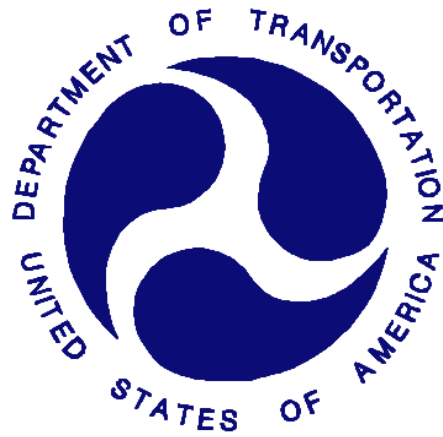


**Vehicle Research and Test Center
FMVSS 213 Testing
Hybrid III 10 Year Old**

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



Summary Report

January 2021

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

SECTION 1
PURPOSE AND SUMMARY FOR HYBRID III 10 YEAR OLD

The purpose of the testing is: to determine if higher pulses within the FMVSS 213 corridor produce different results.

SUMMARY

A Hybrid III 10 year old dummy (serial number F001) was secured in the right rear (position 3 or P3) in a belt positioning booster child restraint system (CRS). The Hybrid III 10 year old was instrumented with head, chest, and pelvis triaxial accelerometers, upper neck, lower neck, and lumbar force and moment load cells, a displacement potentiometer in the chest. During this test series the dummy was restrained with a 3 point seat belt (SB3PT).

The neck was re-qualified on 1/27/2021.

Section 2 contains testing performed using a forward facing CRS in the right rear seating position. Section 3 contains the dummy certification information. Section 3A contains the re-qualified neck certification information.

SECTION 2
FORWARD FACING CRS RIGHT REAR TEST SUMMARY

TEST DUMMY INFORMATION

| | |
|---------------------|-----------------------------|
| Description | Position # 3 CRS |
| ATD Type/Serial No. | Hybrid III 10 Year Old/F001 |
| Restraint System | SB3PT |
| CRS Direction | Forward Facing |
| Foam Cushion | WB8, WB13, WB10 |

CAMERA POSITIONING FARO MEASUREMENTS

| Description | Units | X | Y | Z |
|------------------------|-------|---------|---------|---------|
| Origin | mm | 0.00 | 0.00 | 0.00 |
| Passenger Front | mm | 1866.57 | -322.94 | -501.62 |
| N3 Passenger Excursion | mm | 812.84 | 903.58 | -459.10 |
| N5 Passenger Side | mm | 418.12 | 906.19 | -391.42 |

DUMMY POSITIONING

CRS: Harmony Youth NB – Belt Positioning Booster – SB3PT

TRC Test Number: S210121-1

VRTC Test Number: FR_RR_PE_14



DUMMY POSITIONING FARO MEASUREMENTS

| Description | Units | X | Y | Z |
|------------------------------|-------|---------|---------|---------|
| Z-Point | mm | -0.09 | -0.45 | -0.10 |
| Top of Headrest | mm | -162.88 | -349.22 | -818.57 |
| Top of Head | mm | 96.01 | -350.00 | -889.61 |
| Bridge of Nose | mm | 186.93 | -347.19 | -795.68 |
| Head CG Outboard | mm | 105.73 | -280.97 | -790.74 |
| Neck Center | mm | 107.96 | -348.40 | -669.60 |
| Knee Outboard | mm | 531.30 | -214.10 | -353.39 |
| Ankle Outboard | mm | 672.67 | -240.61 | -101.61 |
| Base Center | mm | 455.02 | -350.66 | -238.55 |
| Center of Seat Frame Bottom | mm | 616.40 | -350.41 | -109.60 |
| Target 2 - Seat Base H-Point | mm | 177.72 | -145.09 | -256.50 |
| Target 3 - Seat Base Side | mm | 412.15 | -179.88 | -259.02 |

| | |
|---------------------|---------|
| HIC (36 ms) | 620 |
| Chest Clip (3 ms) | 51.30 g |
| Head Excursion (mm) | 486 |
| Knee Excursion (mm) | 675 |

DUMMY POSITIONING

CRS: Harmony Youth NB – Belt Positioning Booster – SB3PT

TRC Test Number: S210122-1

VRTC Test Number: FR_RR_PE_16



DUMMY POSITIONING FARO MEASUREMENTS

| Description | Units | X | Y | Z |
|------------------------------|-------|---------|---------|---------|
| Z-Point | mm | -0.42 | -0.31 | -0.06 |
| Top of Headrest | mm | -176.66 | -356.45 | -816.95 |
| Top of Head | mm | 96.79 | -350.47 | -894.36 |
| Bridge of Nose | mm | 189.73 | -350.32 | -798.41 |
| Head CG Outboard | mm | 107.79 | -284.66 | -794.16 |
| Neck Center | mm | 110.65 | -351.62 | -673.23 |
| Shoulder Belt Top | mm | 174.87 | -350.83 | -602.63 |
| Shoulder Belt Bottom | mm | 214.08 | -350.60 | -527.93 |
| Lap Belt Top | mm | 277.32 | -351.93 | -402.08 |
| Lap Belt Bottom | mm | 314.83 | -350.31 | -375.18 |
| Knee Outboard | mm | 532.99 | -220.76 | -354.93 |
| Ankle Outboard | mm | 666.15 | -242.03 | -97.84 |
| Base Center | mm | 456.95 | -350.36 | -238.95 |
| Center of Seat Frame Bottom | mm | 616.49 | -350.26 | -109.50 |
| Target 2 - Seat Base H-Point | mm | 171.09 | -152.47 | -256.64 |
| Target 3 - Seat Base Side | mm | 405.41 | -185.16 | -258.34 |

| | |
|---------------------|---------|
| HIC (36 ms) | 572 |
| Chest Clip (3 ms) | 49.92 g |
| Head Excursion (mm) | 494 |
| Knee Excursion (mm) | 678 |

DUMMY POSITIONING

CRS: Harmony Youth NB – Belt Positioning Booster – SB3PT

TRC Test Number: S210122-2

VRTC Test Number: FR_RR_PE_18



DUMMY POSITIONING FARO MEASUREMENTS

| Description | Units | X | Y | Z |
|------------------------------|-------|---------|---------|---------|
| Z-Point | mm | -0.16 | -0.44 | 0.00 |
| Top of Headrest | mm | -165.54 | -350.14 | -822.62 |
| Top of Head | mm | 97.74 | -348.51 | -888.14 |
| Bridge of Nose | mm | 190.07 | -351.01 | -794.00 |
| Head CG Outboard | mm | 110.60 | -283.62 | -787.86 |
| Neck Center | mm | 110.00 | -350.62 | -668.55 |
| Shoulder Belt Top | mm | 170.53 | -351.26 | -598.20 |
| Shoulder Belt Bottom | mm | 211.09 | -350.41 | -522.35 |
| Lap Belt Top | mm | 272.17 | -350.71 | -402.91 |
| Lap Belt Bottom | mm | 306.20 | -349.52 | -372.41 |
| Knee Outboard | mm | 528.42 | -222.02 | -356.91 |
| Ankle Outboard | mm | 668.68 | -238.72 | -101.42 |
| Base Center | mm | 459.24 | -351.46 | -240.22 |
| Center of Seat Frame Bottom | mm | 616.54 | -350.45 | -109.22 |
| Target 2 - Seat Base H-Point | mm | 182.61 | -153.81 | -252.12 |
| Target 3 - Seat Base Side | mm | 419.14 | -186.12 | -255.14 |

| | |
|---------------------|---------|
| HIC (36 ms) | 595 |
| Chest Clip (3 ms) | 50.16 g |
| Head Excursion (mm) | 494 |
| Knee Excursion (mm) | 672 |

DUMMY POSITIONING

CRS: Evenflo Big Kid LX HB – Belt Positioning Booster – SB3PT

TRC Test Number: S210125-1

VRTC Test Number: FR_RR_PE_20



DUMMY POSITIONING FARO MEASUREMENTS

| Description | Units | X | Y | Z |
|------------------------------|-------|---------|---------|---------|
| Z-Point | mm | -0.39 | -0.12 | 0.05 |
| Center of Seat Frame Back | mm | -118.31 | -348.56 | -682.02 |
| Top of CRS | mm | -1.85 | -351.87 | -684.66 |
| Top of Headrest | mm | 9.78 | -352.43 | -933.42 |
| Top of Head | mm | 197.62 | -349.32 | -919.37 |
| Bridge of Nose | mm | 275.67 | -350.05 | -812.59 |
| Head CG Outboard | mm | 193.29 | -281.93 | -816.19 |
| Neck Center | mm | 179.01 | -352.45 | -700.06 |
| Shoulder Belt Top | mm | 226.71 | -350.38 | -633.72 |
| Shoulder Belt Bottom | mm | 260.04 | -350.47 | -564.08 |
| Lap Belt Top | mm | 308.48 | -350.78 | -428.89 |
| Lap Belt Bottom | mm | 343.88 | -350.68 | -398.09 |
| Base Center | mm | 531.05 | -352.78 | -255.21 |
| Center of Seat Frame Bottom | mm | 616.22 | -350.05 | -110.09 |
| Knee Outboard | mm | 562.77 | -229.57 | -391.04 |
| Ankle Outboard | mm | 646.79 | -251.66 | -113.48 |
| Target 1 - Seat Side Upper | mm | 33.91 | -225.25 | -742.81 |
| Target 4 - Seat Side Lower | mm | 37.96 | -248.19 | -473.14 |
| Target 2 - Seat Base H-Point | mm | 167.92 | -165.08 | -300.09 |
| Target 3 - Seat Base Side | mm | 338.88 | -156.40 | -232.70 |

| | |
|---------------------|---------|
| HIC (36 ms) | 502 |
| Chest Clip (3 ms) | 47.20 g |
| Head Excursion (mm) | 554 |
| Knee Excursion (mm) | 700 |

DUMMY POSITIONING

CRS: Evenflo Big Kid LX HB – Belt Positioning Booster – SB3PT

TRC Test Number: S210127-1

VRTC Test Number: FR_RR_PE_22



DUMMY POSITIONING FARO MEASUREMENTS

| Description | Units | X | Y | Z |
|------------------------------|-------|---------|---------|---------|
| Z-Point | mm | -0.04 | -0.32 | 0.15 |
| Center of Seat Frame Back | mm | -117.95 | -348.56 | -681.89 |
| Top of CRS | mm | -0.85 | -350.50 | -686.44 |
| Top of Headrest | mm | 7.25 | -350.13 | -935.18 |
| Top of Head | mm | 193.37 | -349.14 | -922.95 |
| Bridge of Nose | mm | 272.75 | -351.90 | -820.85 |
| Head CG Outboard | mm | 190.88 | -284.66 | -821.58 |
| Neck Center | mm | 180.16 | -352.61 | -703.96 |
| Shoulder Belt Top | mm | 229.86 | -350.20 | -634.05 |
| Shoulder Belt Bottom | mm | 263.39 | -350.30 | -562.05 |
| Lap Belt Top | mm | 311.71 | -350.45 | -427.85 |
| Lap Belt Bottom | mm | 347.28 | -351.04 | -399.82 |
| Base Center | mm | 528.85 | -353.47 | -261.98 |
| Center of Seat Frame Bottom | mm | 616.26 | -350.19 | -110.44 |
| Knee Outboard | mm | 568.10 | -223.11 | -394.79 |
| Ankle Outboard | mm | 649.25 | -244.14 | -117.98 |
| Target 1 - Seat Side Upper | mm | 36.49 | -223.94 | -743.28 |
| Target 4 - Seat Side Lower | mm | 40.68 | -244.05 | -475.11 |
| Target 2 - Seat Base H-Point | mm | 169.17 | -158.73 | -302.31 |
| Target 3 - Seat Base Side | mm | 339.71 | -149.40 | -235.46 |

| | |
|---------------------|---------|
| HIC (36 ms) | 480 |
| Chest Clip (3 ms) | 46.13 g |
| Head Excursion (mm) | 545 |
| Knee Excursion (mm) | 694 |

DUMMY POSITIONING

CRS: Evenflo Big Kid LX HB – Belt Positioning Booster – SB3PT

TRC Test Number: S210128-1

VRTC Test Number: FR_RR_PE_24



DUMMY POSITIONING FARO MEASUREMENTS

| Description | Units | X | Y | Z |
|------------------------------|-------|---------|---------|---------|
| Z-Point | mm | -0.09 | -0.24 | 0.18 |
| Center of Seat Frame Back | mm | -118.35 | -348.83 | -681.91 |
| Top of CRS | mm | 1.39 | -350.76 | -687.16 |
| Top of Headrest | mm | 9.91 | -346.87 | -936.31 |
| Top of Head | mm | 198.77 | -350.05 | -925.30 |
| Bridge of Nose | mm | 276.60 | -351.21 | -820.60 |
| Head CG Outboard | mm | 194.39 | -284.83 | -823.57 |
| Neck Center | mm | 182.72 | -351.72 | -705.80 |
| Shoulder Belt Top | mm | 231.13 | -349.79 | -636.01 |
| Shoulder Belt Bottom | mm | 263.41 | -350.73 | -566.44 |
| Lap Belt Top | mm | 308.64 | -350.49 | -431.22 |
| Lap Belt Bottom | mm | 345.06 | -350.53 | -400.79 |
| Base Center | mm | 529.85 | -349.93 | -257.70 |
| Center of Seat Frame Bottom | mm | 616.34 | -350.37 | -108.99 |
| Knee Outboard | mm | 566.51 | -224.19 | -392.90 |
| Ankle Outboard | mm | 651.99 | -250.66 | -113.43 |
| Target 1 - Seat Side Upper | mm | 36.89 | -224.32 | -744.26 |
| Target 4 - Seat Side Lower | mm | 38.97 | -248.34 | -473.12 |
| Target 2 - Seat Base H-Point | mm | 169.72 | -164.39 | -299.22 |
| Target 3 - Seat Base Side | mm | 340.29 | -155.34 | -232.02 |

| | |
|---------------------|---------|
| HIC (36 ms) | 491 |
| Chest Clip (3 ms) | 48.05 g |
| Head Excursion (mm) | 565 |
| Knee Excursion (mm) | 701 |

SECTION 3
DUMMY CALIBRATION DATA

SECTION 4A
RE-QUALIFIED NECK CALIBRATION DATA

Transportation Research Center Inc. ATD Certification Report

Customer:

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

Anthropomorphic Device:

Hybrid III (10) Year Old
Serial No. F001
Certification No. 33



**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 17, 2020
Date Completed: December 21, 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: 12/17/2020

Testing Conducted by: Bryce Williams
Bryce Williams, Engineering Technician I

Date: 12/21/2020

Testing Approved by: Sal LoPresti
Sal LoPresti, Supervisor - Calibration Services

Date: 12/22/2020



Appendix A – Incoming Inspection



TRC ATD Laboratory As Received Inspection Report

Name: Bryce Williams

Date: 12/17/2020

Customer: VRTC

ATD S/N: F001

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

| THORAX / ABDOMEN | | |
|------------------|---|-----------|
| No. | Comments | Photo No. |
| 4 | Small cuts on back and on left side of abdomen. | 1,2 |
| 5 | | |
| 6 | | |

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

| PELVIS / LUMBAR | | |
|-----------------|---------------------------------|-----------|
| No. | Comments | Photo No. |
| 10 | Cut on left top side of pelvis. | 3 |
| 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 | | |





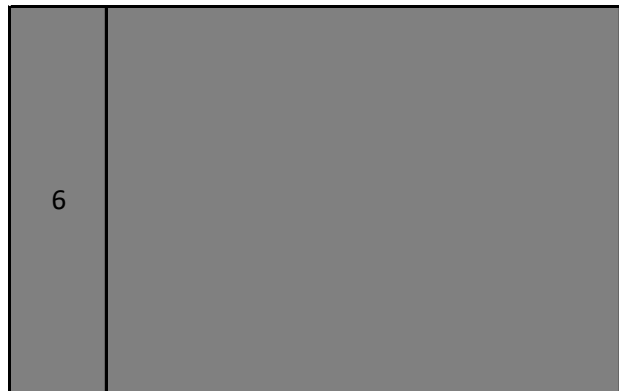
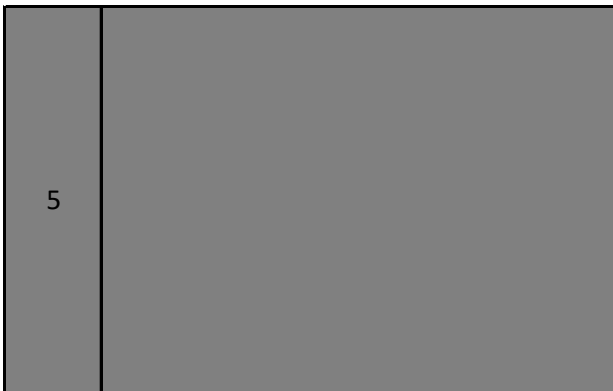
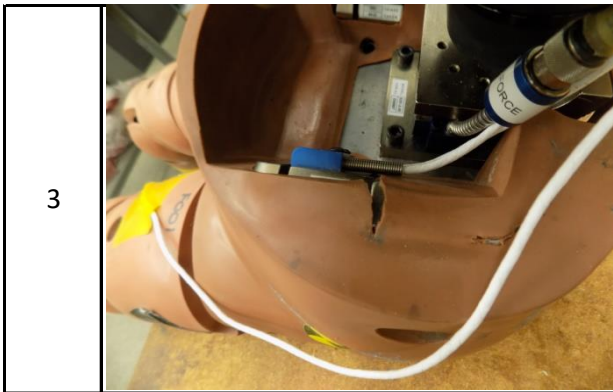
TRC ATD Laboratory As Received Inspection Photos

Name: Bryce Williams

Date: 12/17/2020

Customer: VRTC

ATD S/N: F001





TRC ATD Laboratory Inspection Report Action Items

Name: Bryce Williams

Date: 12/21/2020

Customer: VRTC

ATD S/N: F001

| | |
|---------------|-----------------|
| 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 10YO Serial No. F001 Certification No. 33-1

Test Date: 12/18/2020

| Test Parameter | Specification | Test Results | Pass |
|----------------------------------|----------------------|---------------------|-------------|
| Temperature | 18.9 - 25.6 °C | 21.7 °C | Yes |
| Relative Humidity | 10 - 70 % | 38 % | Yes |
| Peak Head Resultant Acceleration | 250 - 300 g | 293.6 g | Yes |
| Peak Head Lateral Acceleration | (-15) - 15 g | 2.7 g | Yes |
| Is Acceleration Curve Unimodal | < 10 % | 1.59 % | Yes |

Test meets specifications.

Condition: Used

Comments:

Head Skin S/N: 1352

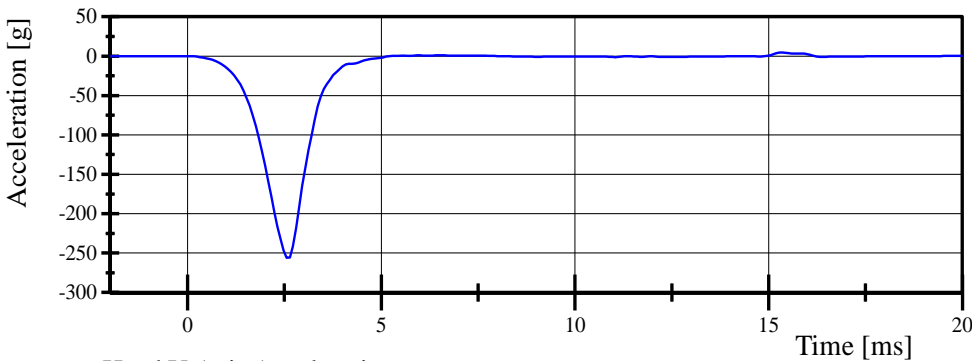
Transportation Research Center Inc.

Front Head Drop

HIII 10YO Serial No. F001 Certification No. 33-1

Test Date: 12/18/2020

Head X-Axis Acceleration

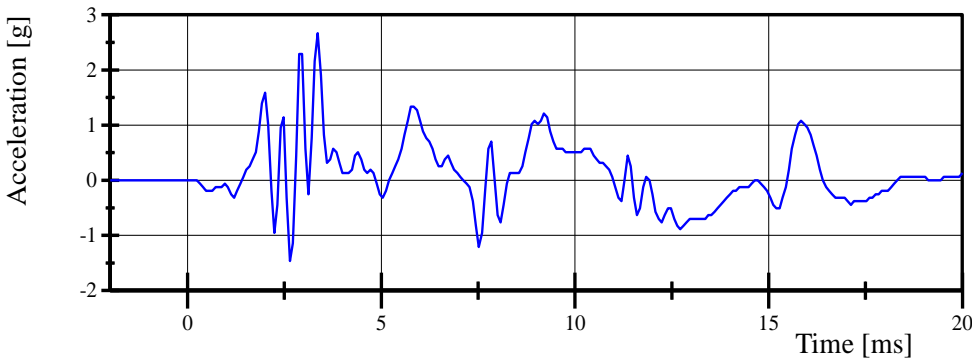


Filter Class: CFC_1000

Max: 4.6 g at 15.3 ms

Min: -256.1 g at 2.6 ms

Head Y-Axis Acceleration

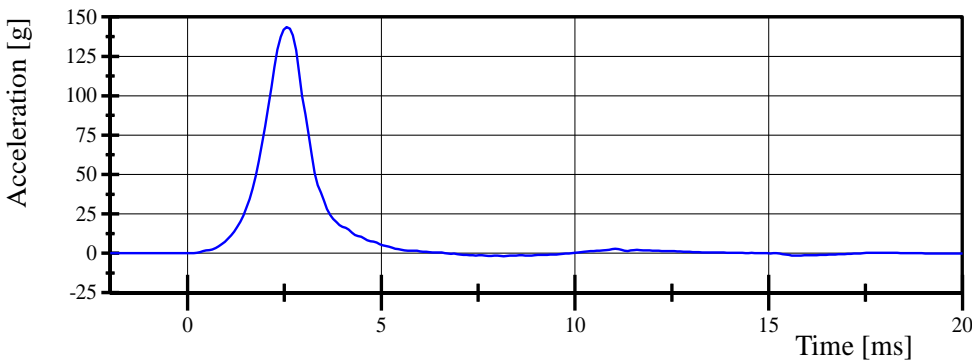


Filter Class: CFC_1000

Max: 2.7 g at 3.4 ms

Min: -1.5 g at 2.6 ms

Head Z-Axis Acceleration

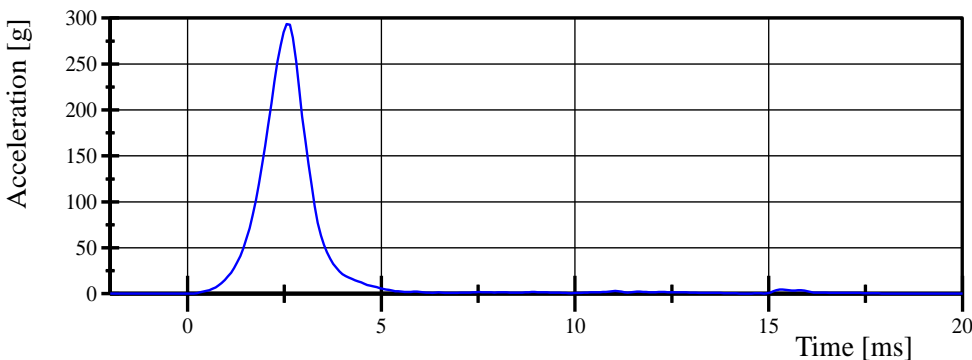


Filter Class: CFC_1000

Max: 143.6 g at 2.6 ms

Min: -1.8 g at 8.2 ms

Head Resultant Acceleration



Filter Class: CFC_1000

Max: 293.6 g at 2.6 ms

Min: 0.0 g at -2.0 ms

Transportation Research Center Inc.

Neck Flexion

HIII 10YO Serial No. F001 Certification No. 33-1

Test Date: 12/21/2020

| Test Parameter | Specification | Test Results | Pass |
|--|-----------------------|---------------------|-------------|
| Temperature | 20.6 - 22.2 °C | 21.7 °C | Yes |
| Relative Humidity | 10 - 70 % | 39 % | Yes |
| Pendulum Impact Velocity | 5.98 - 6.22 m/s | 6.142 m/s | Yes |
| Pendulum Integrated Velocity at 10ms | (-1.64) - (-2.04) m/s | -1.810 m/s | Yes |
| Pendulum Integrated Velocity at 20ms | (-3.04) - (-4.04) m/s | -3.558 m/s | Yes |
| Pendulum Integrated Velocity at 30ms | (-4.45) - (-5.65) m/s | -5.175 m/s | Yes |
| Total Head D-Plane Rotation | (-76.0) - (-90.0) ° | -79.08 ° | Yes |
| Total Neck Occipital Condyles Moment Between -76° and -90° Rotation | 50.0 - 62.0 Nm | 56.28 Nm | Yes |
| Neck Occipital Condyles Moment Decay to 10 Nm | 86.0 - 105.0 ms | 94.25 ms | Yes |

Test meets specifications.

Condition: Used

Comments:

Neck S/N: 22020053A

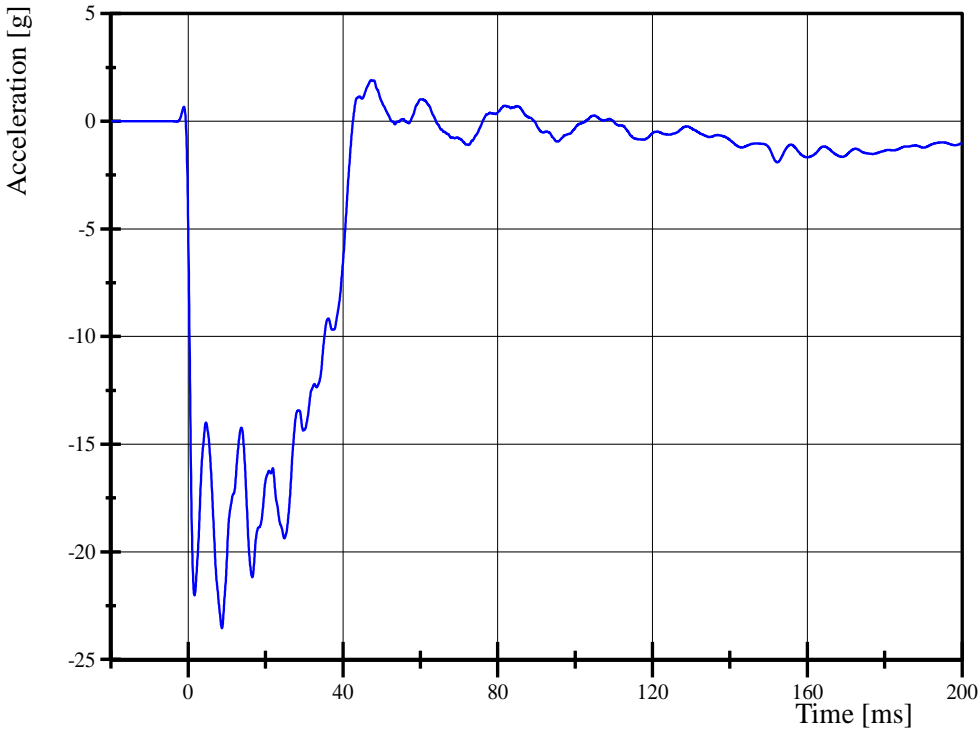
Transportation Research Center Inc.

Neck Flexion

HIII 10YO Serial No. F001 Certification No. 33-1

Test Date: 12/21/2020

Pendulum Acceleration

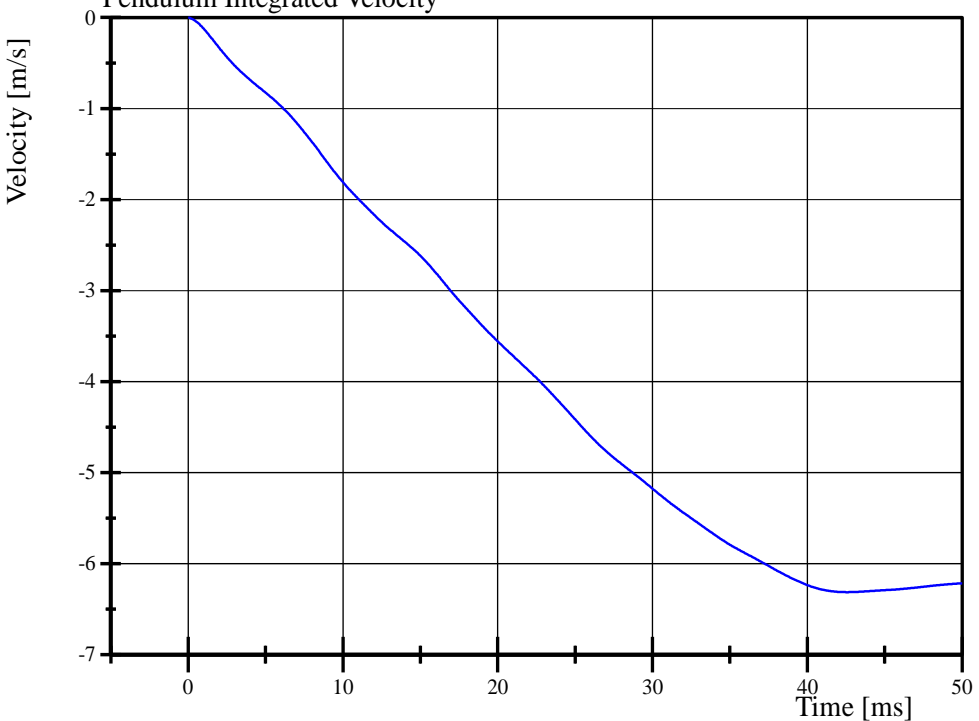


Filter Class: CFC_180

Max: 1.9 g at 47.3 ms

Min: -23.5 g at 8.8 ms

Pendulum Integrated Velocity



Filter Class: CFC_180

Max: 0.0 m/s at 0.0 ms

Min: -6.3 m/s at 42.6 ms

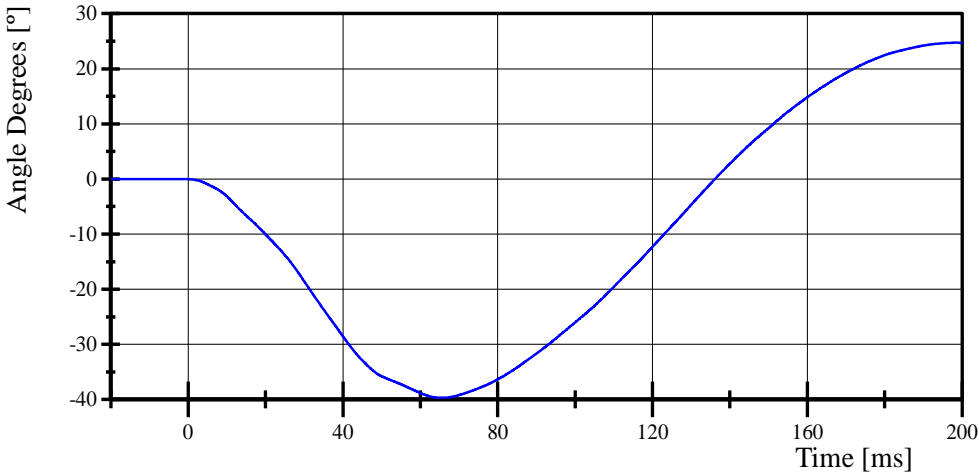
Transportation Research Center Inc.

Neck Flexion

HIII 10YO Serial No. F001 Certification No. 33-1

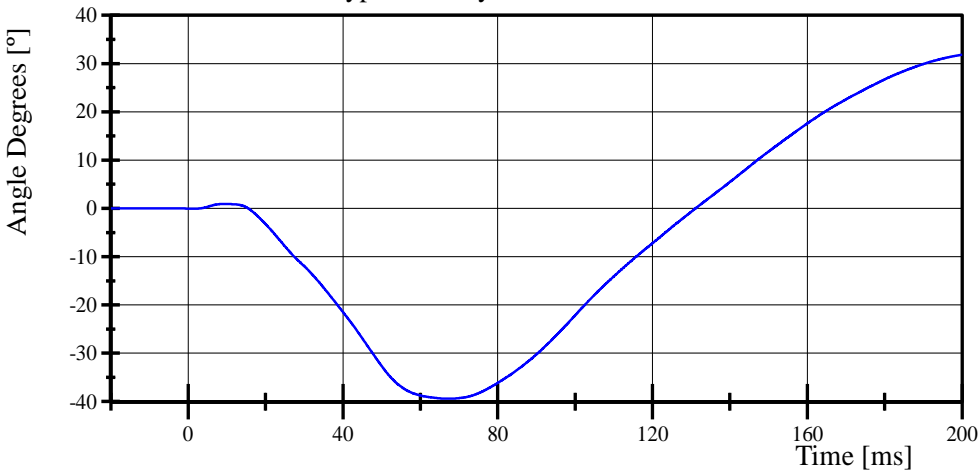
Test Date: 12/21/2020

Pot Rotation at the Base of Neck



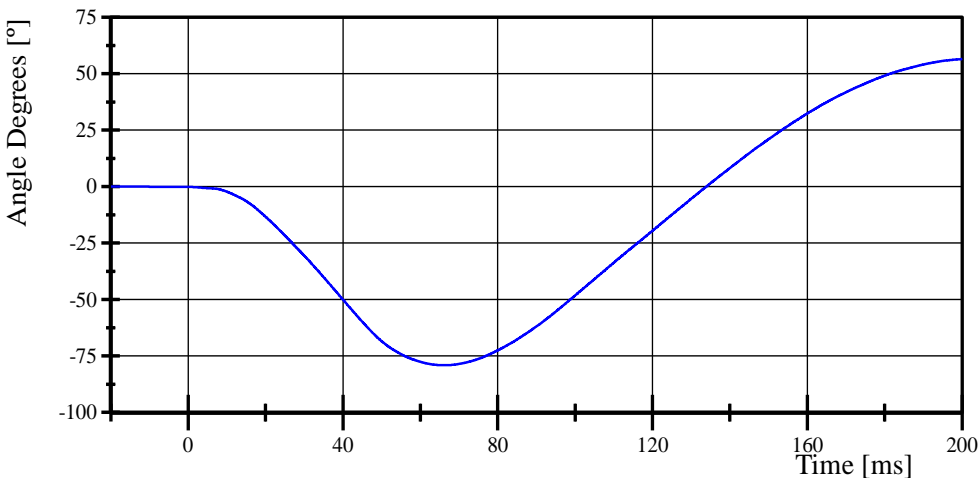
Filter Class: CFC_60
Max: 24.7 ° at 198.3 ms
Min: -39.7 ° at 65.4 ms

Head Rotation at Occypital Condyles



Filter Class: CFC_60
Max: 31.8 ° at 200.0 ms
Min: -39.4 ° at 67.2 ms

Total Head D-Plane Rotation



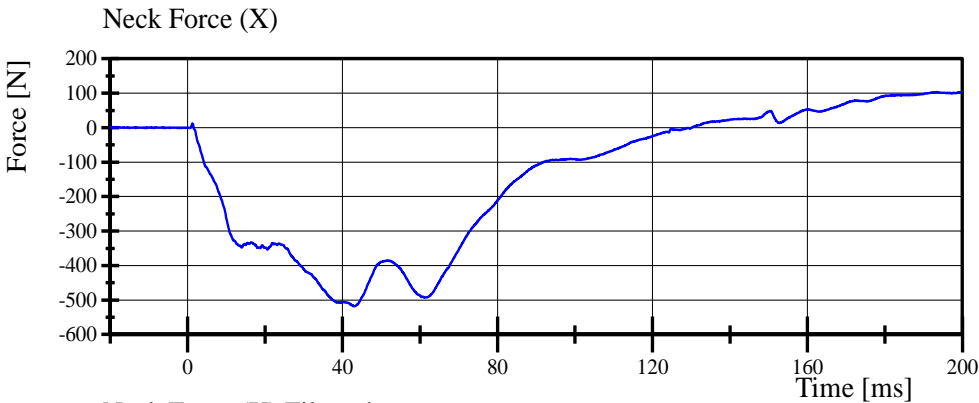
Filter Class: CFC_60
Max: 56.5 ° at 200.0 ms
Min: -79.1 ° at 66.2 ms

Transportation Research Center Inc.

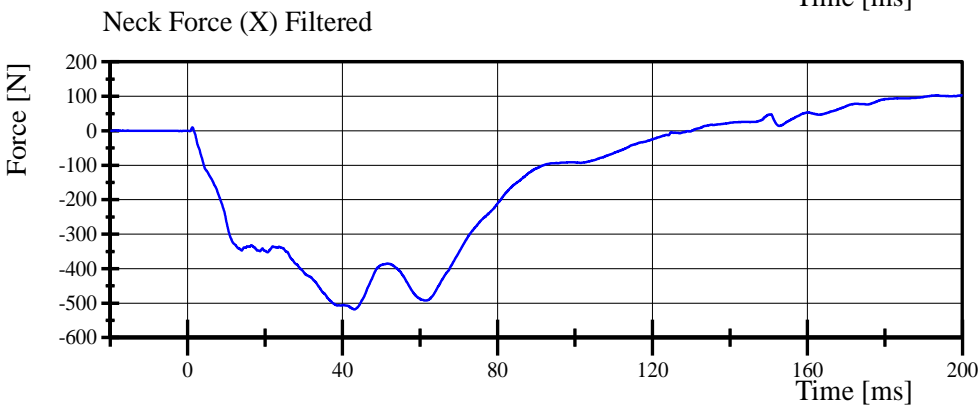
Neck Flexion

HIII 10YO Serial No. F001 Certification No. 33-1

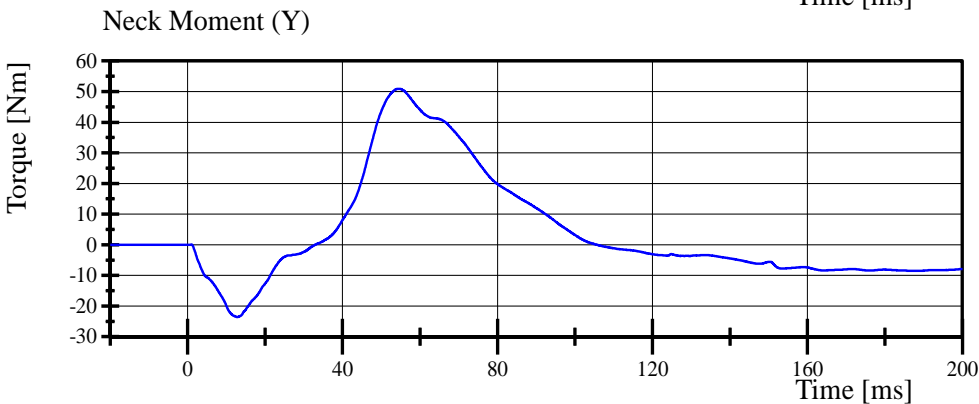
Test Date: 12/21/2020



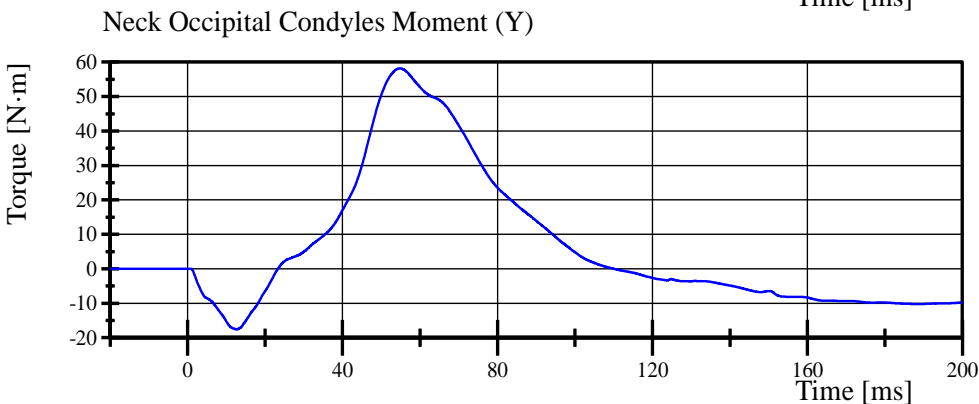
Filter Class: CFC_1000
Max: 103.2 N at 193.2 ms
Min: -518.2 N at 42.9 ms



Filter Class: CFC_600
Max: 103.1 N at 193.3 ms
Min: -518.0 N at 43.0 ms



Filter Class: CFC_600
Max: 50.9 Nm at 54.6 ms
Min: -23.6 Nm at 12.8 ms



Filter Class: Without_(Constar
Max: 58.2 N·m at 54.8 ms
Min: -17.6 N·m at 12.7 ms

Transportation Research Center Inc.

Neck Extension

HIII 10YO Serial No. F001 Certification No. 33-1

Test Date: 12/21/2020

| Test Parameter | Specification | Test Results | Pass |
|---|----------------------|---------------------|-------------|
| Temperature | 20.6 - 22.2 °C | 21.5 °C | Yes |
| Relative Humidity | 10 - 70 % | 40 % | Yes |
| Pendulum Impact Velocity | 4.91 - 5.15 m/s | 4.988 m/s | Yes |
| Pendulum Integrated Velocity at 10ms | 1.49 - 1.89 m/s | 1.680 m/s | Yes |
| Pendulum Integrated Velocity at 20ms | 2.88 - 3.68 m/s | 3.354 m/s | Yes |
| Pendulum Integrated Velocity at 30ms | 4.20 - 5.20 m/s | 4.879 m/s | Yes |
| Total Head D-Plane Rotation | 96.0 - 115.0 ° | 102.19 ° | Yes |
| Total Neck Occipital Condyles Moment Between 96° and 115° Rotation | (-37.0) - (-46.0) Nm | -40.01 Nm | Yes |
| Neck Occipital Condyles Moment Decay to -10 Nm | 100.0 - 116.0 ms | 106.80 ms | Yes |

Test meets specifications.

Condition: Used

Comments:

Neck S/N: 22020053A

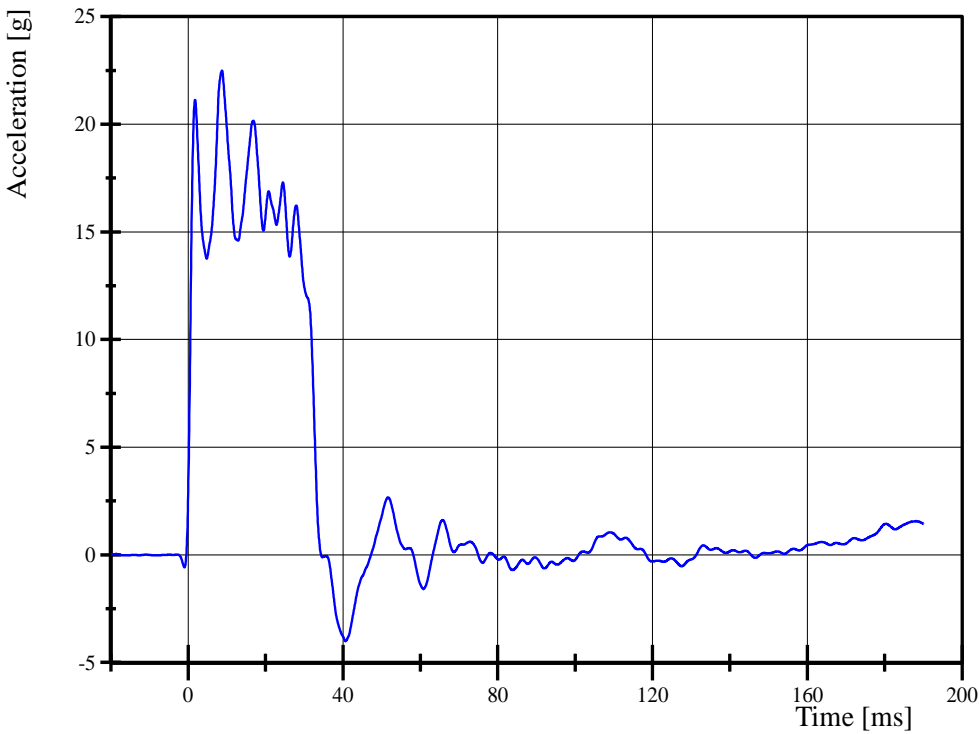
Transportation Research Center Inc.

Neck Extension

HIII 10YO Serial No. F001 Certification No. 33-1

Test Date: 12/21/2020

Pendulum Acceleration

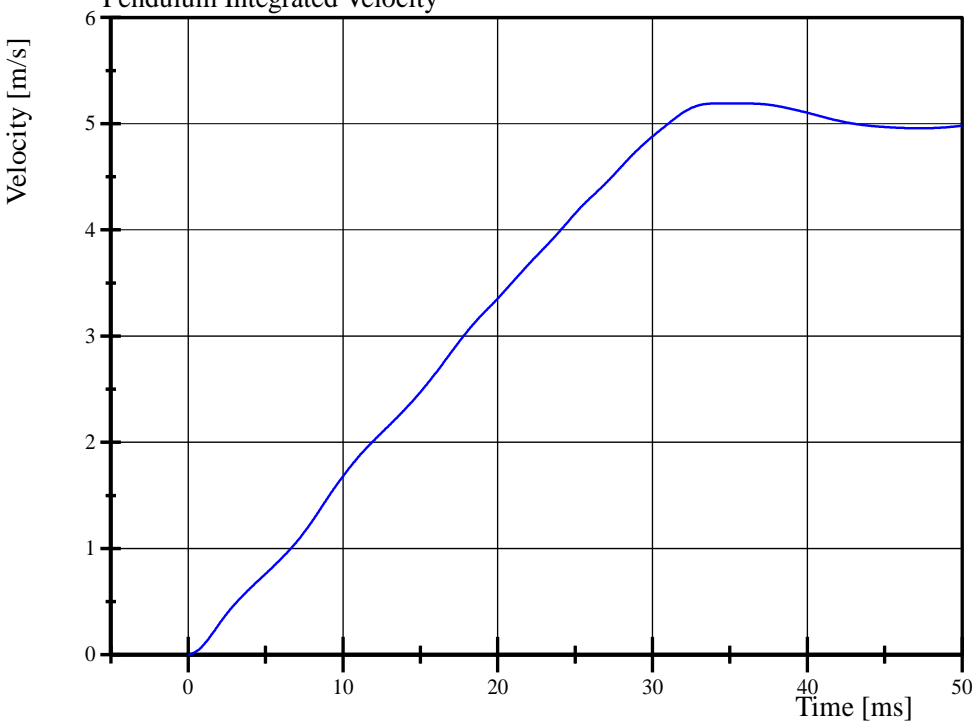


Filter Class: CFC_180

Max: 22.5 g at 8.8 ms

Min: -4.0 g at 40.7 ms

Pendulum Integrated Velocity



Filter Class: CFC_180

Max: 5.2 m/s at 34.4 ms

Min: 0.0 m/s at 0.0 ms

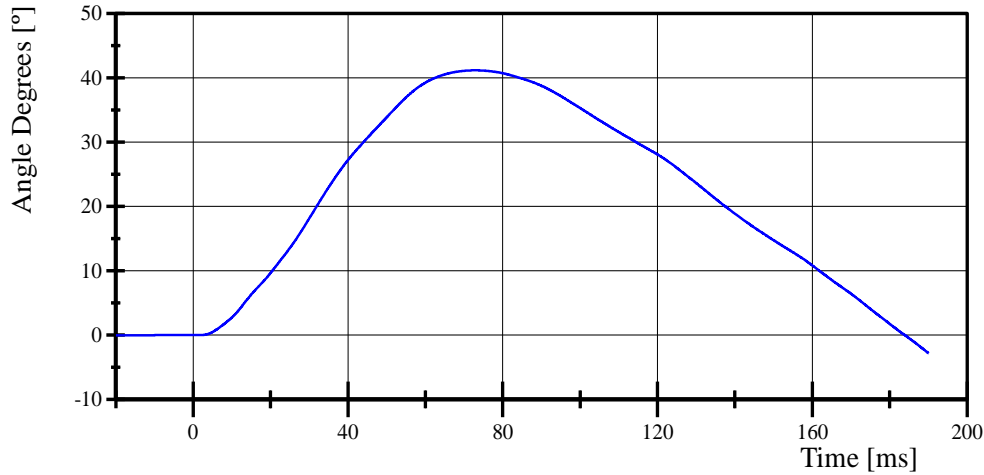
Transportation Research Center Inc.

Neck Extension

HIII 10YO Serial No. F001 Certification No. 33-1

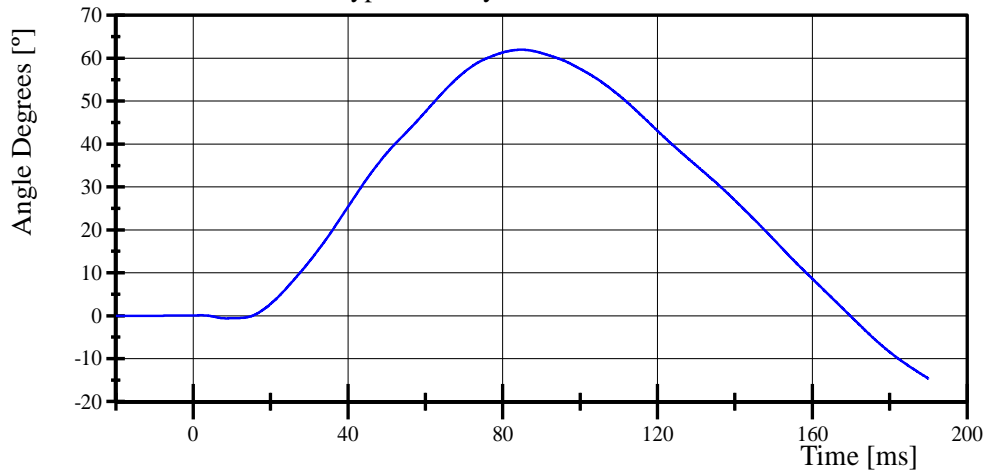
Test Date: 12/21/2020

Pot Rotation at the Base of Neck



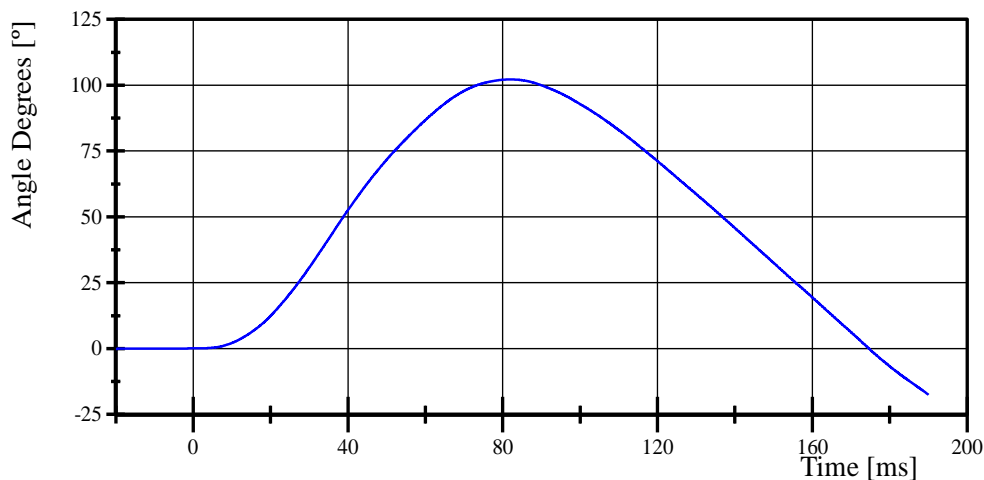
Filter Class: CFC_60
Max: 41.2 ° at 72.9 ms
Min: -2.8 ° at 190.1 ms

Head Rotation at Occipital Condyles



Filter Class: CFC_60
Max: 62.0 ° at 84.8 ms
Min: -14.7 ° at 190.1 ms

Total Head D-Plane Rotation



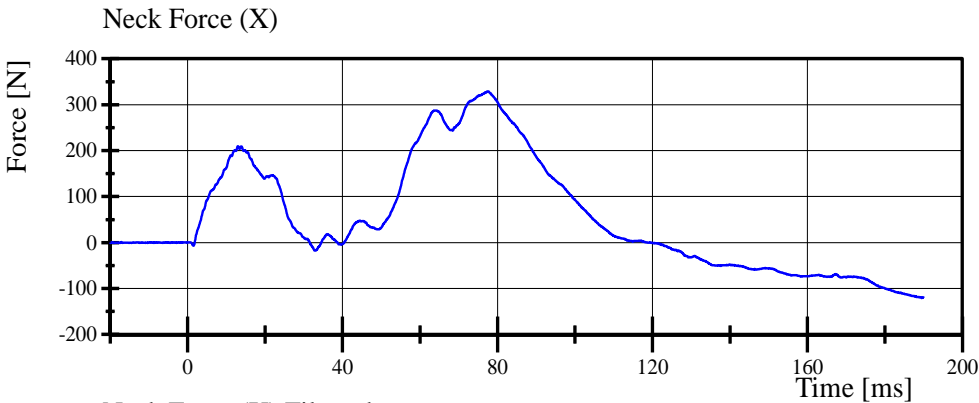
Filter Class: CFC_60
Max: 102.2 ° at 81.9 ms
Min: -17.5 ° at 190.1 ms

Transportation Research Center Inc.

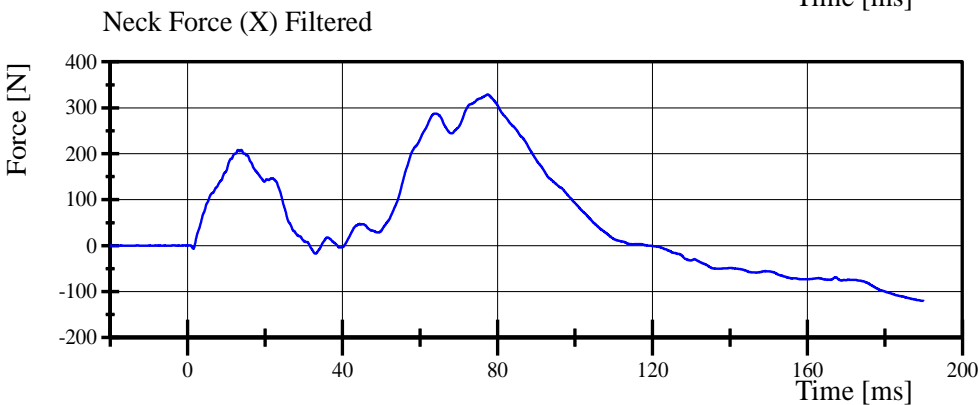
Neck Extension

HIII 10YO Serial No. F001 Certification No. 33-1

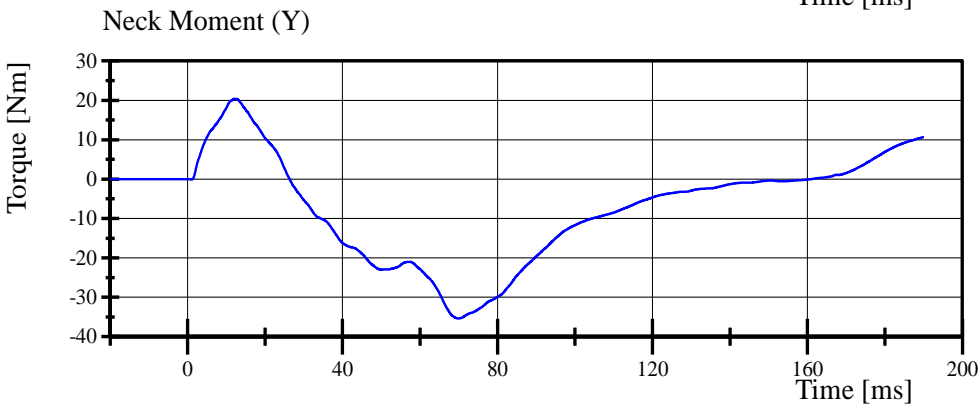
Test Date: 12/21/2020



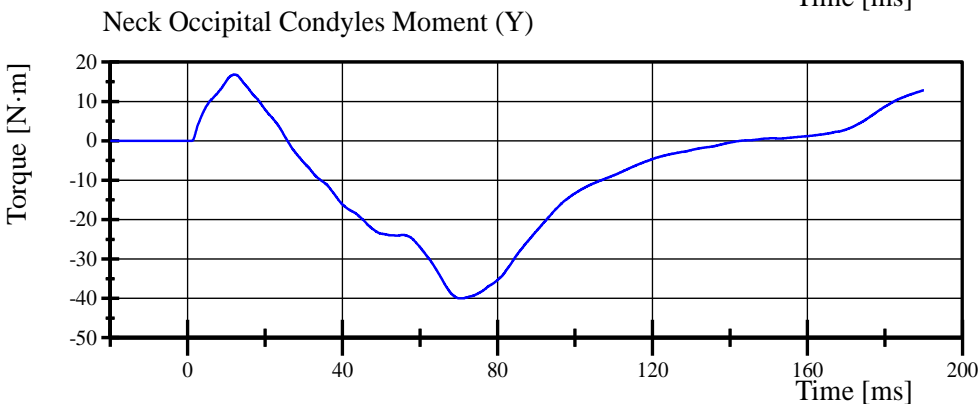
Filter Class: CFC_1000
Max: 329.2 N at 77.5 ms
Min: -120.4 N at 189.5 ms



Filter Class: CFC_600
Max: 328.9 N at 77.5 ms
Min: -120.4 N at 190.1 ms



Filter Class: CFC_600
Max: 20.4 Nm at 12.1 ms
Min: -35.4 Nm at 70.0 ms



Filter Class: Without_(Constar
Max: 16.8 N·m at 12.1 ms
Min: -40.0 N·m at 70.8 ms

Transportation Research Center Inc.

Front Thorax

HIII 10YO Serial No. F001 Certification No. 33-1

Test Date: 12/21/2020

| Test Parameter | Specification | Test Results | Pass |
|--|-----------------------|---------------------|-------------|
| Temperature | 20.6 - 22.2 °C | 21.5 °C | Yes |
| Relative Humidity | 10 - 70 % | 40 % | Yes |
| Probe Velocity | 5.88 - 6.12 m/s | 6.021 m/s | Yes |
| Probe Force Peak Between 37 mm and 46 mm Chest Deflection | (-2,000) - (-2,450) N | -2,318.1 N | Yes |
| Probe Force Peak Between 20.0 mm and 37 mm Chest Deflection | >= (-2,520) N | -2,312.4 N | Yes |
| Maximum Chest Compression | (-37) - (-46) mm | -40.2 mm | Yes |
| Internal Hysteresis | 69 - 85 % | 80.5 % | Yes |

Test meets specifications.

Condition: Used

Comments:

Jacket S/N: 08948

Rib Set S/N: 22031804A

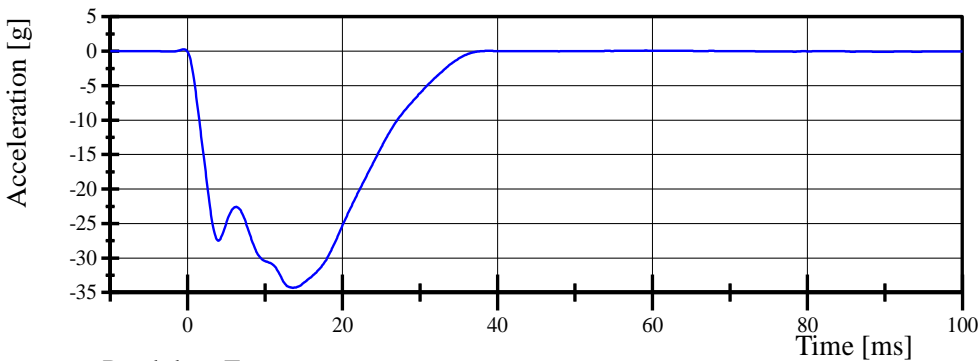
Transportation Research Center Inc.

Front Thorax

HIII 10YO Serial No. F001 Certification No. 33-1

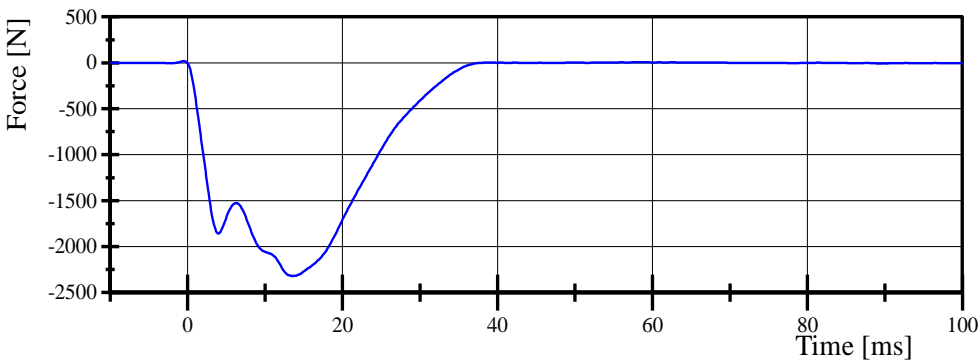
Test Date: 12/21/2020

Pendulum Acceleration



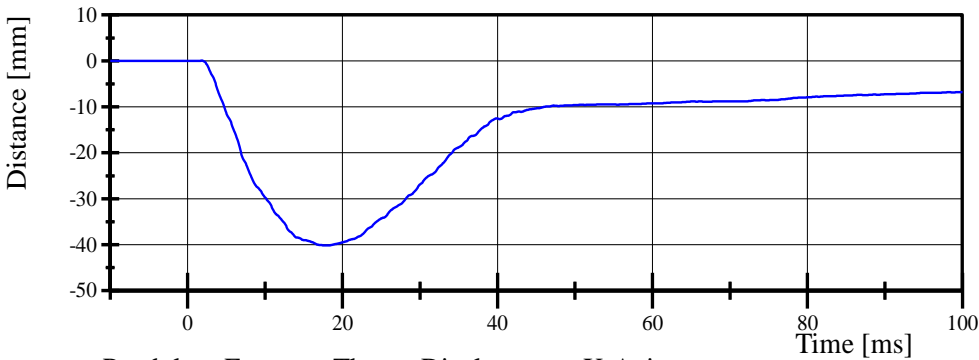
Filter Class: CFC_180
Max: 0.3 g at -0.5 ms
Min: -34.3 g at 13.6 ms

Pendulum Force



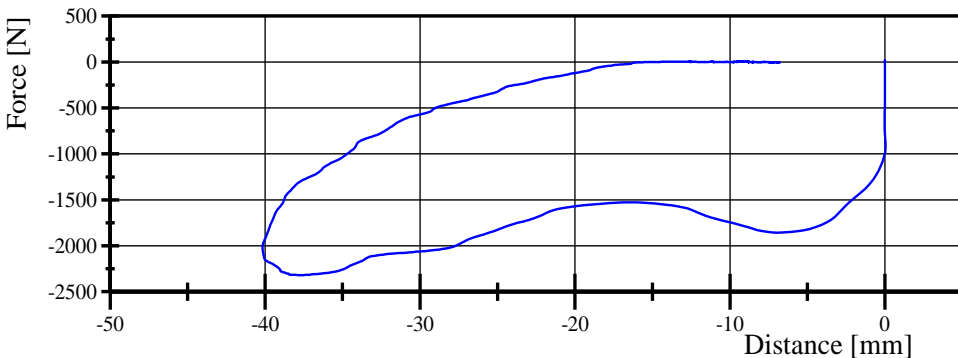
Filter Class: CFC_180
Max: 18.1 N at -0.5 ms
Min: -2,318.1 N at 13.6 ms

Thorax Displacement X-Axis



Filter Class: CFC_600
Max: 0.0 mm at 1.8 ms
Min: -40.2 mm at 18.2 ms

Pendulum Force vs. Thorax Displacement X-Axis



Filter Class: CFC_180
Max: 18.1 N at -0.0 mm
Min: -2,318.1 N at -37.7 mm

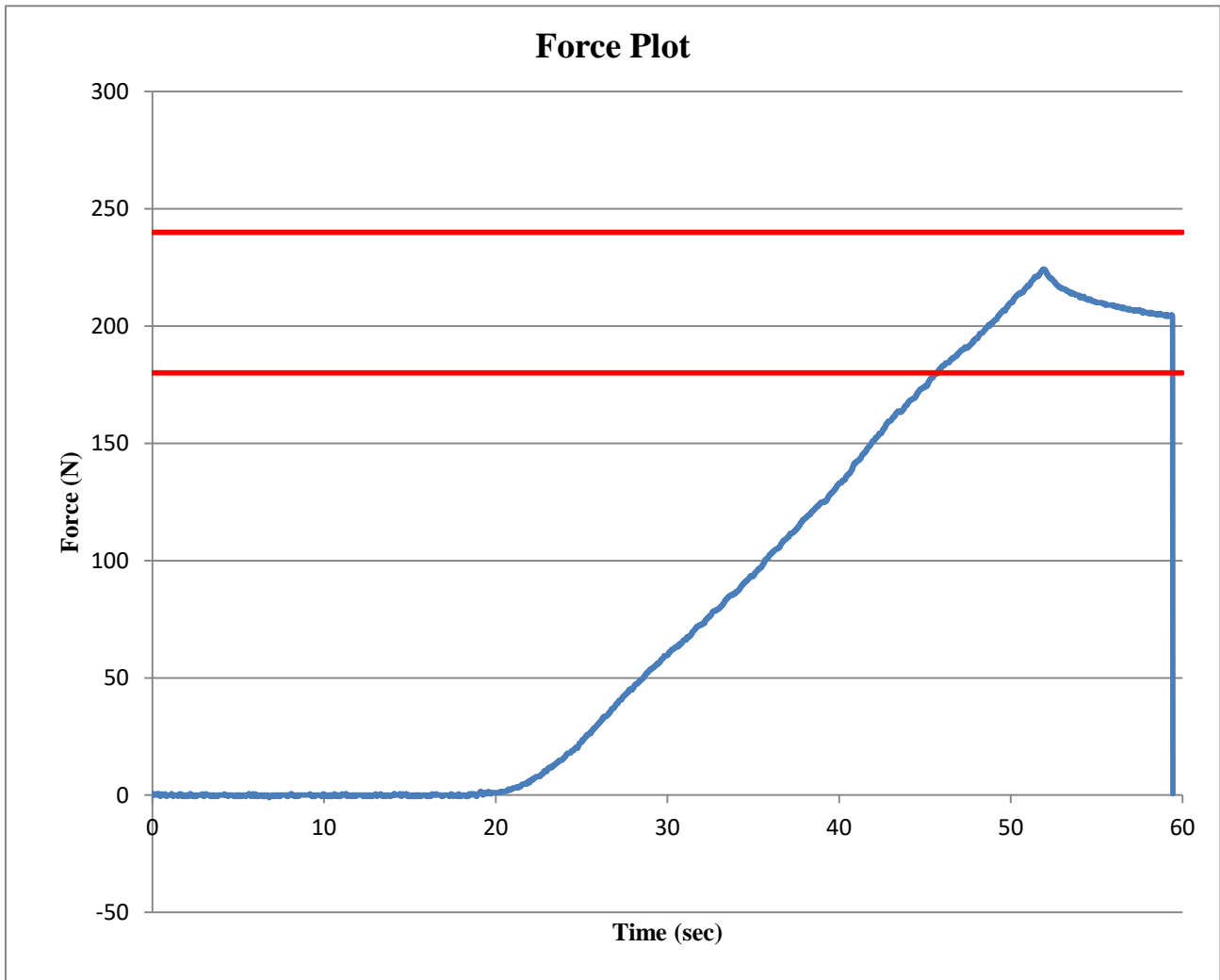
Transportation Research Center Inc.

Hybrid III 10-Year Old Torso Flexion



Customer: VRTC
Serial Number: F001 Date: 12/18/2020
Test Number: 1 Time: 10:15

| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|--------------------------|---------------|------------------------|
| Temperature | 18.9 - 25.6 | 21.3 °C Pass |
| Humidity | 10 - 70 | 41 % Pass |
| Average Angular Velocity | 0.5 - 1.5 | 0.96 deg/sec Pass |
| Initial Angle | 0 - 20 | 4.71 deg Pass |
| Peak Force at 35.28° | 180 - 240 | 224.23 N Pass |
| Final Angle | 0 - 8 | 2.28 deg Pass |



Comments:
Lumbar S/N: 0053
Abdomen S/N: N/A

Transportation Research Center Inc.

Left Knee Femur Response Test

HIII 10YO Serial No. F001 Certification No. 33-1

Test Date: 12/18/2020

| Test Parameter | Specification | Test Results | Pass |
|-----------------------|-----------------------|---------------------|-------------|
| Temperature | 20.6 - 22.2 °C | 21.6 °C | Yes |
| Relative Humidity | 10 - 70 % | 41 % | Yes |
| Probe Velocity | 2.07 - 2.13 m/s | 2.105 m/s | Yes |
| Peak Femur Force | (-2,600) - (-3,200) N | -2,719.6 N | Yes |

Test meets specifications.

Condition: Used

Comments:

Knee Skin S/N: 527

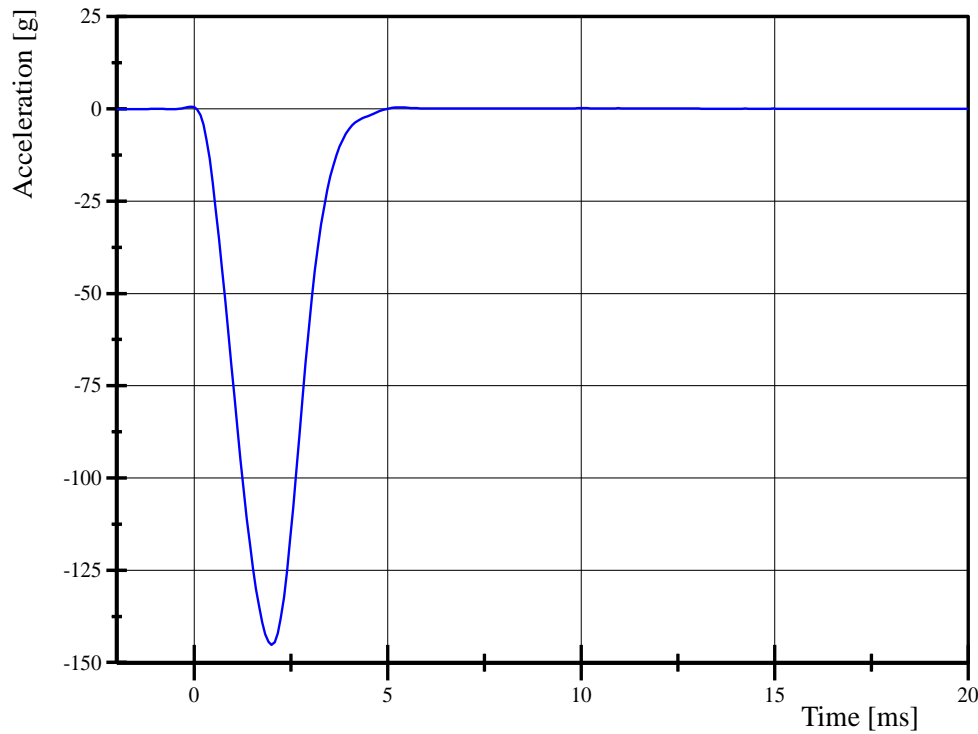
Transportation Research Center Inc.

Left Knee Femur Response Test

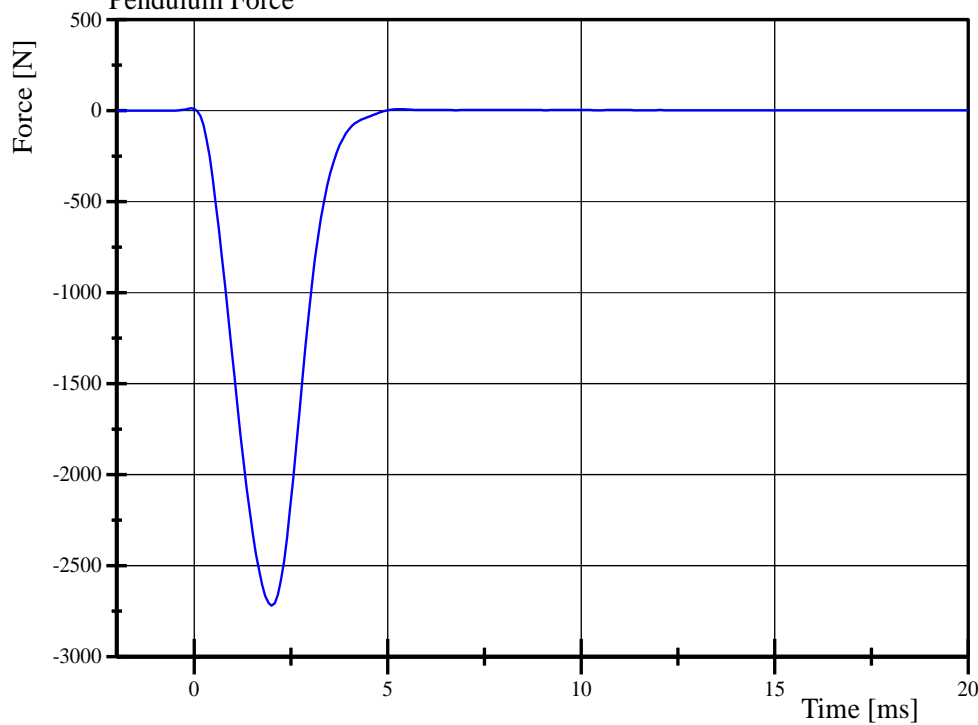
HIII 10YO Serial No. F001 Certification No. 33-1

Test Date: 12/18/2020

Pendulum Acceleration



Pendulum Force



Transportation Research Center Inc.

Right Knee Femur Response Test

HIII 10YO Serial No. F001 Certification No. 33-1

Test Date: 12/18/2020

| Test Parameter | Specification | Test Results | Pass |
|-----------------------|-----------------------|---------------------|-------------|
| Temperature | 20.6 - 22.2 °C | 21.5 °C | Yes |
| Relative Humidity | 10 - 70 % | 41 % | Yes |
| Probe Velocity | 2.07 - 2.13 m/s | 2.110 m/s | Yes |
| Peak Femur Force | (-2,600) - (-3,200) N | -2,874.1 N | Yes |

Test meets specifications.

Condition: Used

Comments:

Knee Skin S/N: 526

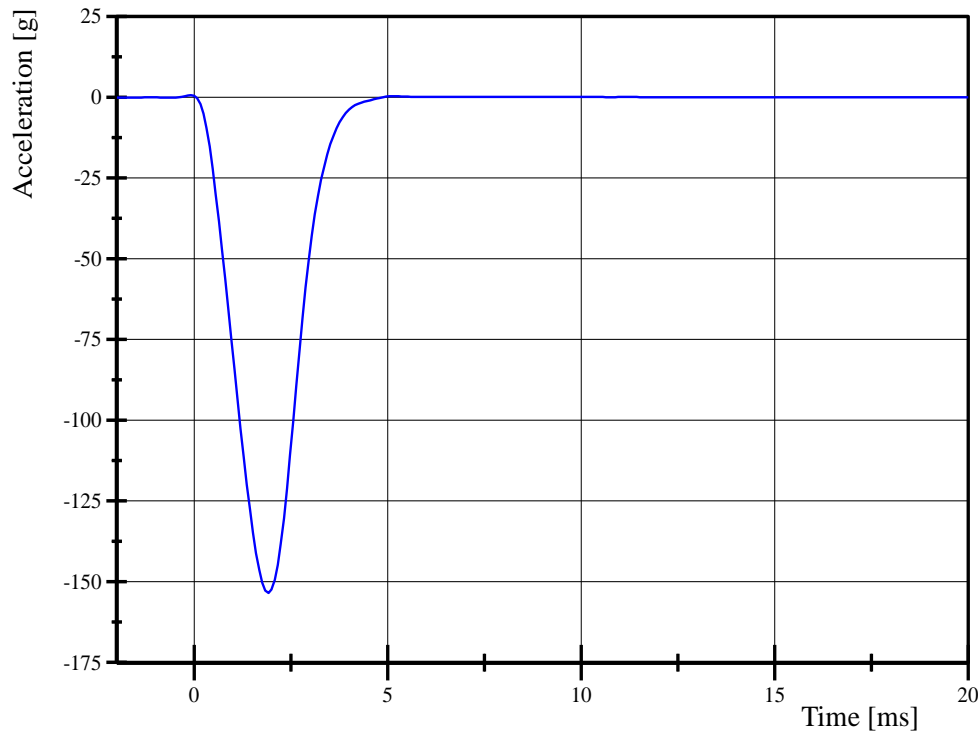
Transportation Research Center Inc.

Right Knee Femur Response Test

HIII 10YO Serial No. F001 Certification No. 33-1

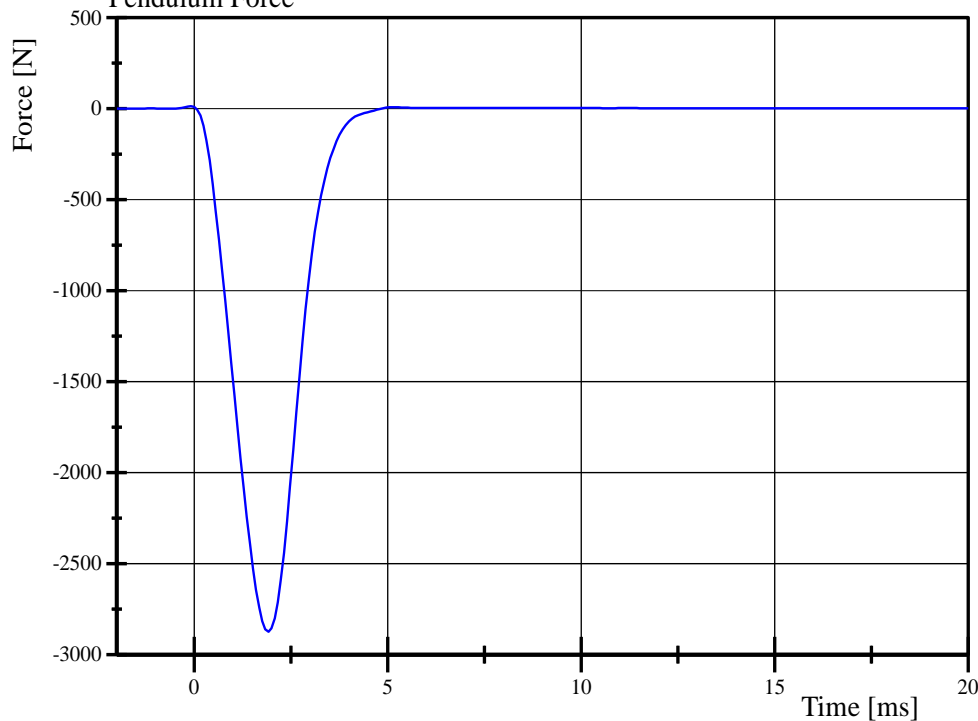
Test Date: 12/18/2020

Pendulum Acceleration



Filter Class: CFC_600
Max: 0.7 g at -0.1 ms
Min: -153.4 g at 1.9 ms

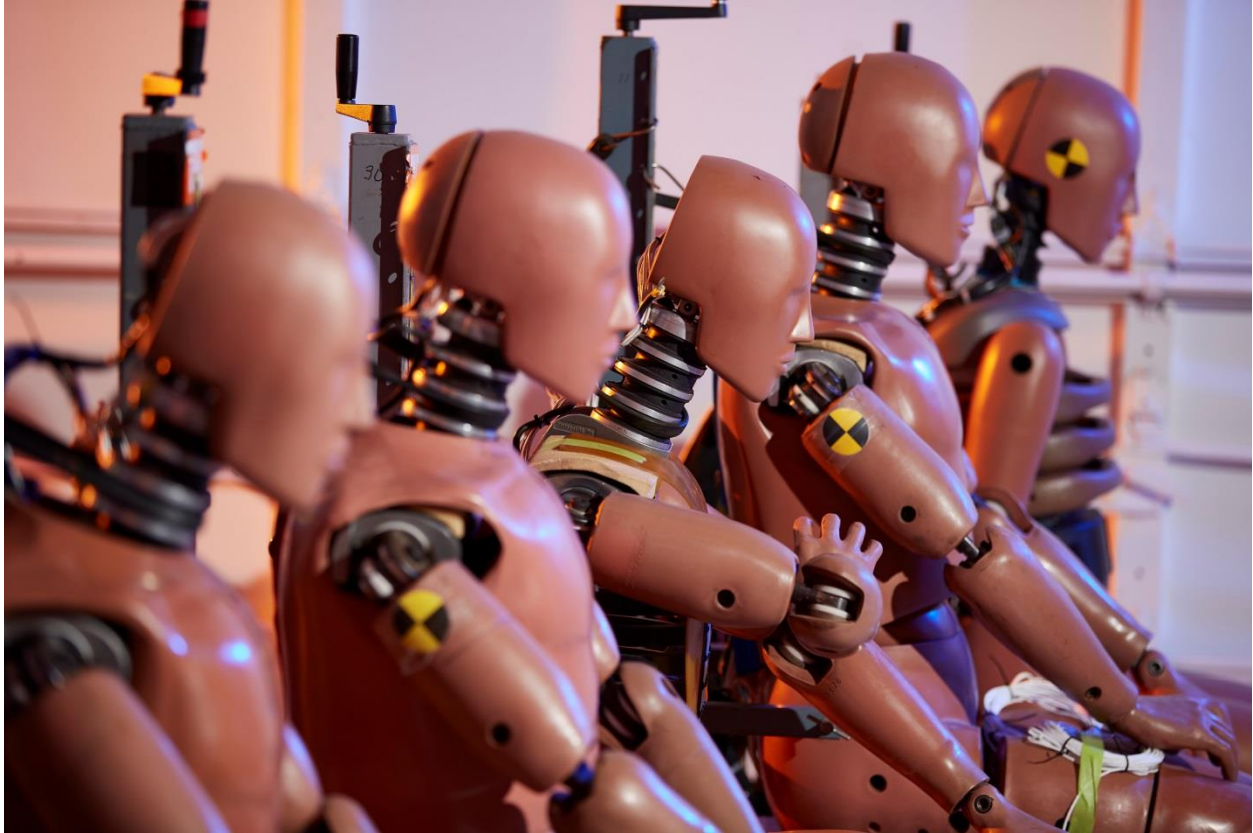
Pendulum Force



Filter Class: CFC_600
Max: 12.5 N at -0.1 ms
Min: -2,874.1 N at 1.9 ms

Appendix C – Quality Assurance

Quality Assurance



ATD Assembly & Final Inspection

ATD Type: Hybrid III (10) Year Old

ATD Serial Number: F001

Assembled by: *Ben Lin*

Inspected by: *Rat Benda*

Date Inspected: 12/21/2020

Transportation Research Center Inc.

Neck Extension

HIII 10YO Serial No. F001 Certification No. 33-2

Test Date: 1/27/2021

| Test Parameter | Specification | Test Results | Pass |
|---|----------------------|---------------------|-------------|
| Temperature | 20.6 - 22.2 °C | 21.4 °C | Yes |
| Relative Humidity | 10 - 70 % | 23 % | Yes |
| Pendulum Impact Velocity | 4.91 - 5.15 m/s | 4.992 m/s | Yes |
| Pendulum Integrated Velocity at 10ms | 1.49 - 1.89 m/s | 1.775 m/s | Yes |
| Pendulum Integrated Velocity at 20ms | 2.88 - 3.68 m/s | 3.461 m/s | Yes |
| Pendulum Integrated Velocity at 30ms | 4.20 - 5.20 m/s | 4.945 m/s | Yes |
| Total Head D-Plane Rotation | 96.0 - 115.0 ° | 101.64 ° | Yes |
| Total Neck Occipital Condyles Moment Between 96° and 115° Rotation | (-37.0) - (-46.0) Nm | -40.83 Nm | Yes |
| Neck Occipital Condyles Moment Decay to -10 Nm | 100.0 - 116.0 ms | 105.60 ms | Yes |

Test meets specifications.

Condition: Used

Comments:

Neck S/N: 22020053A

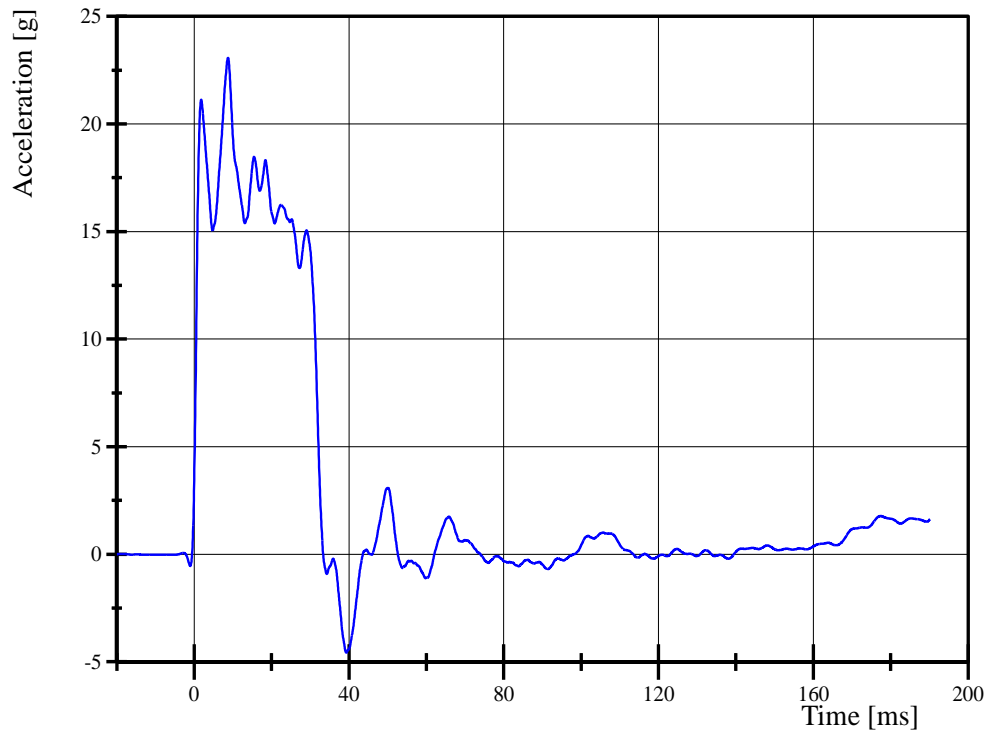
Transportation Research Center Inc.

Neck Extension

HIII 10YO Serial No. F001 Certification No. 33-2

Test Date: 1/27/2021

Pendulum Acceleration

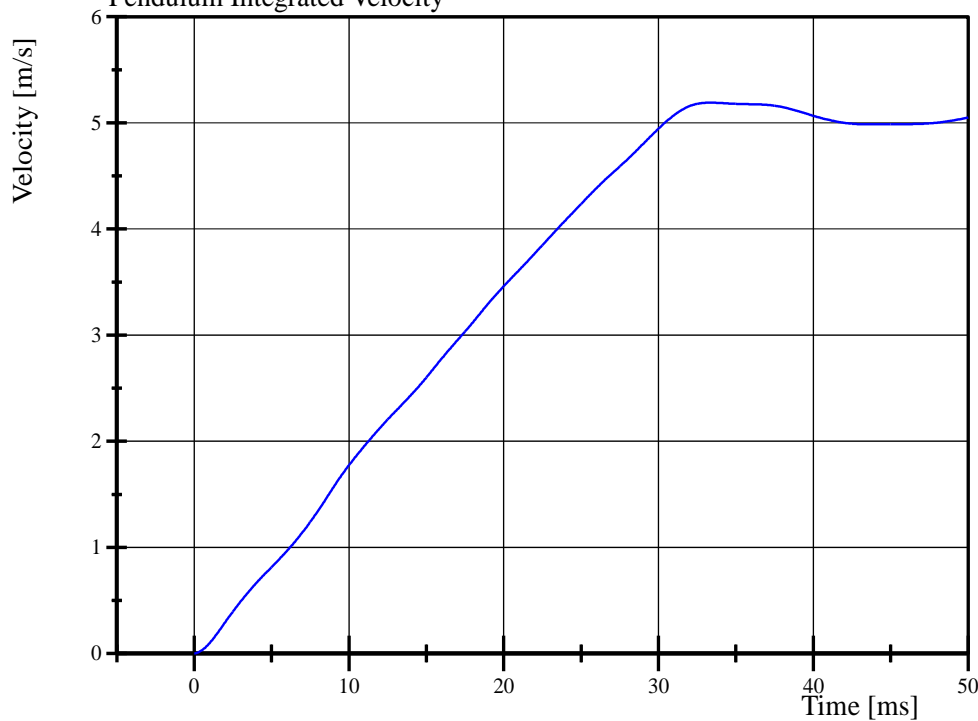


Filter Class: CFC_180

Max: 23.1 g at 8.8 ms

Min: -4.6 g at 39.4 ms

Pendulum Integrated Velocity



Filter Class: CFC_180

Max: 5.2 m/s at 33.4 ms

Min: 0.0 m/s at 0.0 ms

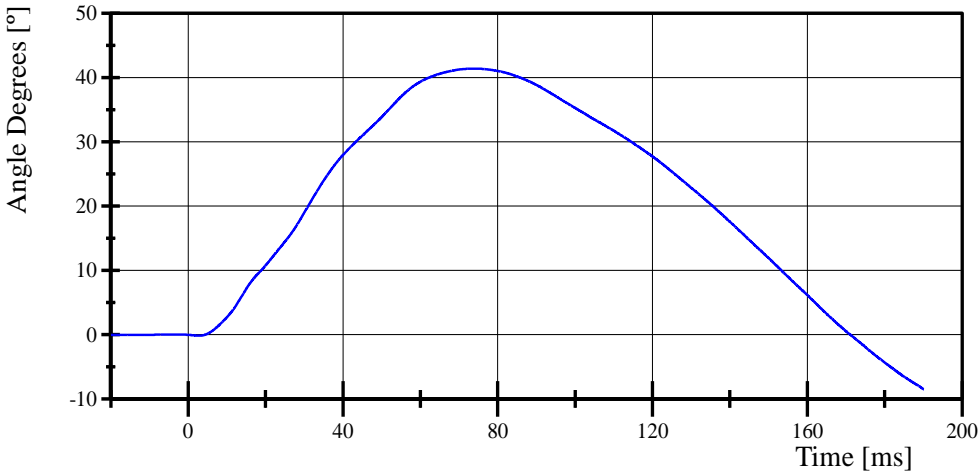
Transportation Research Center Inc.

Neck Extension

HIII 10YO Serial No. F001 Certification No. 33-2

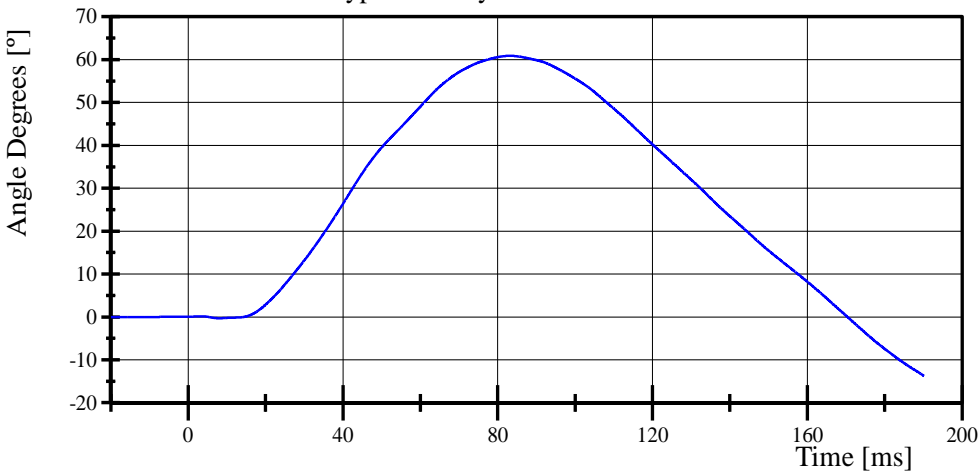
Test Date: 1/27/2021

Pot Rotation at the Base of Neck



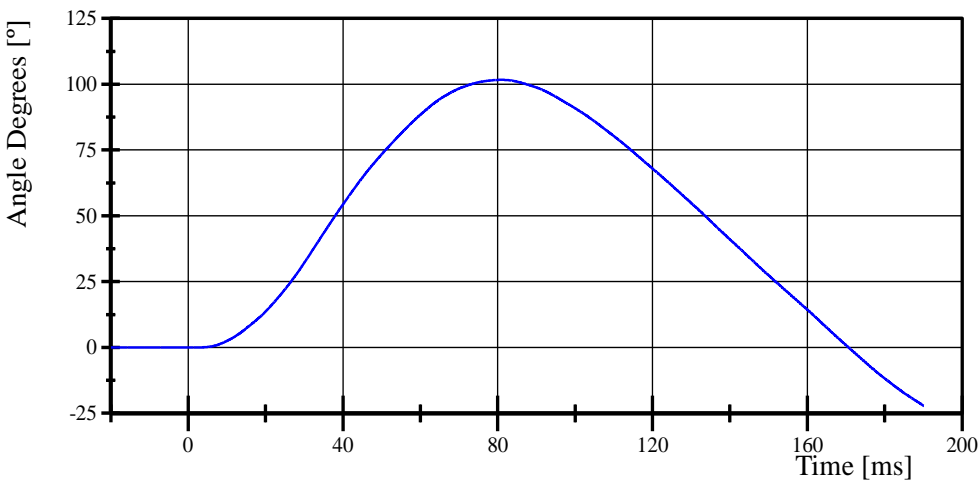
Filter Class: CFC_60
Max: 41.4 ° at 74.0 ms
Min: -8.5 ° at 190.2 ms

Head Rotation at Occypital Condyles



Filter Class: CFC_60
Max: 60.9 ° at 83.2 ms
Min: -13.7 ° at 190.2 ms

Total Head D-Plane Rotation



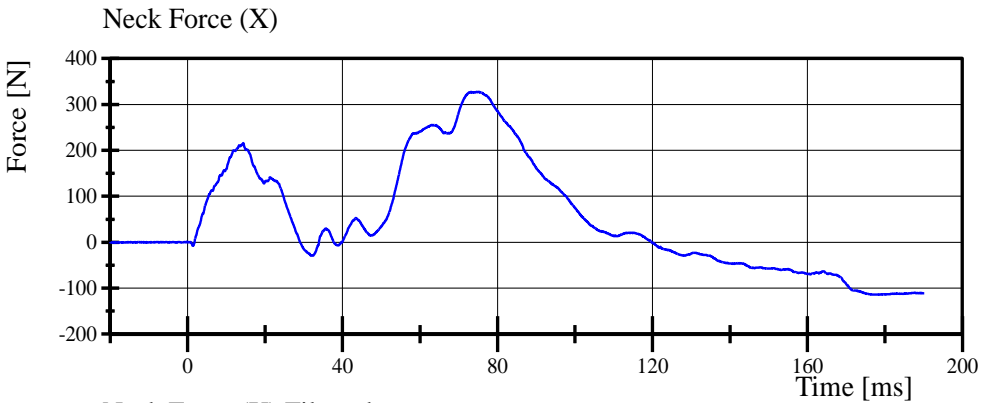
Filter Class: CFC_60
Max: 101.6 ° at 81.0 ms
Min: -22.2 ° at 190.2 ms

Transportation Research Center Inc.

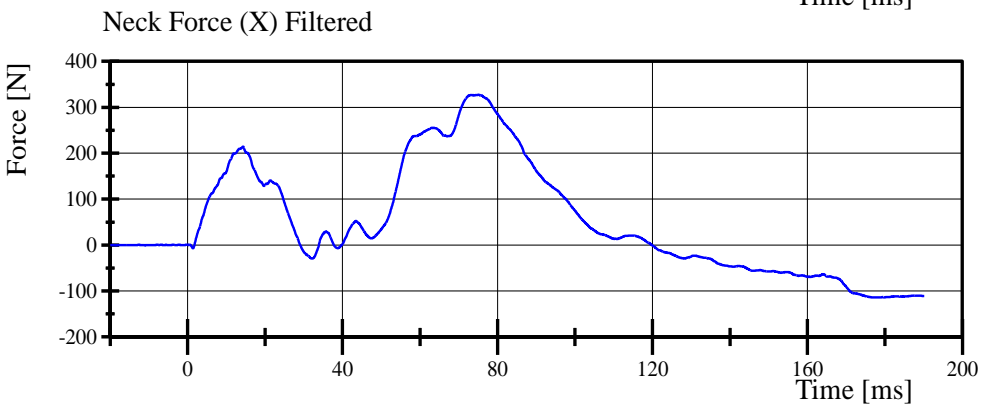
Neck Extension

HIII 10YO Serial No. F001 Certification No. 33-2

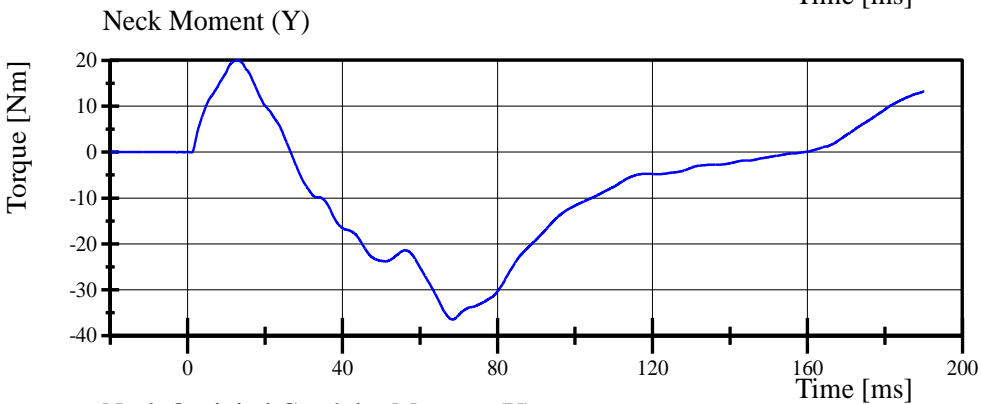
Test Date: 1/27/2021



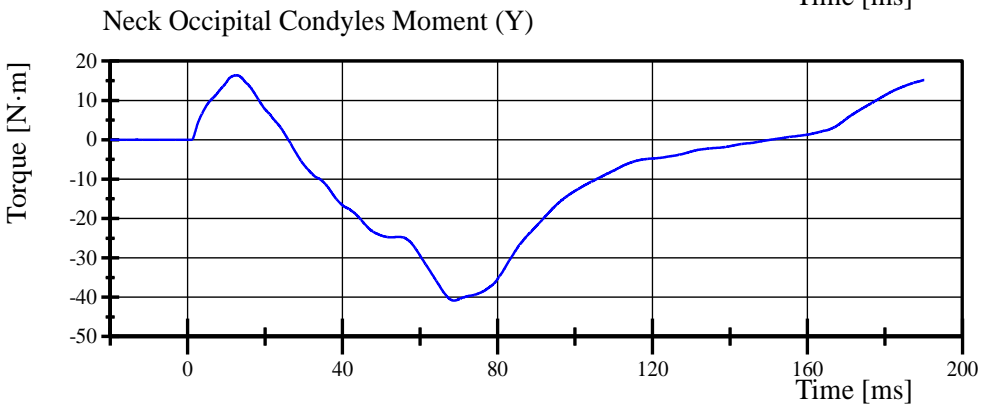
Filter Class: CFC_1000
Max: 327.3 N at 75.1 ms
Min: -114.1 N at 176.9 ms



Filter Class: CFC_600
Max: 327.2 N at 75.1 ms
Min: -114.1 N at 178.9 ms



Filter Class: CFC_600
Max: 20.0 Nm at 13.1 ms
Min: -36.5 Nm at 68.4 ms



Filter Class: Without_(Constar
Max: 16.4 N·m at 12.6 ms
Min: -40.8 N·m at 68.8 ms

Transportation Research Center Inc.

Neck Flexion

HIII 10YO Serial No. F001 Certification No. 33-2

Test Date: 1/27/2021

| Test Parameter | Specification | Test Results | Pass |
|--|-----------------------|---------------------|-------------|
| Temperature | 20.6 - 22.2 °C | 21.8 °C | Yes |
| Relative Humidity | 10 - 70 % | 30 % | Yes |
| Pendulum Impact Velocity | 5.98 - 6.22 m/s | 6.137 m/s | Yes |
| Pendulum Integrated Velocity at 10ms | (-1.64) - (-2.04) m/s | -1.965 m/s | Yes |
| Pendulum Integrated Velocity at 20ms | (-3.04) - (-4.04) m/s | -3.850 m/s | Yes |
| Pendulum Integrated Velocity at 30ms | (-4.45) - (-5.65) m/s | -5.527 m/s | Yes |
| Total Head D-Plane Rotation | (-76.0) - (-90.0) ° | -80.15 ° | Yes |
| Total Neck Occipital Condyles Moment Between -76° and -90° Rotation | 50.0 - 62.0 Nm | 56.42 Nm | Yes |
| Neck Occipital Condyles Moment Decay to 10 Nm | 86.0 - 105.0 ms | 92.65 ms | Yes |

Test meets specifications.

Condition: Used

Comments:

Neck S/N: 22020053A

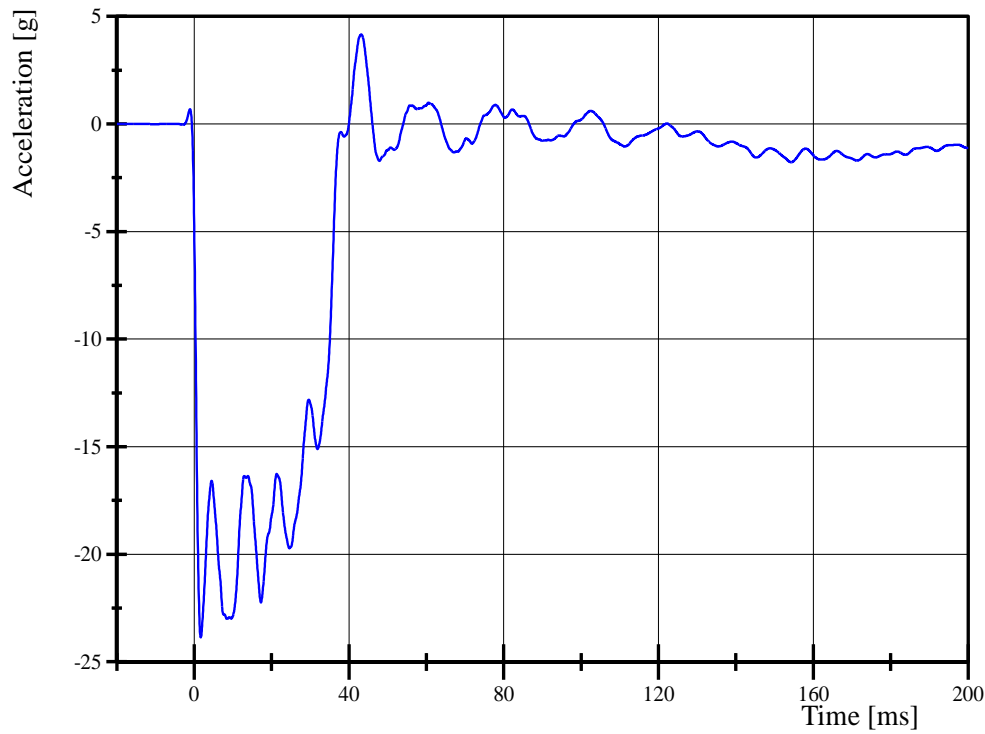
Transportation Research Center Inc.

Neck Flexion

HIII 10YO Serial No. F001 Certification No. 33-2

Test Date: 1/27/2021

Pendulum Acceleration

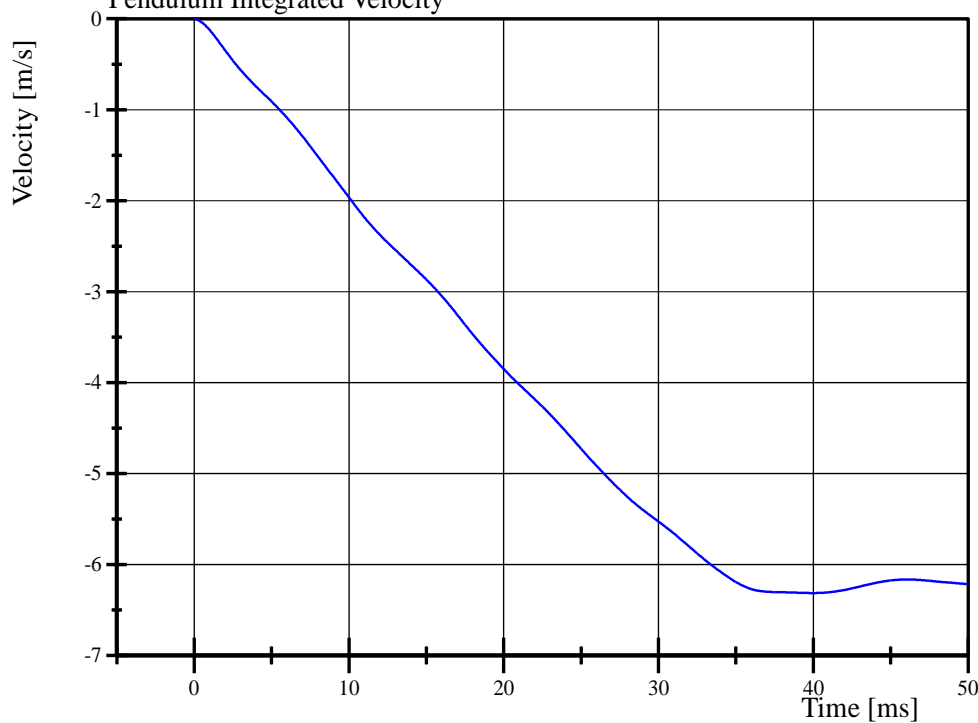


Filter Class: CFC_180

Max: 4.2 g at 43.2 ms

Min: -23.9 g at 1.7 ms

Pendulum Integrated Velocity



Filter Class: CFC_180

Max: 0.0 m/s at 0.0 ms

Min: -6.3 m/s at 40.0 ms

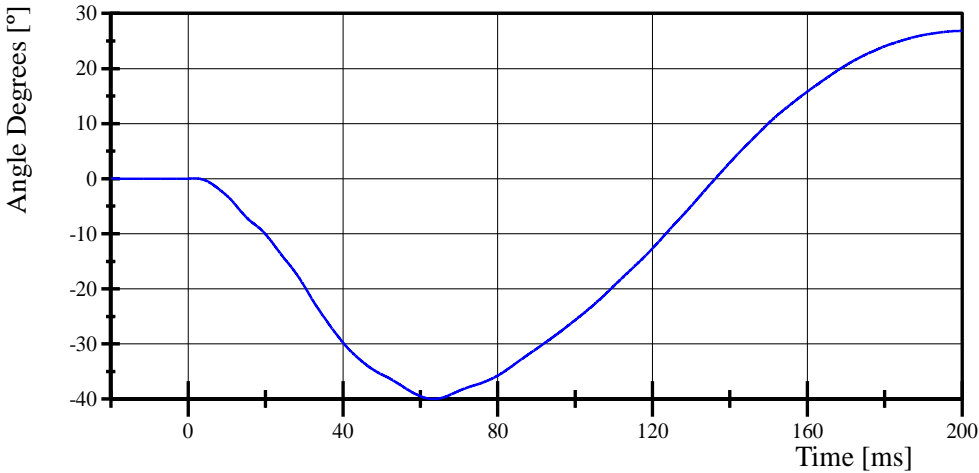
Transportation Research Center Inc.

Neck Flexion

HIII 10YO Serial No. F001 Certification No. 33-2

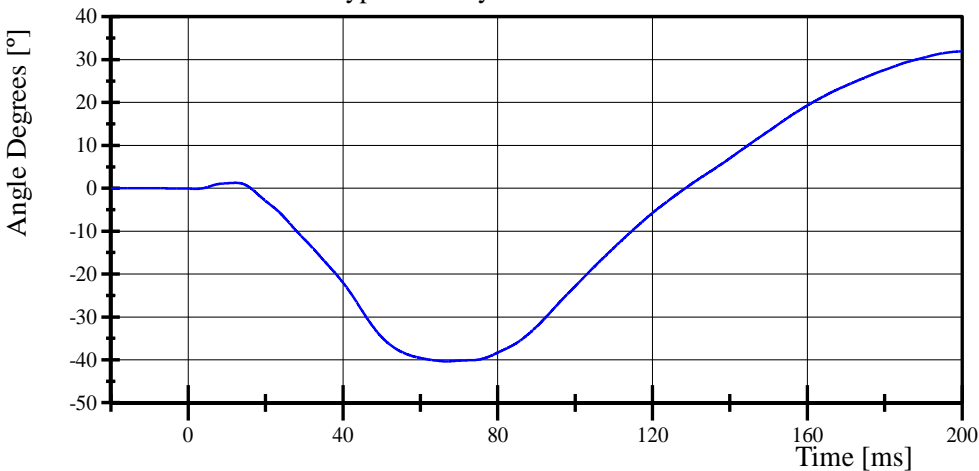
Test Date: 1/27/2021

Pot Rotation at the Base of Neck



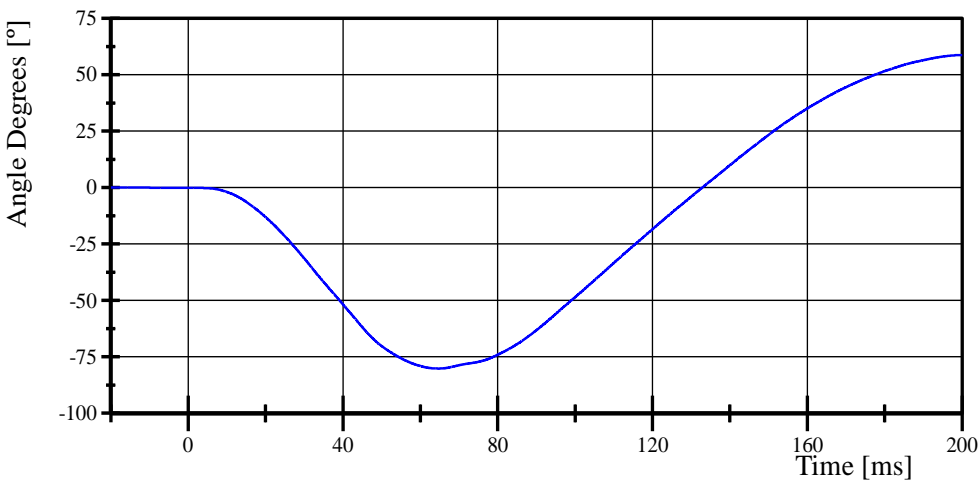
Filter Class: CFC_60
Max: 26.8 ° at 200.0 ms
Min: -40.0 ° at 63.3 ms

Head Rotation at Occypital Condyles



Filter Class: CFC_60
Max: 31.9 ° at 200.0 ms
Min: -40.4 ° at 66.8 ms

Total Head D-Plane Rotation



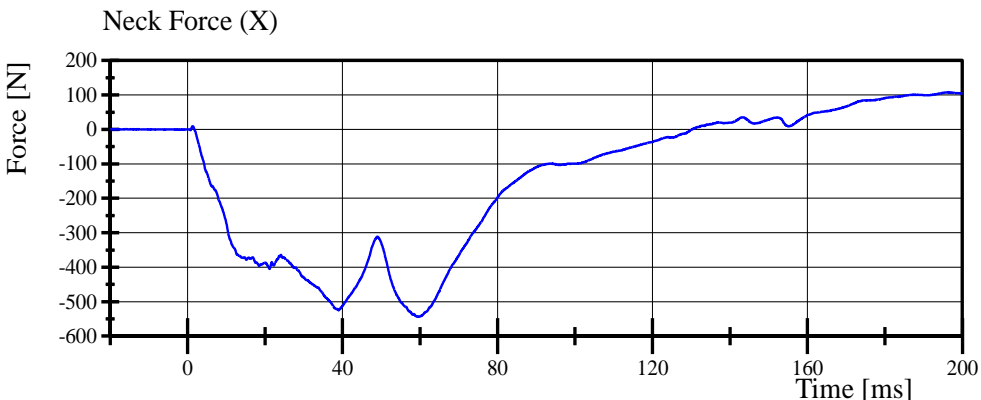
Filter Class: CFC_60
Max: 58.8 ° at 200.0 ms
Min: -80.2 ° at 64.7 ms

Transportation Research Center Inc.

Neck Flexion

HIII 10YO Serial No. F001 Certification No. 33-2

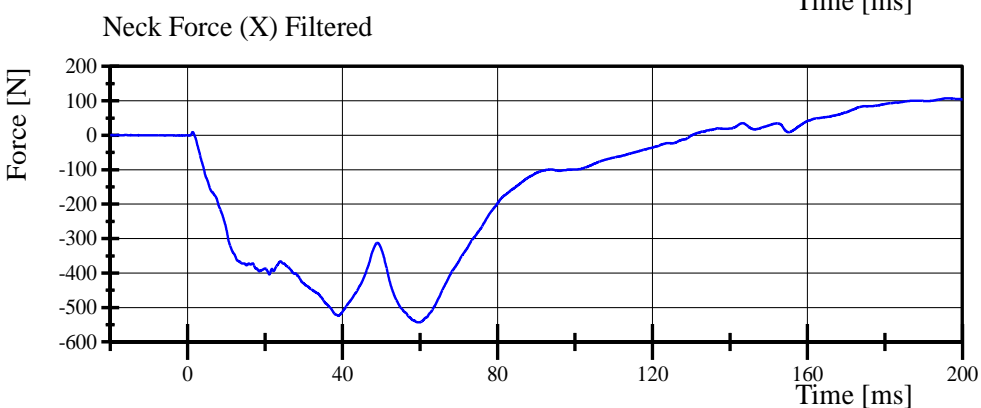
Test Date: 1/27/2021



Filter Class: CFC_1000

Max: 108.2 N at 196.4 ms

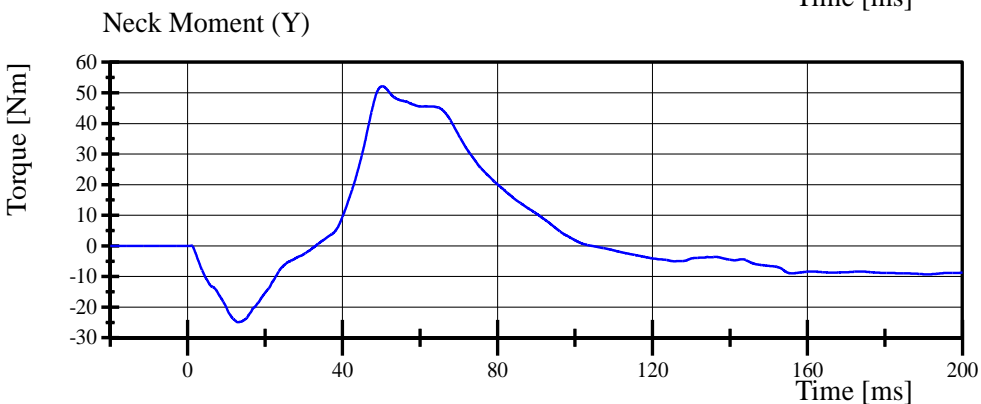
Min: -543.7 N at 59.5 ms



Filter Class: CFC_600

Max: 107.6 N at 196.4 ms

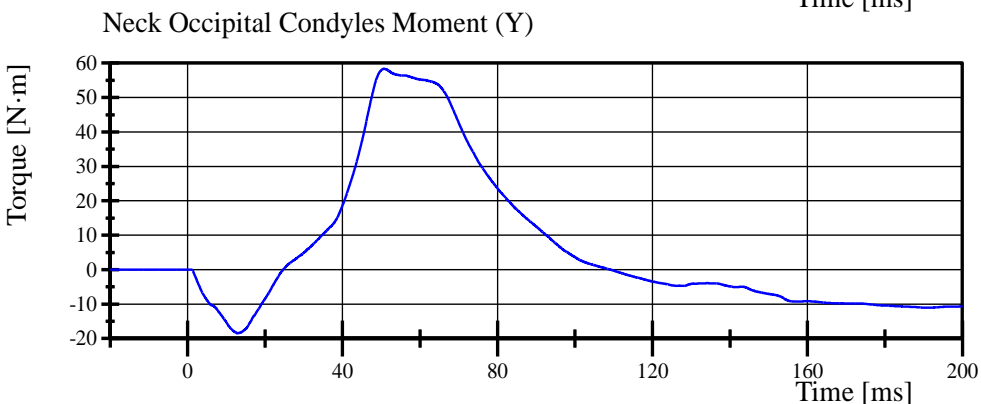
Min: -543.3 N at 59.5 ms



Filter Class: CFC_600

Max: 52.2 Nm at 50.3 ms

Min: -24.9 Nm at 13.0 ms



Filter Class: Without_(Constar

Max: 58.3 N·m at 50.7 ms

Min: -18.4 N·m at 12.9 ms