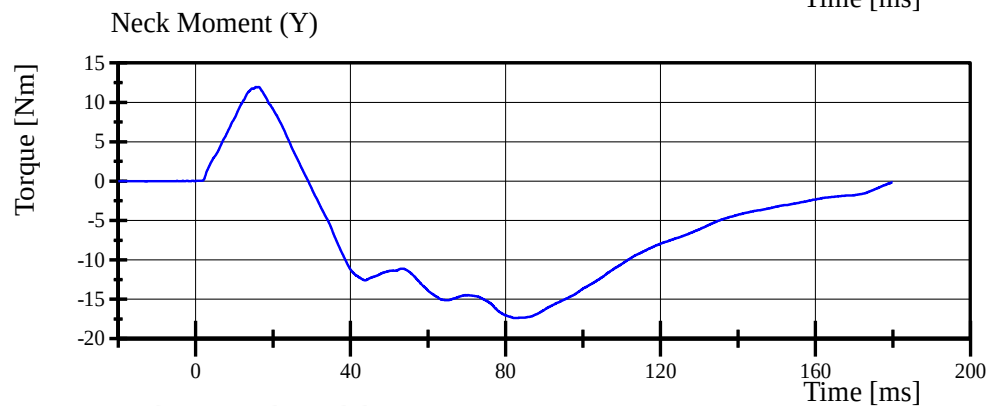
Test Date: 6/5/2023



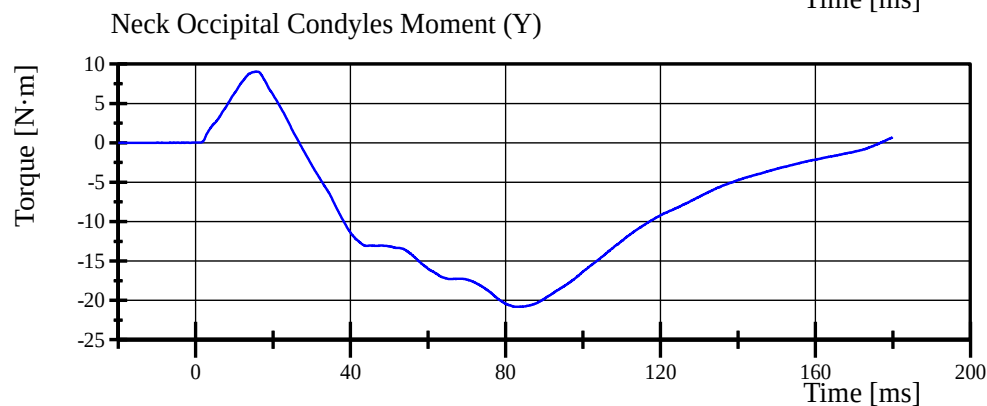
Filter Class: CFC_1000
Max: 196.0 N at 76.1 ms
Min: -47.5 N at 180.0 ms



Filter Class: CFC_600
Max: 195.6 N at 76.2 ms
Min: -47.5 N at 180.0 ms



Filter Class: CFC_600
Max: 12.0 Nm at 16.3 ms
Min: -17.4 Nm at 82.4 ms



Filter Class: Without_(Consta
Max: 9.0 N·m at 15.6 ms
Min: -20.8 N·m at 83.1 ms

Transportation Research Center Inc.

Front Thorax

HIII 6YO Serial No. 027 Certification No. 28-2

Test Date: 6/2/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	20.8 °C	Yes
Relative Humidity	10 - 70 %	47 %	Yes
Probe Velocity	6.59 - 6.83 m/s	6.755 m/s	Yes
Probe Force Peak Between 38.0 mm and 46.0 mm Chest Deflection	(-1,150) - (-1,380) N	-1,260.4 N	Yes
Probe Force Peak Between 12.5 mm and 38.0 mm Chest Deflection	>= (-1,500) N	-1,470.7 N	Yes
Maximum Chest Compression	(-38) - (-46) mm	-38.8 mm	Yes
Internal Hysteresis	65 - 85 %	79.9 %	Yes

Test meets specifications.

Condition: Used

Comments:

Jacket S/N: DL6916

Rib Set S/N: ER1260

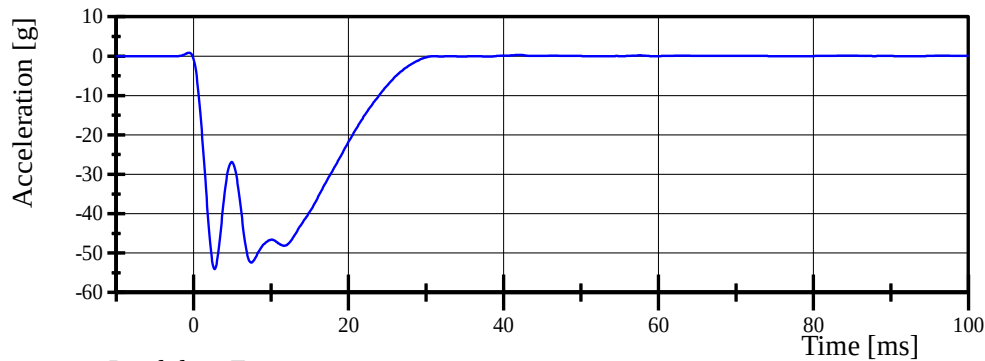
Transportation Research Center Inc.

Front Thorax

HIII 6YO Serial No. 027 Certification No. 28-2

Test Date: 6/2/2023

Pendulum Acceleration

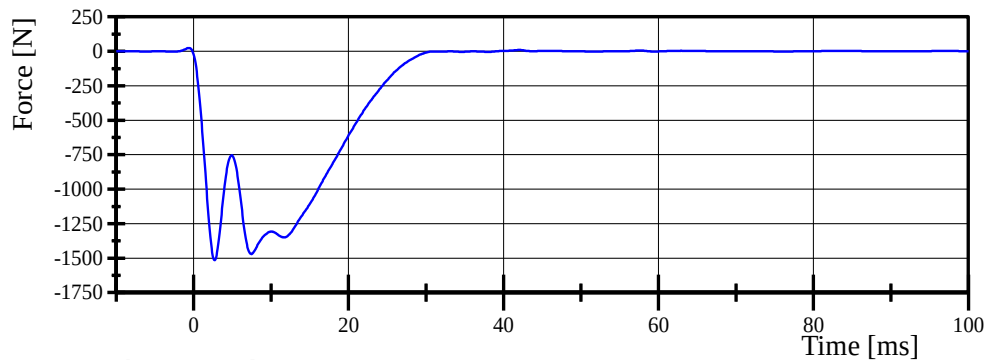


Filter Class: CFC_180

Max: 0.8 g at -0.6 ms

Min: -54.0 g at 2.7 ms

Pendulum Force

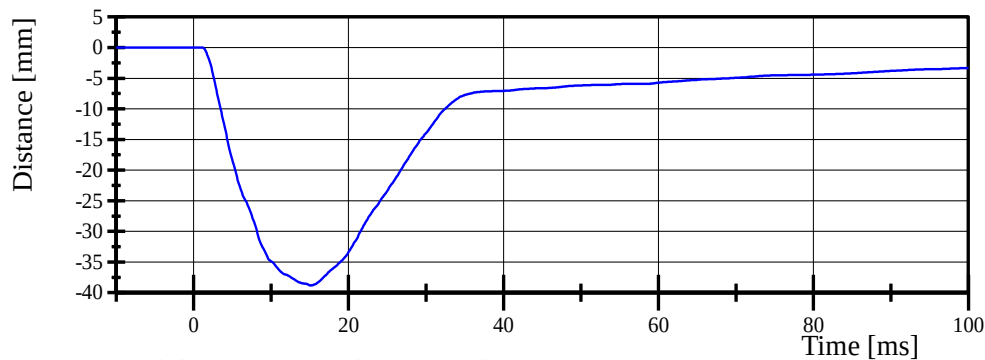


Filter Class: CFC_180

Max: 23.7 N at -0.6 ms

Min: -1,515.6 N at 2.7 ms

Thorax Displacement X-Axis

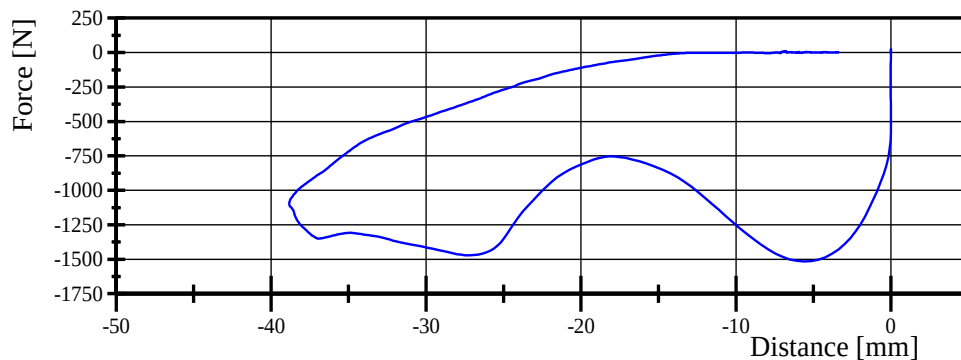


Filter Class: CFC_600

Max: 0.0 mm at 1.0 ms

Min: -38.8 mm at 15.1 ms

Pendulum Force vs. Thorax Displacement X-Axis



Filter Class: CFC_180

Max: 23.7 N at -0.0 mm

Min: -1,515.6 N at -5.6 mm

Transportation Research Center Inc.

Hybrid III Six-Year-Old Child Torso Flexion



Customer: VRTC

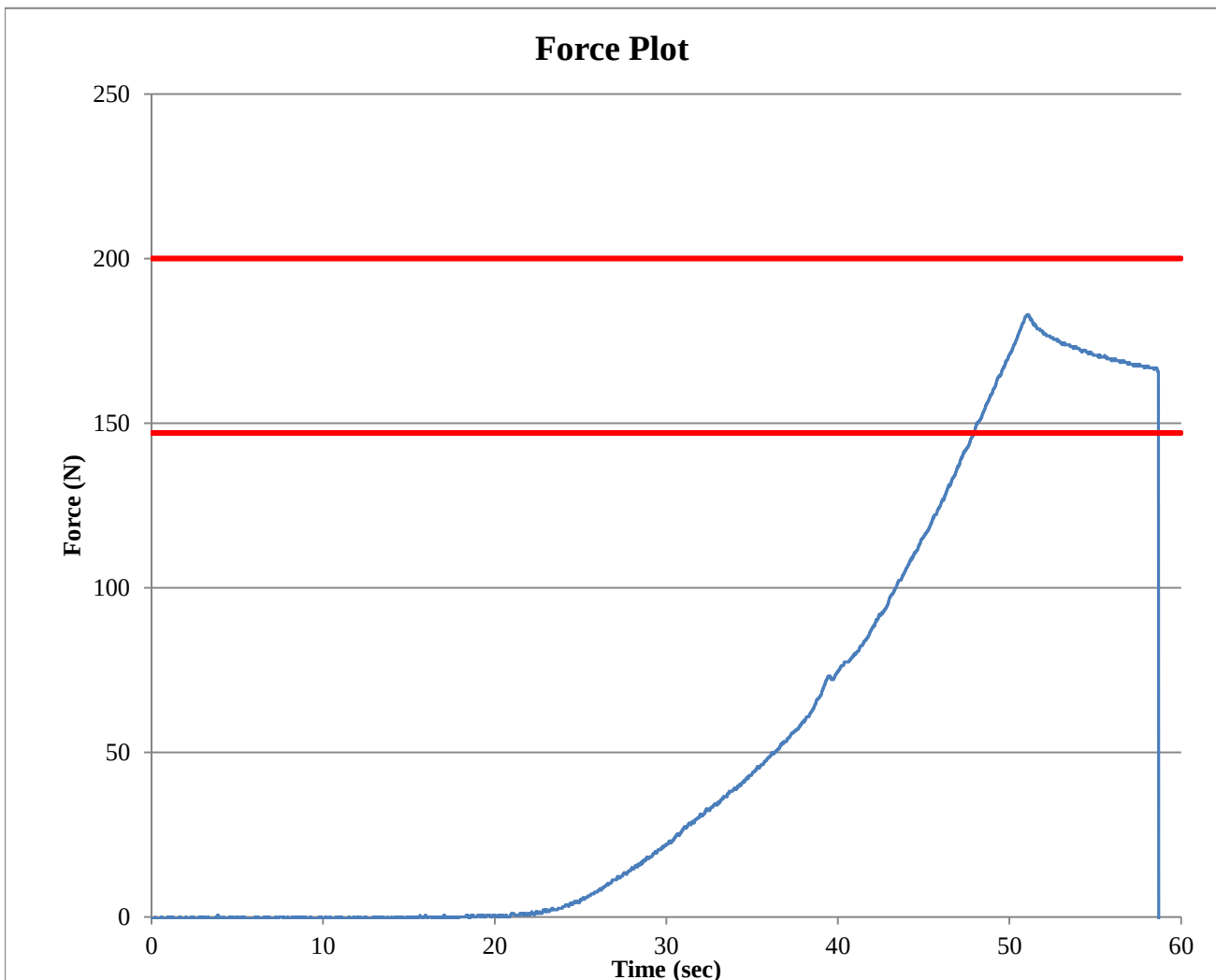
Serial Number: 027

Date: 6/5/2023

Test Number: 3

Time: 9:18

TEST PARAMETER	SPECIFICATION			TEST RESULTS		
Temperature	18.9	-	25.6	20.8	°C	Pass
Humidity	10	-	70	38	%	Pass
Average Angular Rate	0.5	-	1.5	0.57	deg/sec	Pass
Initial Angle	0	-	22	18.54	deg	Pass
Peak Force at 45.53°	147	-	200	182.96	N	Pass
Final Angle	-8	-	8	-0.72	deg	Pass



Components:

Jacket S/N: DL6916

Abdomen S/N: DL8691

Lumbar S/N: N/A

Comments:

Transportation Research Center Inc.

Left Knee Femur Response Test

HIII 6YO Serial No. 027 Certification No. 28-2

Test Date: 6/5/2023

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.6 °C	21.2 °C	Yes
Relative Humidity	10 - 70 %	37 %	Yes
Probe Velocity	2.07 - 2.13 m/s	2.072 m/s	Yes
Peak Femur Force	(-2,000) - (-3,000) N	-2,517.3 N	Yes

Test meets specifications.

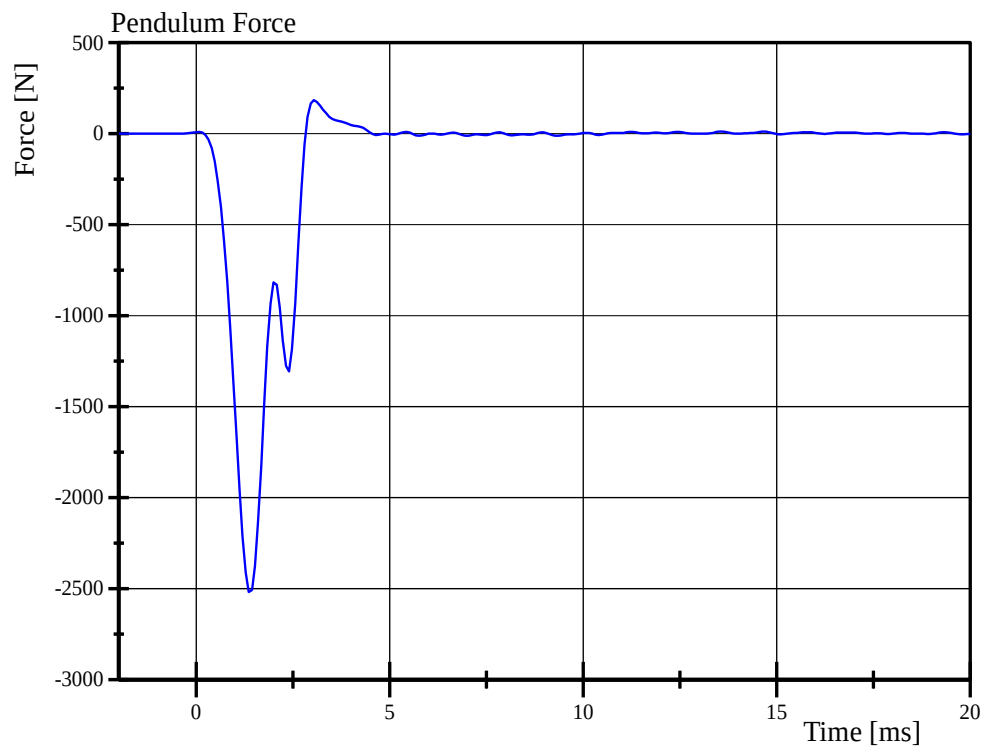
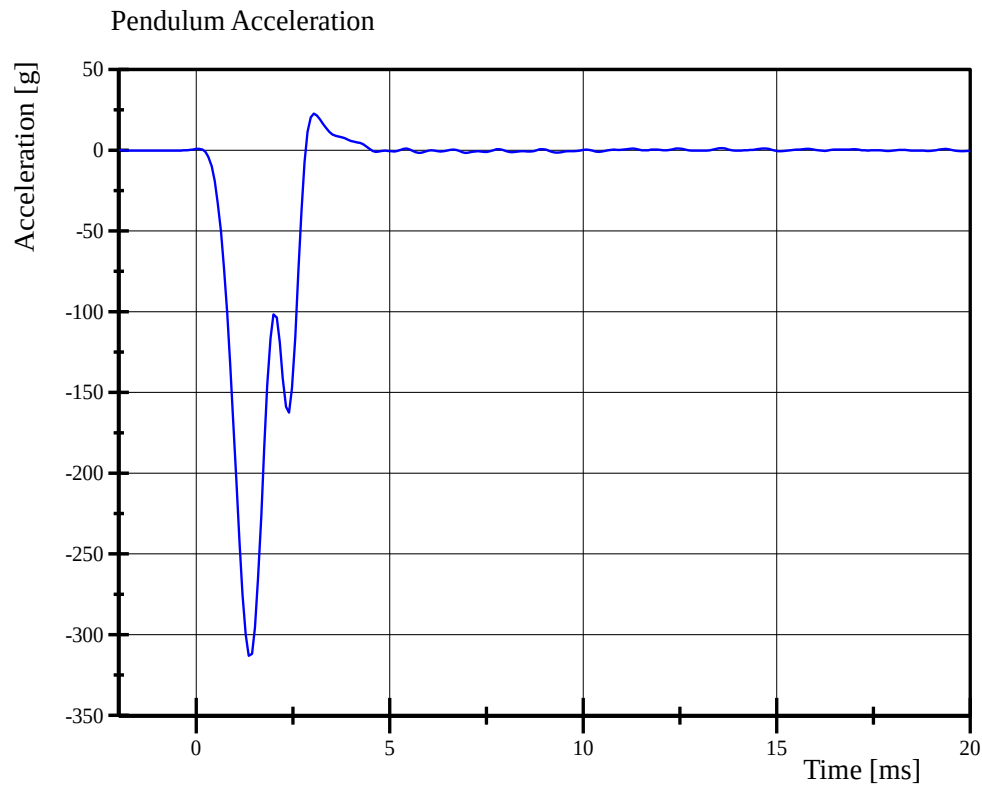
Condition: Used

Comments:

Knee Skin S/N: 640

Transportation Research Center Inc.

Left Knee Femur Response Test
HIII 6YO Serial No. 027 Certification No. 28-2
Test Date: 6/5/2023



Transportation Research Center Inc.

Right Knee Femur Response Test

HIII 6YO Serial No. 027 Certification No. 28-3

Test Date: 6/5/2023

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.6 °C	21.4 °C	Yes
Relative Humidity	10 - 70 %	37 %	Yes
Probe Velocity	2.07 - 2.13 m/s	2.098 m/s	Yes
Peak Femur Force	(-2,000) - (-3,000) N	-2,777.1 N	Yes

Test meets specifications.

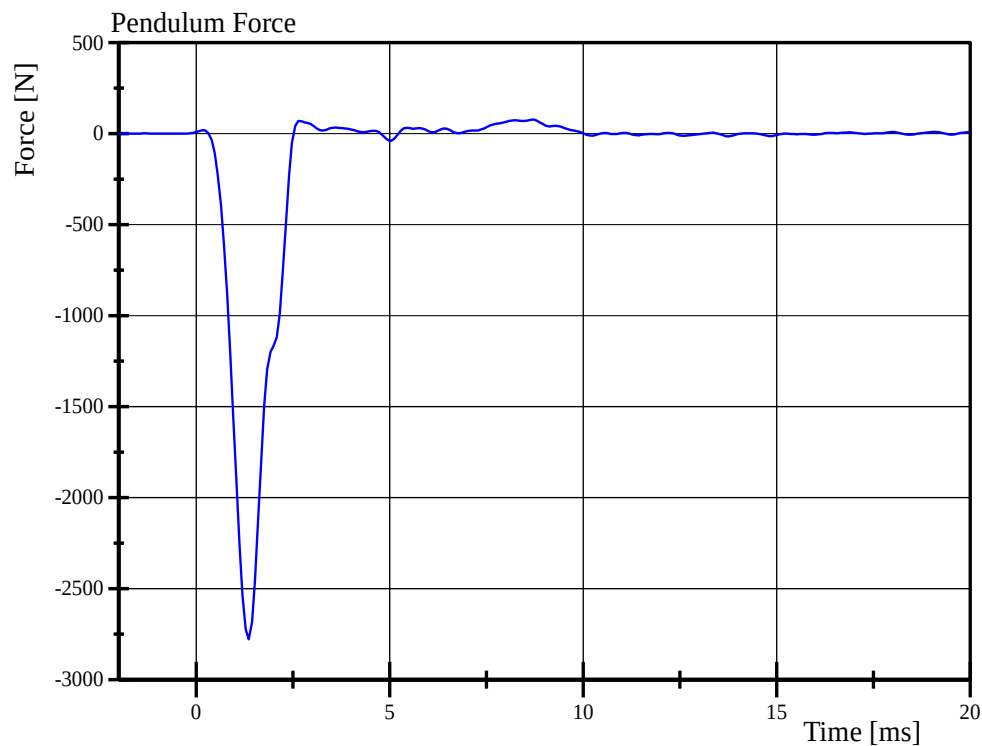
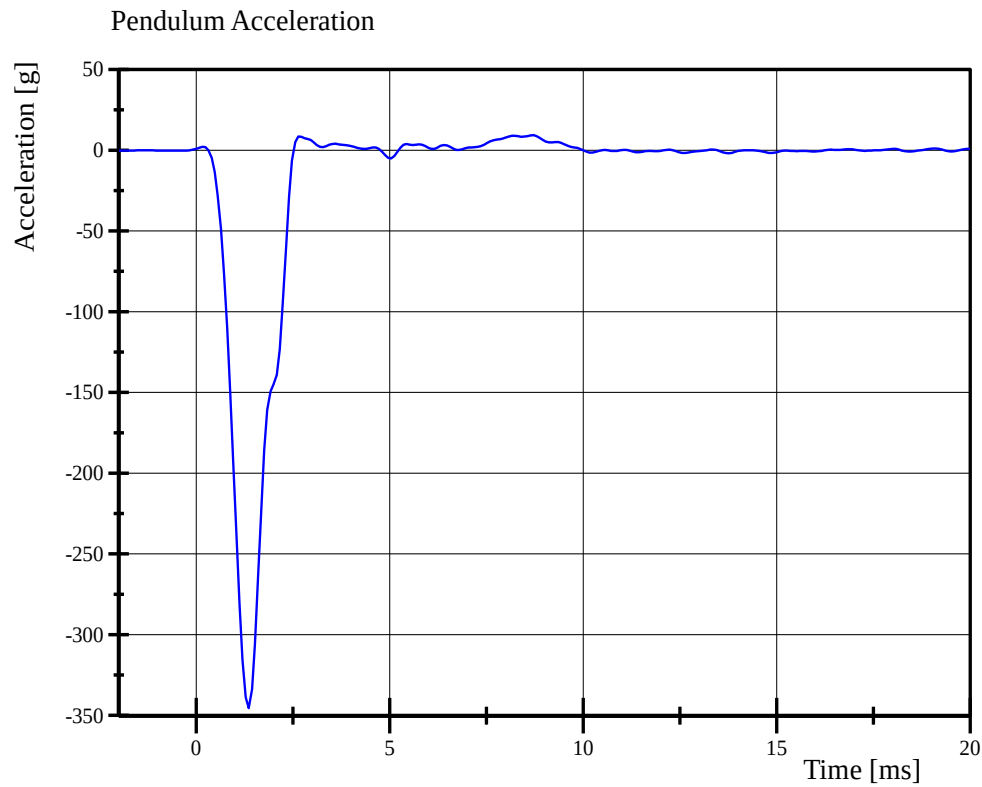
Condition: Used

Comments:

Knee Skin S/N: 643

Transportation Research Center Inc.

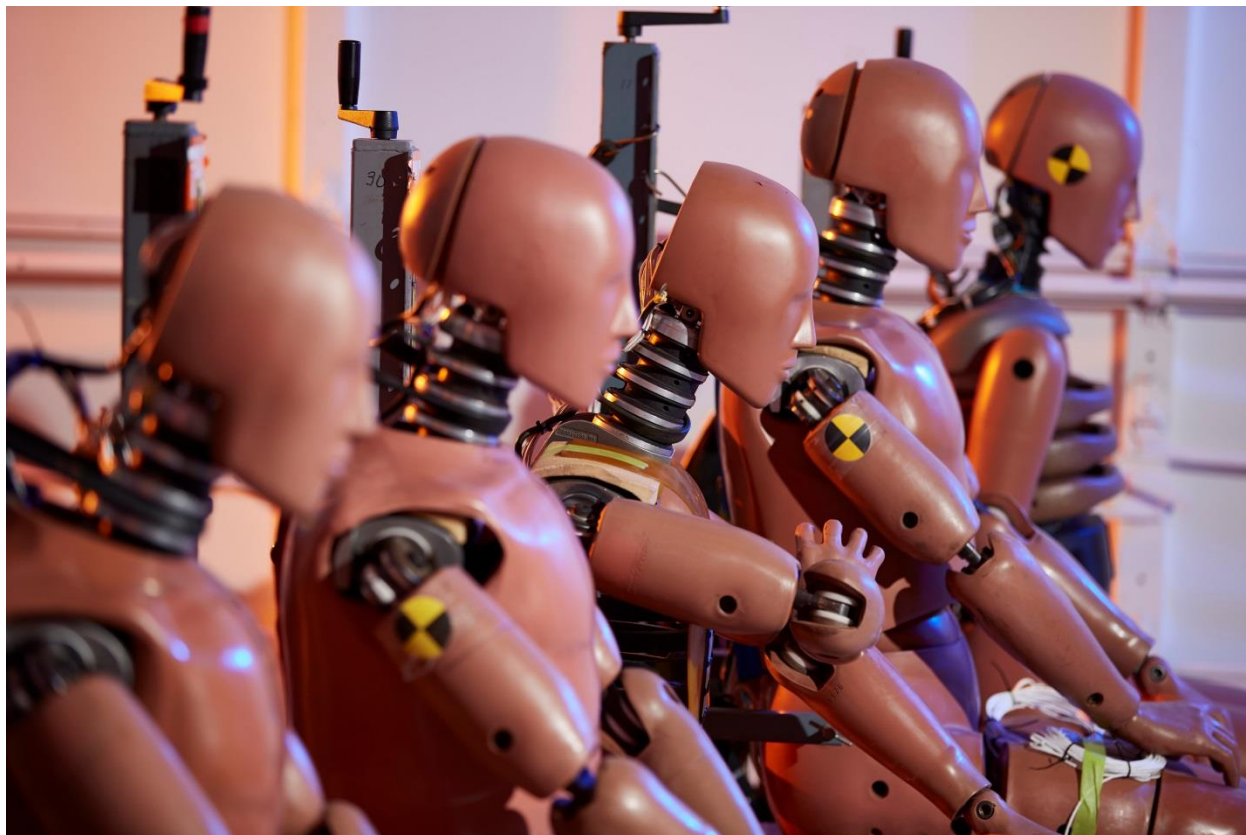
Right Knee Femur Response Test
HIII 6YO Serial No. 027 Certification No. 28-3
Test Date: 6/5/2023



Appendix C – Quality Assurance



Quality Assurance



ATD Assembly & Final Inspection

ATD Type: Hybrid III (6) Year Old

ATD Serial Number: 027

Assembled by: *Ruth Benda*

Date Inspected: 06/05/2023