



REPORT NUMBER: TWG-MGA-2013-010

**SIDE AIRBAG OUT-OF-POSITION INJURY
TECHNICAL WORKING GROUP**

**MERCEDES-BENZ U.S. INTL., INC
2013 Mercedes-Benz ML350 SUV
NHTSA No.: MD0511TWG2**

TEST DATE: MARCH 25, 2013

FINAL REPORT DATE: APRIL 4, 2013

FINAL REPORT

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FINAL REPORT ACCEPTANCE BY:

Date: _____

The results presented in this report relate only to the specified test items.

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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

The purpose of this test was to obtain data in a static out-of-position side air bag deployment. These data constitute part of the general consumer information collected by Alpha Technology Associate, Inc.

SUMMARY

The effects of a curtain airbag deployment in a 2013 Mercedes-Benz ML350 SUV with an out-of-position Hybrid III 6-Year-Old child dummy were evaluated. The curtain airbag was fired remotely. The test was performed by MGA Research Corporation on March 25, 2013. Pre and post-test photographs of the vehicle and dummy can be found in Appendix A.

Three high-speed cameras (1000 fps) were used to document the side airbag deployment event. The following camera locations were used:

- Left Side Through Removed Driver Door
- Front Through Windshield
- Left Side $\frac{3}{4}$ View Through Windshield

One Hybrid III 6-Year-Old child dummy (Serial Number 144) was placed in the right front passenger seat situated in the front-facing position along the outboard edge of the seat per Section 3.3.3.5 according to dummy placement instructions specified in the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags as prepared by the Side Airbag Out-of-Position Injury Technical Working Group (TWG).

The dummy was instrumented with the following instrumentation:

- Head Accelerations
- Upper Neck Load Cell
- Lower Neck Load Cell

The 15 channels of data were recorded on an on-board data acquisition system. Appendix B contains the dummy data traces.

The Hybrid III 6-Year-Old child dummy's visible contact points were as follows:

- Side curtain airbag to top and right side of head, right shoulder, and torso

The Hybrid III 6-Year-Old child dummy was placed in the right front passenger seat along the outboard edge of the foam block, aligning the upper spine with the deployment trajectory of the airbag. The dummy's head was placed in between the seat bolster and pillar/side trim. The head remained in its neutral orientation. The legs were aligned so that they cross the heel placement points that were previously marked on the seat cushion. The feet were held in place and the pelvis slid forward and parallel to the centerline of the vehicle until the dummy's head/neck junction was aligned vertically with the top edge of the airbag module. The legs were then repositioned so that they cross the heel placement points. With the vehicle door closed, the dummy's outboard arm was raised to clear the armrest and the pelvis and upper torso was slid outboard until the pelvis or torso contacted the door. The outboard arm was placed on the armrest. The inboard arm was flexed so that the upper arm contacted the seat back and the fingertips contacted the foam block.

The dummy's skullcap seam was taped with 4mm electrical tape to prevent the airbag from getting caught in the seam. The dummy's headskin was cleaned with alcohol and dusted with baby powder to achieve acceptable frictional characteristics.

This orientation complies with Section 3.3.3.5 of the TWG Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags as defined by Lund, et al and the Technical Working Group First Revision dated July, 2003.

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
TEST SUMMARY

	Test Data	Description
Seating Position	P2	Right Front Seating Position
Test	3.3.3.5*	Forward-facing child dummy
Curtain Airbag	Roof-Rail Mounted	Side Airbag
Torso Airbag	Seat Mounted	Side Airbag – Not Fired
ATD Type/Serial No.	Hybrid III 6 Year Old / 144	Child Dummy

*Procedure as defined by Lund, et al and the Technical Working Group dated July, 2003

Number of Data Channels	15
Number of Airbag Channels	2
Number of High-Speed Video	3

Visible Dummy Contact Points	
Head Contact	Side Curtain Airbag to Top and Right Side of Head
Right Shoulder Contact	Curtain Airbag
Right Torso Contact	Curtain Airbag
Right Pelvis Contact	No Contact

DATA SHEET NO. 2**TEST VEHICLE INFORMATION**

Please note that this vehicle had previously been tested in an
NCAP Side Impact on December 20, 2012.

TEST VEHICLE INFORMATION

Manufacturer	Mercedes-Benz
Model	ML350
Body Style	SUV
NHTSA No.	MD0511TWG2
VIN	4JGDA5JB3DA136887
Color	Iridium Silver Metallic
Delivery Date	11/14/2012
Odometer Reading (mile)	73
Dealer	Concord Mercedes
Transmission	Automatic
Final Drive	Rear
Number of Cylinders	6
Engine Displacement (L)	3.5
Engine Placement	Longitudinal
Automatic Door Lock (ADL)	Yes
Owner's Manual Details Instructions on Disabling ADLs	Yes
Bucket Seats	Yes

TEST VEHICLE OPTIONS

Driver Front Airbag	Yes
Driver Side Curtain Airbag	Yes
Driver Side Torso/Pelvis Airbag	Yes
Rear Passenger Side Curtain Airbag	Yes
Rear Passenger Side Torso Airbag	Yes
Force Limiter	Yes
Pretensioner	Yes
Power Steering	Yes
Power Door Locks	Yes
Tilt Wheel	Yes
Air Conditioning	Yes
Anti-lock Brakes	Yes
Traction Control	Yes
All Wheel Drive	No
Power Seats	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	MERCEDES-BENZ U.S. INTL., INC
Date of Manufacture	10/12

GVWR (kg)	2850
GAWR Front (kg)	1300
GAWR Rear (kg)	1600

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				550
Cargo Wt. (RCLW) (kg)				210

DATA SHEET NO. 3
DUMMY POSITIONING IN VEHICLE

Measurement		Value
Seat Position		Full Forward
Seat Height Position		Mid
Placed in Position No. 2		---
Seat Back Angle (at headrest post)	SA (°)	12.2
Top of Curtain Airbag Module to Head/Neck Junction	AN (mm)	321
Top of Seat Airbag Module to Head/Neck Junction	AN (mm)	120
Head CG to Door Window	HD (mm)	233
Head to Seat Back Centerline	HSC (mm)	162
Chest to Dash	CD (mm)	487
Chest to Seatback	CS (mm)	255
Right Arm to Seat Back Centerline	RACL (mm)	345
Left Arm to Seat Back Centerline	LACL (mm)	104
Right Arm to Door Panel	RA (mm)	Contact
Left Arm to Door Panel	LA (mm)	280
Knee to Knee	KK (mm)	128
Toe to Toe	TT (mm)	164
Right Knee to Seat Cushion Centerline	KSCR (mm)	128
Left Knee to Seat Cushion Centerline	KSCL (mm)	13
Right Toe to Seat Cushion Centerline	TSCR (mm)	16
Left Toe to Seat Cushion Centerline	TSCL (mm)	152
Nose to Dash	ND (mm)	552
Nose to Headrest	NS (mm)	243
Top of Head to Headliner	HH (mm)	159

DATA SHEET NO. 4
DUMMY INJURY CRITERIA VALUES

NHTSA No. MD0511TWG2

		MAXIMUM VALUE			
		Position No. 2			
DESCRIPTION	UNIT	MAXIMUM	TIME (ms)	MINIMUM	TIME (ms)
Head X	g	70.3	8.8	-19.7	9.9
Head Y	g	41.5	11.0	-65.0	9.2
Head Z	g	220.1	9.0	-21.7	10.5
Head Resultant	g	220.2	9.0		
Upper Neck Fx	N	11.8	8.6	-530.5	9.0
Upper Neck Fy	N	165.9	24.2	-109.3	9.8
Upper Neck Fz	N	39.5	155.6	-1655.4	9.1
Upper Neck F Resultant	N	1699.9	9.1		
Upper Neck Mx	Nm	9.6	11.4	-8.6	52.3
Upper Neck My	Nm	4.5	106.0	-8.7	17.0
Upper Neck Mz	Nm	2.5	49.8	-1.4	96.0
Upper Neck M Resultant	Nm	11.9	9.9		
Lower Neck Fx	N	84.2	22.1	-173.7	9.4
Lower Neck Fy	N	72.9	72.6	-108.2	11.0
Lower Neck Fz	N	42.9	160.3	-1596.5	11.6
Lower Neck F Resultant	N	1600.9	11.6		
Lower Neck Mx	Nm	13.3	95.4	-4.2	10.8
Lower Neck My	Nm	64.4	11.6	-0.6	173.8
Lower Neck Mz	Nm	4.7	52.9	-4.4	11.0
Lower Neck M Resultant	Nm	64.6	11.6		

DATA SHEET NO. 4 (continued)
DUMMY INJURY CRITERIA VALUES
NHTSA No. MD0511TWG2

HEAD INJURY CRITERIA (HIC)						
ATD position	HIC15			HIC36		
	HIC	T ¹ (msec)	T ² (msec)	HIC	T ¹ (msec)	T ² (msec)
No. 2 Right Front	140.26	8.8	9.1	140.26	8.8	9.1

Position 2 Neck Injury Summary (6-Year-Old – Out-Of-Position)

	Nij	Time (msec)	Z Force (N) (CFC 600)	X Force (N) (CFC 600)	Y Moment (N-m) (CFC 600)
Ntf	0.05	114.4	0.84	-60.59	3.74
Nte	0.03	165.9	32.42	-20.94	-1.12
Ncf	0.32	8.9	-897.52	-309.20	-5.33
Nce	0.63	11.2	-1518.44	-160.35	-6.25
Peak Tension (CFC1000)	39.5 N		Peak Compression (CFC 1000)		-1655.4 N

Critical Values

Nij Intercepts				Peak Limits	
Tension (CVt)	2800 N	Extension (mCVe)	37 N-m	Tension	1490 N
Compression (CVc)	2800 N	Flexion (mCVf)	93 N-m	Compression	1820 N
Condyle Offset	0.01778 m				

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Right ¾ Front View of Vehicle, As Received



Vehicle Certification Label



Pre-Test Vehicle Left Side View



Post-Test Vehicle Left Side View



Pre-Test 6-Year-Old Child Dummy Left Side View



Post-Test 6-Year-Old Child Dummy Left Side View



Pre-Test 6-Year-Old Child Dummy Left Side Closeup View



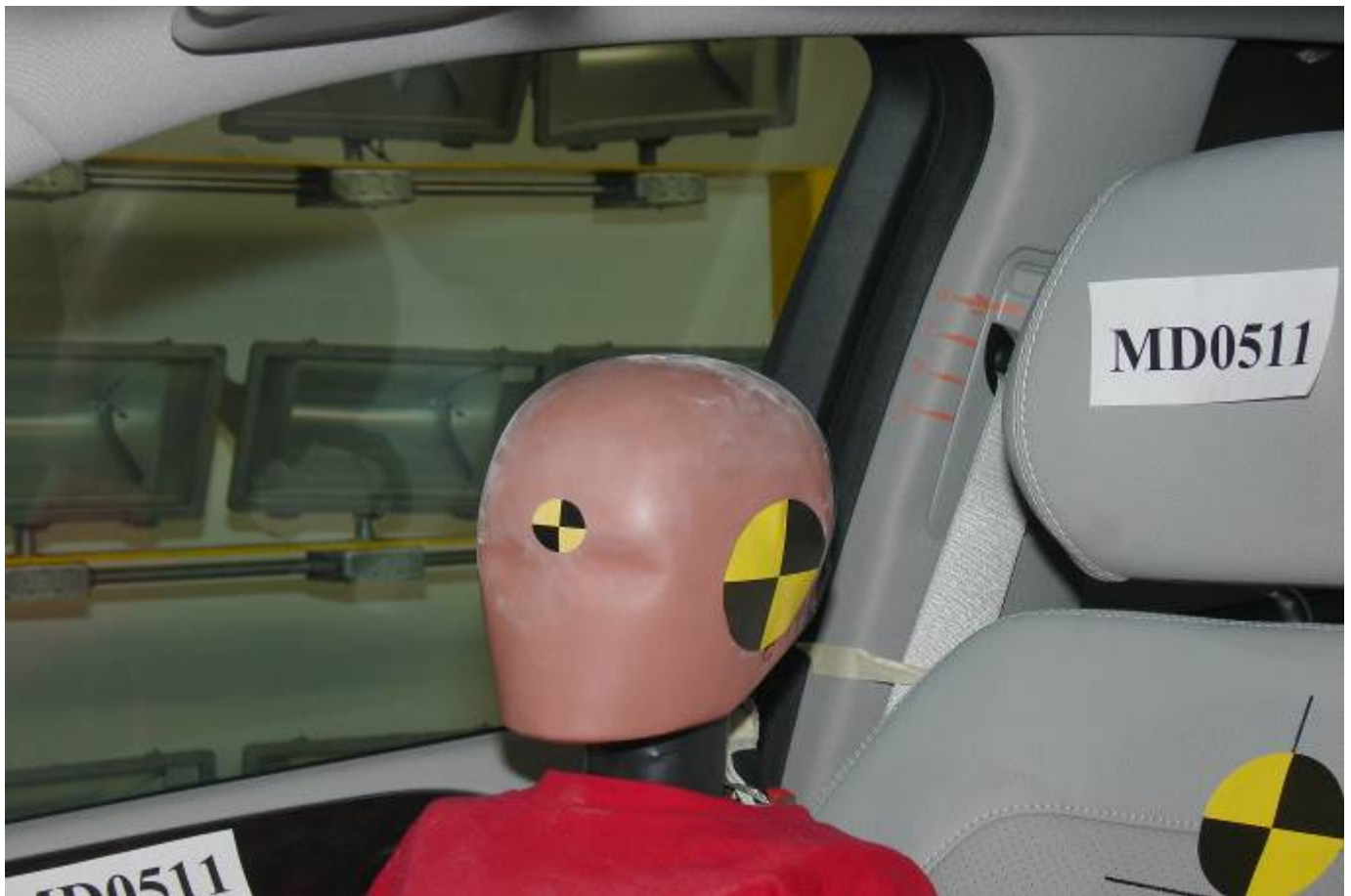
Post-Test 6-Year-Old Child Dummy Left Side Closeup View



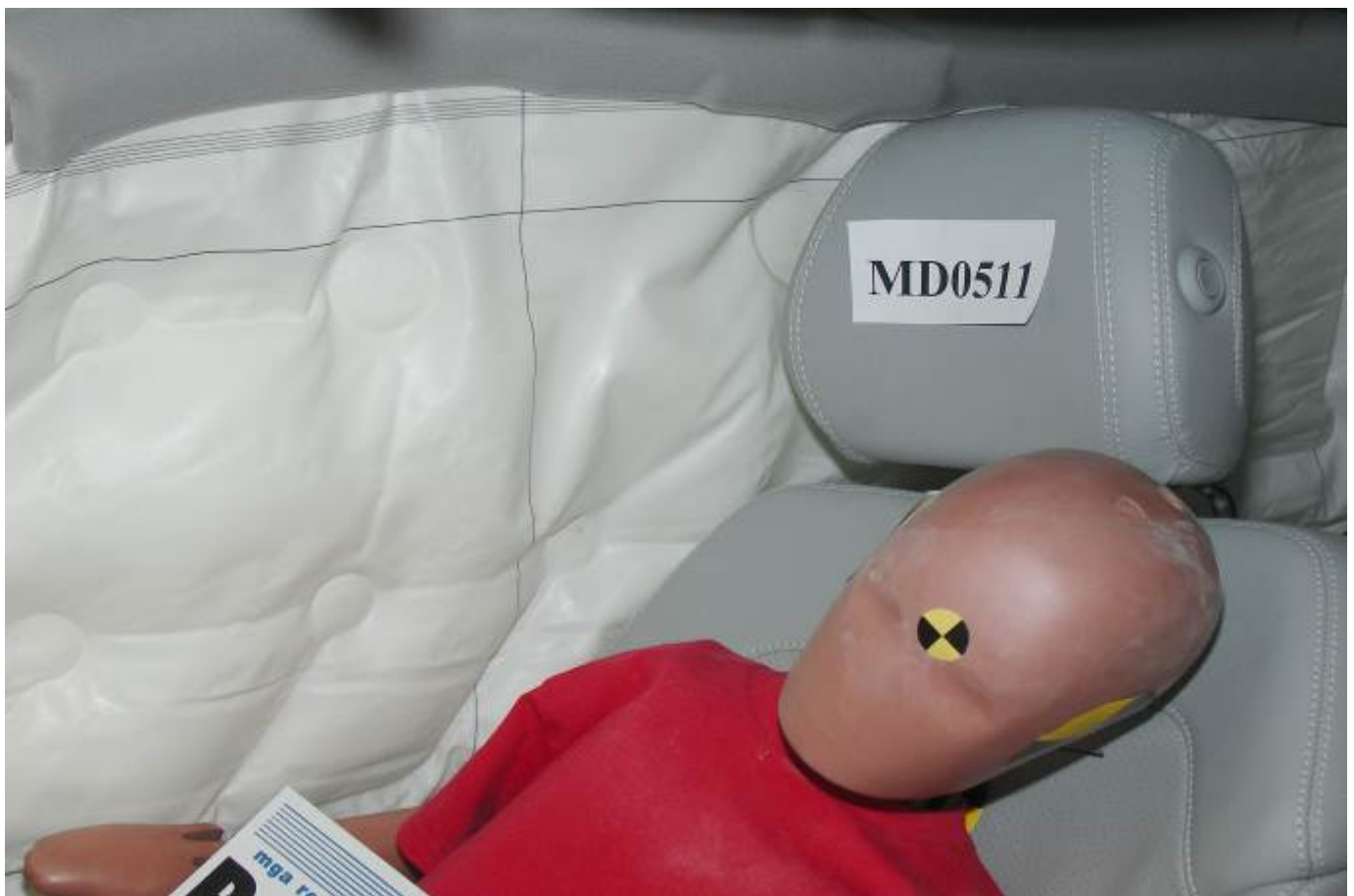
Pre-Test 6-Year-Old Child Dummy Left 3/4 Front View



Post-Test 6-Year-Old Child Dummy Left 3/4 Front View



Pre-Test 6-Year-Old Child Dummy Left $\frac{3}{4}$ Front Closeup View



Post-Test 6-Year-Old Child Dummy Left $\frac{3}{4}$ Front Closeup View



Pre-Test 6-Year-Old Child Dummy Front View



Post-Test 6-Year-Old Child Dummy Front View



Pre-Test 6-Year-Old Child Dummy Front Closeup View



Post-Test 6-Year-Old Child Dummy Front Closeup View



Pre-Test 6-Year-Old Child Dummy Right ¾ Front View



Post-Test 6-Year-Old Child Dummy Right ¾ Front View



Pre-Test 6-Year-Old Child Dummy Right Side View



Post-Test 6-Year-Old Child Dummy Right Side View



Post-Test 6-Year-Old Child Dummy Right Side View (Door Open)



Post-Test Curtain Airbag Left Side View



Post-Test Curtain Airbag Left 3/4 Front View



Post-Test Curtain Airbag Front View

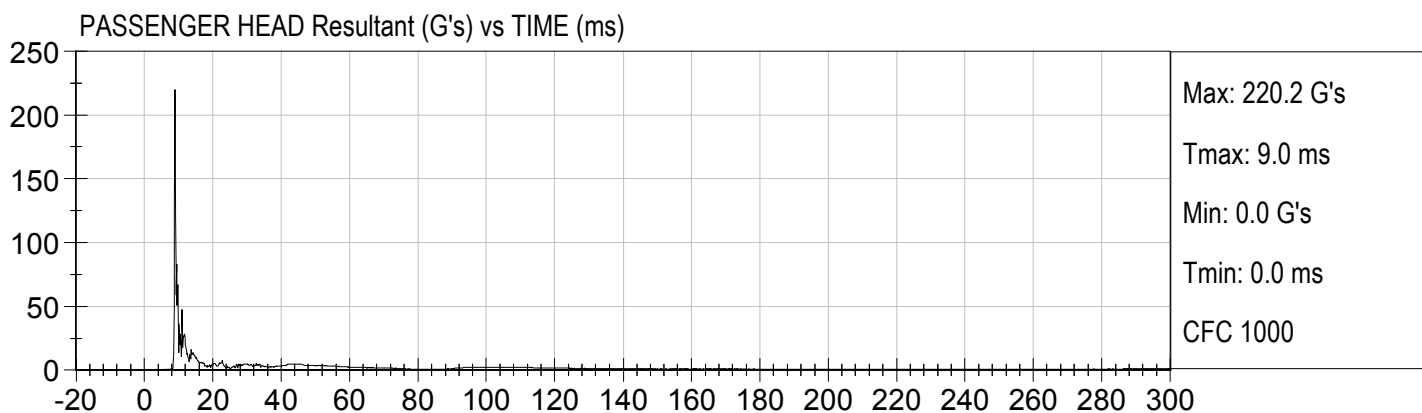
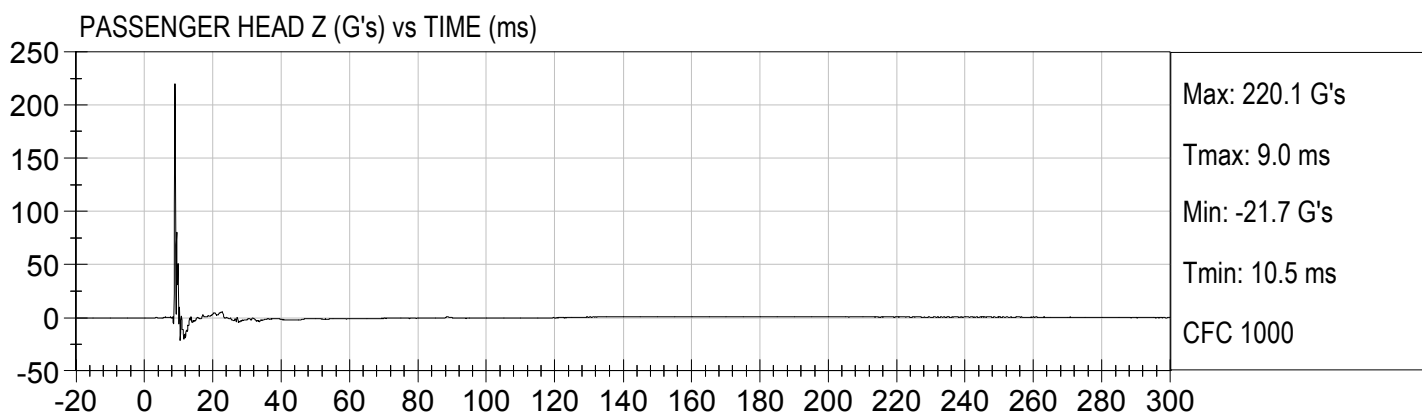
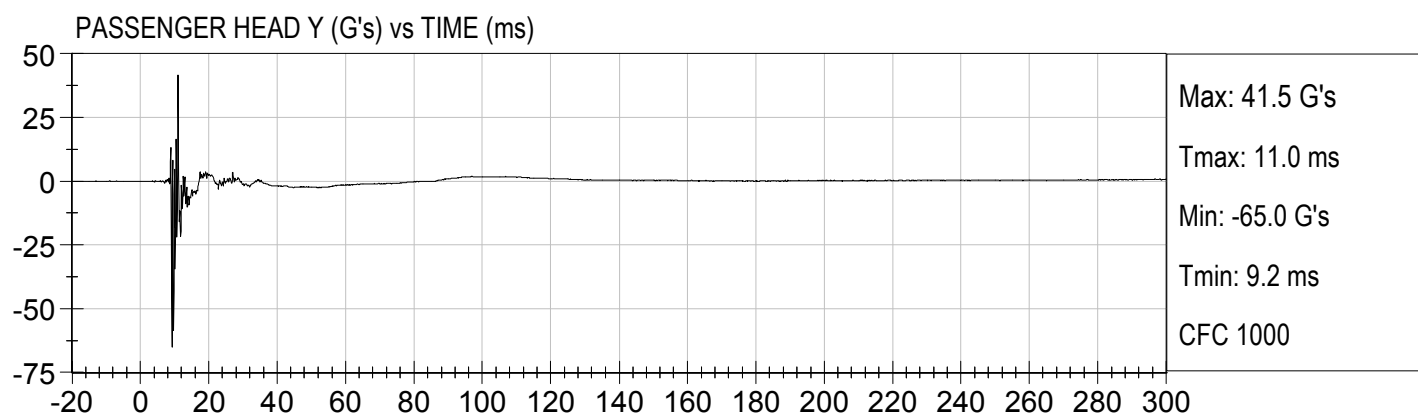
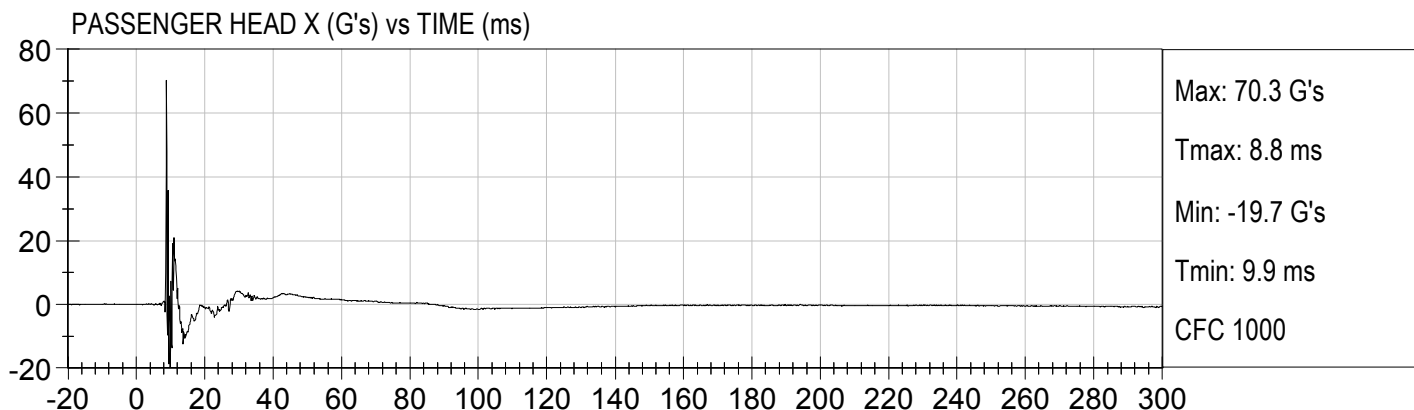


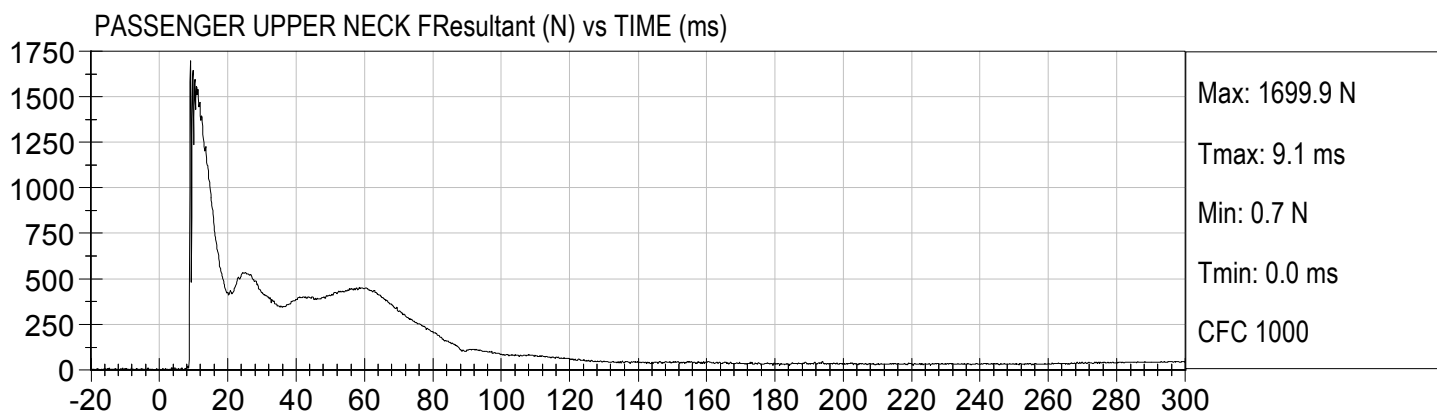
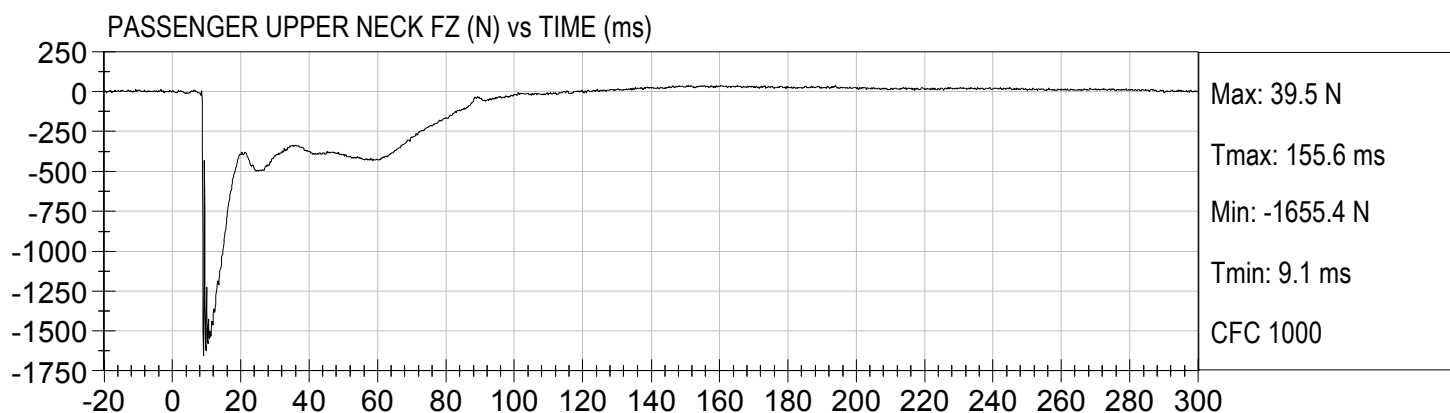
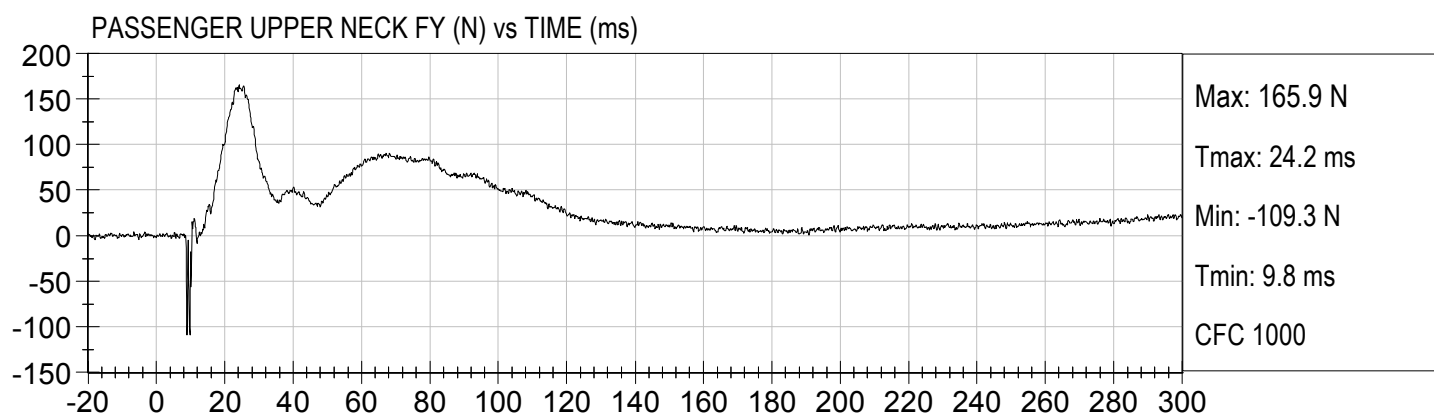
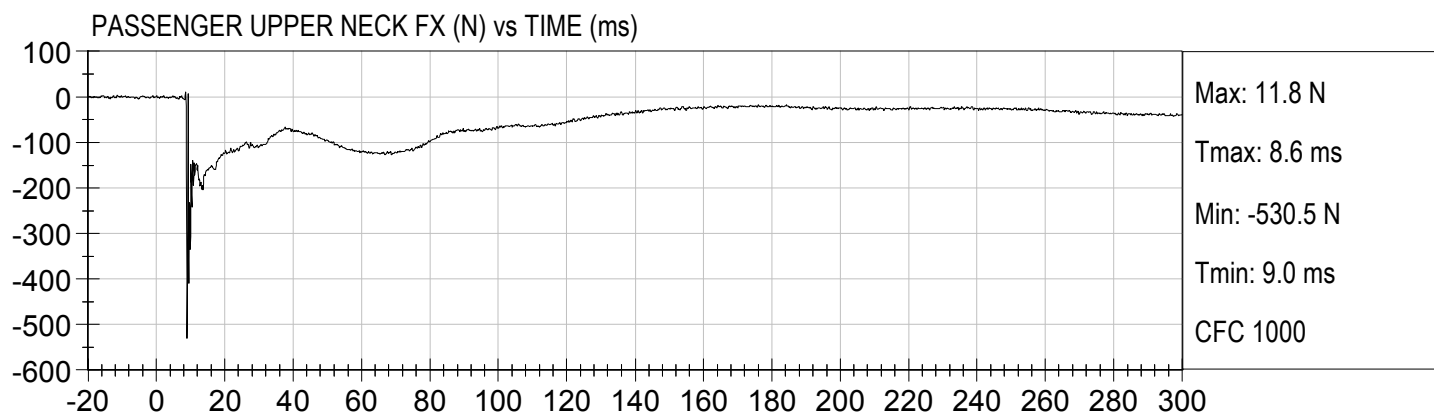
Post-Test Curtain Airbag Right Side View (Door Open)

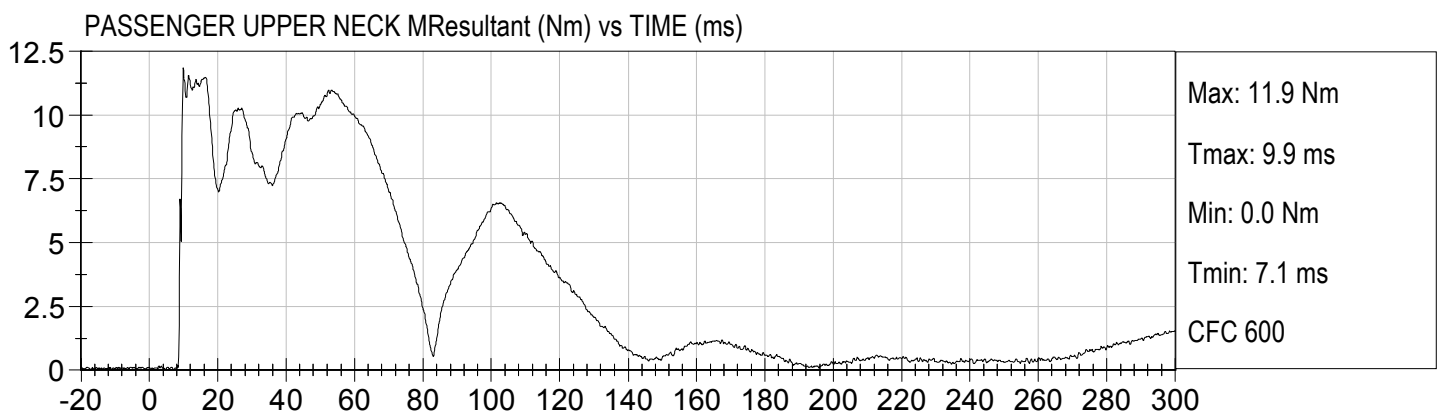
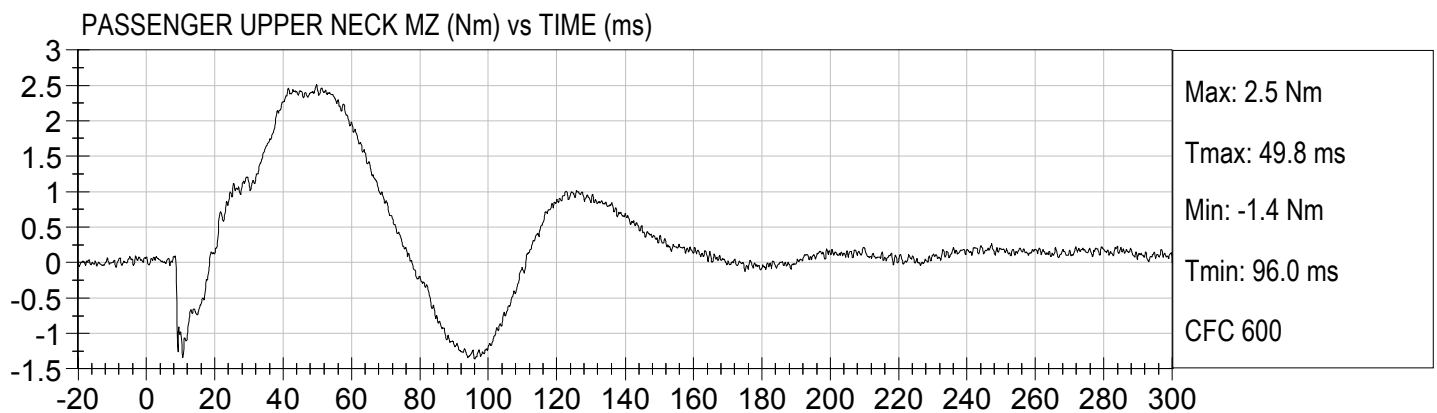
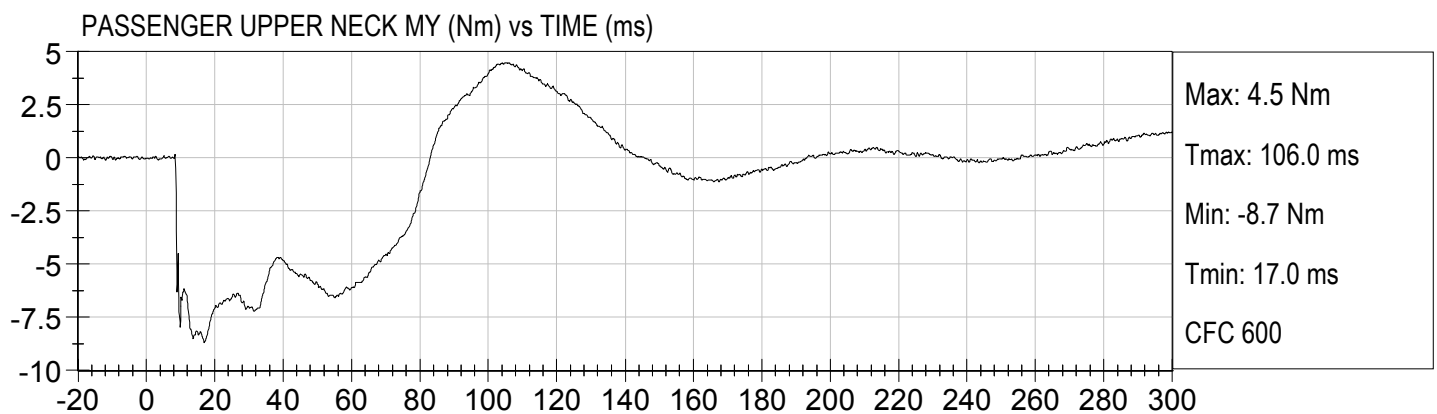
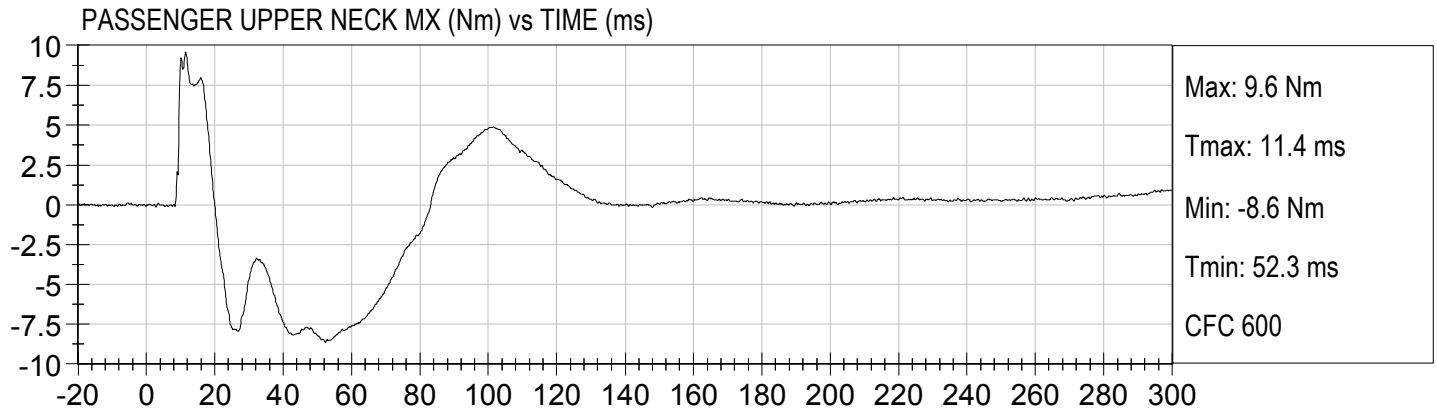
APPENDIX B
DUMMY RESPONSE DATA TRACES

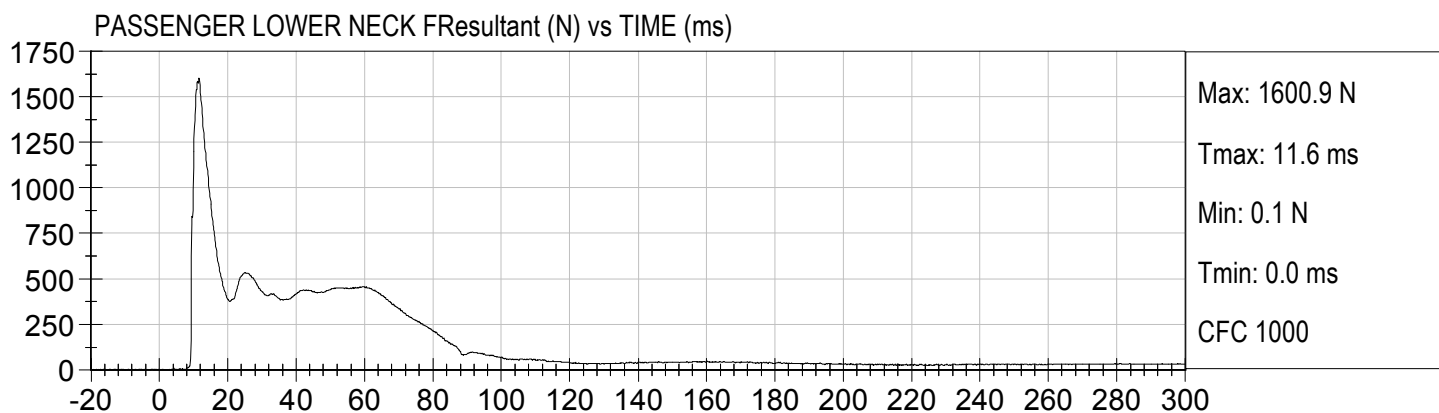
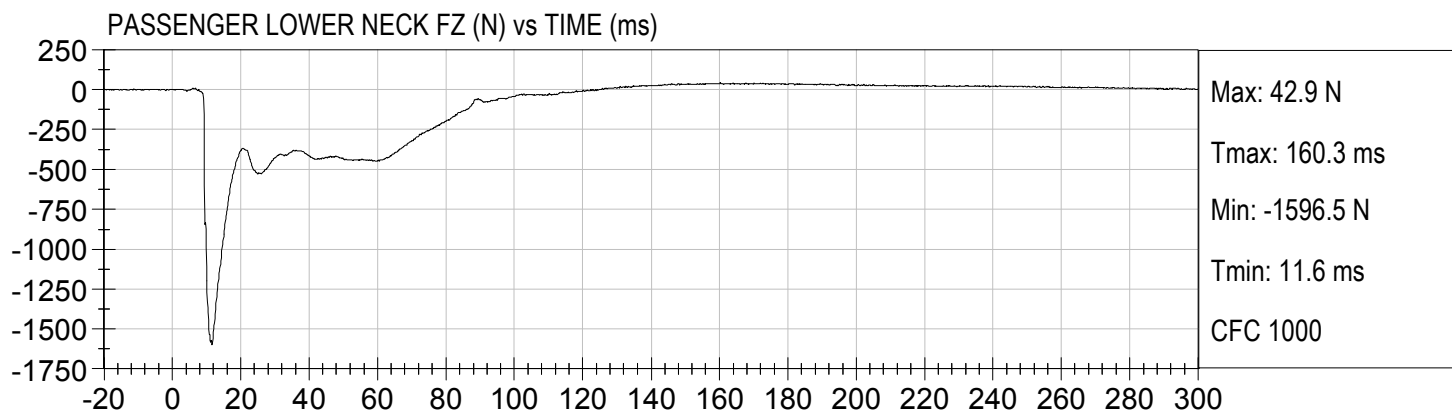
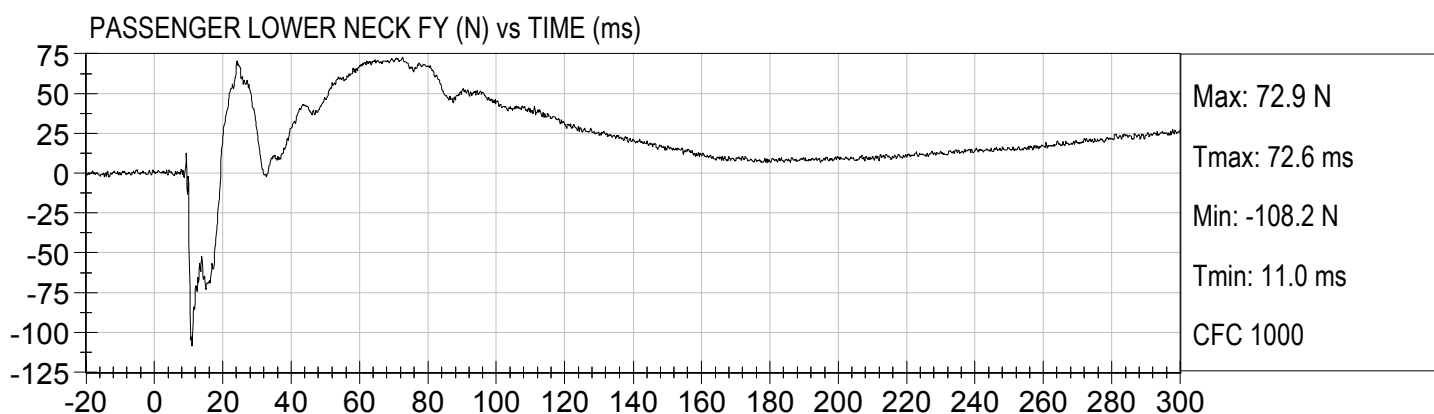
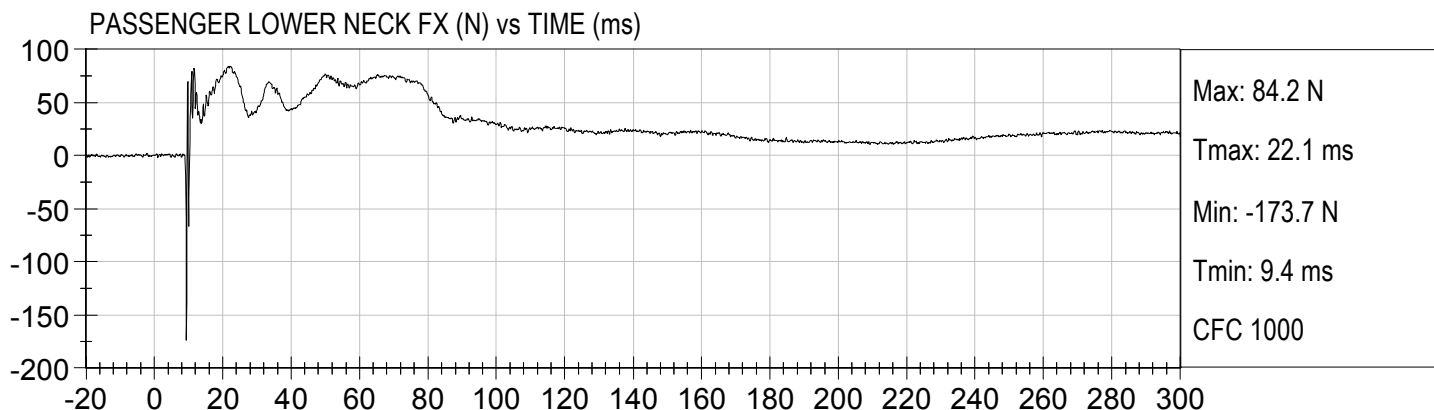
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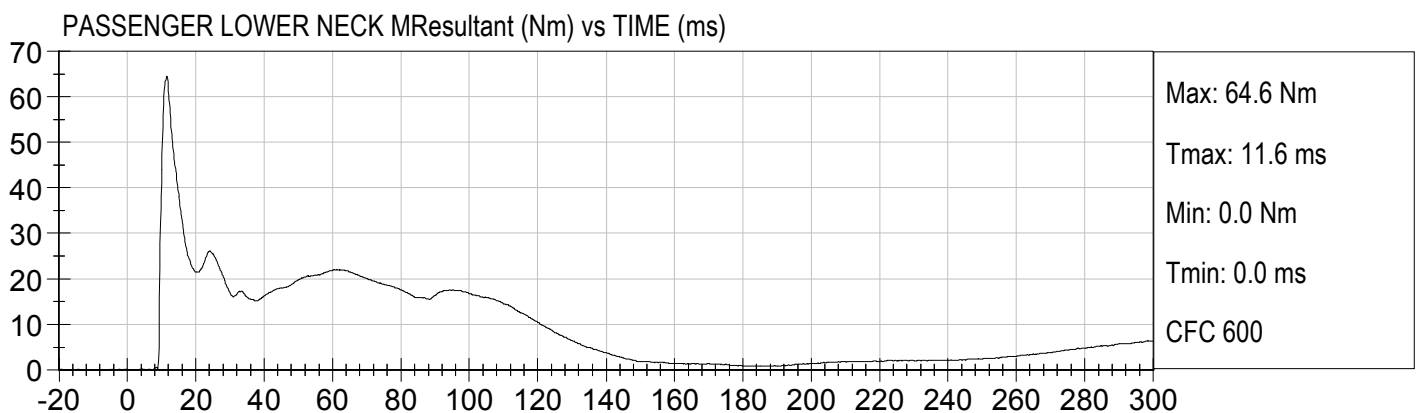
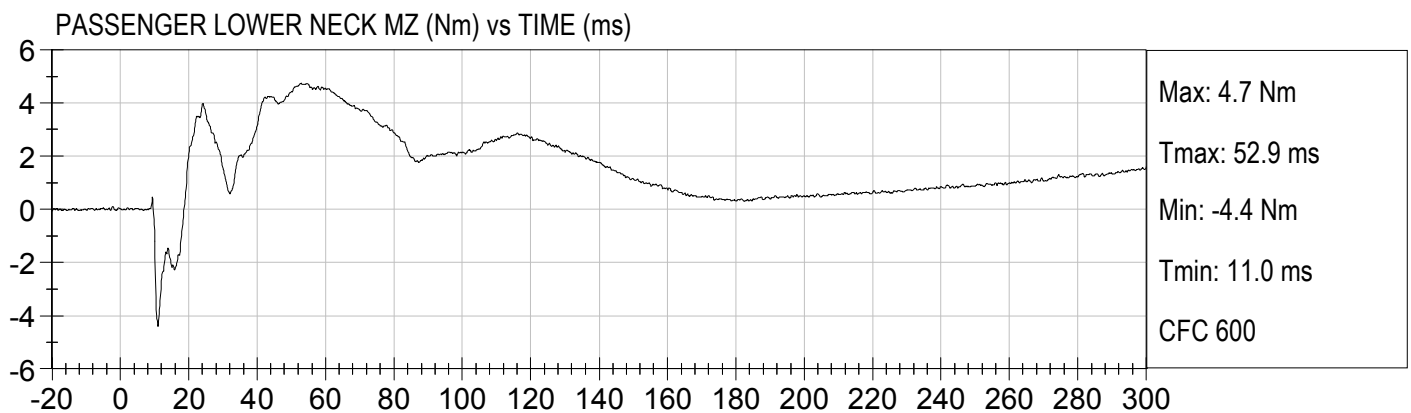
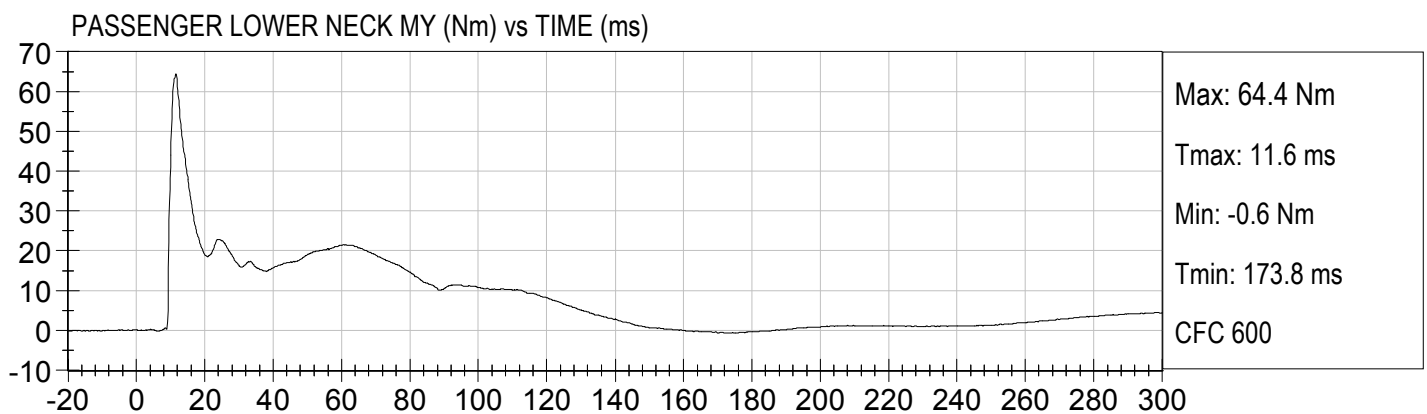
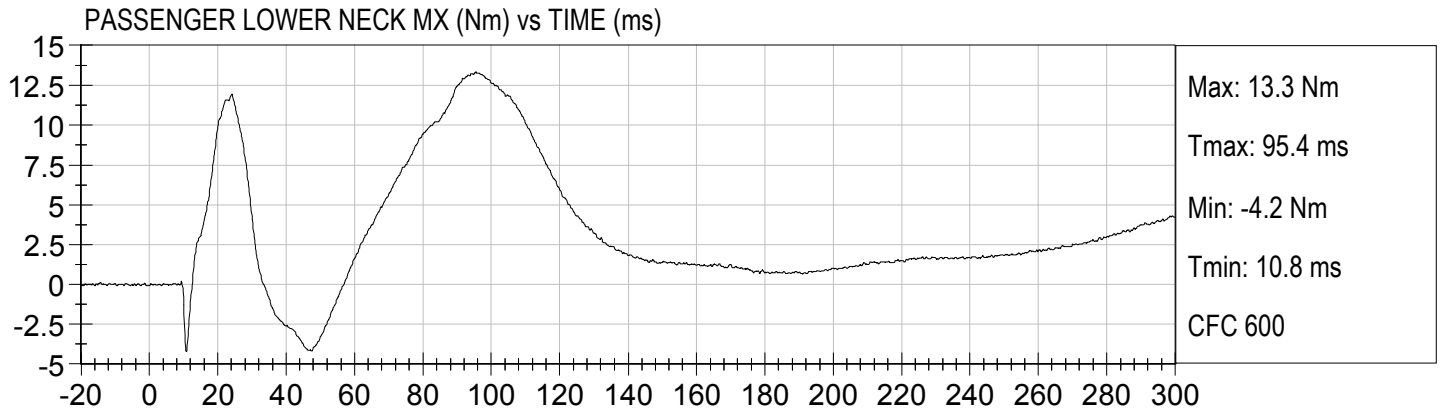
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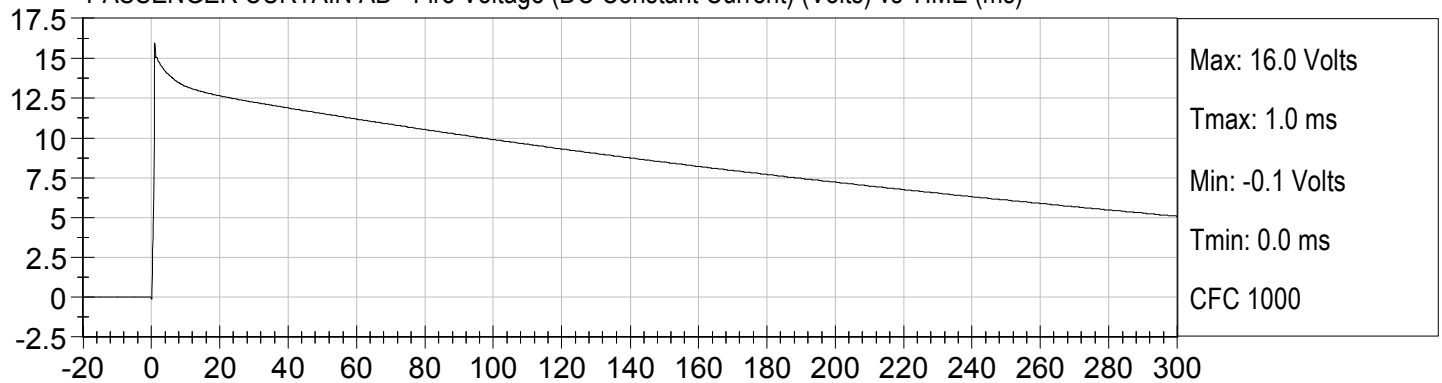








PASSENGER CURTAIN AB - Fire Voltage (DC Constant Current) (Volts) vs TIME (ms)



PASSENGER CURTAIN AB - Fire Current (DC Constant Current) (Amps) vs TIME (ms)

