mga research corporation

REPORT NUMBER: TWG-MGA-2013-004

SIDE AIRBAG OUT-OF-POSITION INJURY
TECHNICAL WORKING GROUP

VOLKSWAGEN AG GERMANY
2013 Volkswagen Tiguan S AWD SUV
NHTSA No.: MD5802TWG2

TEST DATE: JANUARY 3, 2013

FINAL REPORT DATE: FEBRUARY 13, 2013

FINAL REPORT

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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 both a curtain and torso airbag deployment in a 2013 Volkswagen Tiguan S AWD SUV with an out-of-position SID-IIs Build Level D were evaluated. The curtain and seat airbags were fired remotely. The test was performed by MGA Research Corporation on January 3, 2013. Pre-test 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 ¾ View Through Windshield

One SID-IIs Build Level D dummy (Serial Number 304) was placed in the right front passenger seat situated in the inboard-facing position per Section 3.3.5.3 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

The 9 channels of data were recorded using an on-board data acquisition system. Appendix B contains the dummy data traces.

The SID-IIs dummy's visible contact points were as follows:

- Curtain airbag to top and back of head
- Torso bag to left torso

The SID-IIs dummy was placed in the right front passenger seat facing toward the center of the vehicle with its arm against the seatback. The arm was rotated horizontally in the forward direction with respect to the dummy. The seat track was adjusted forward to minimize the vertical distance between the dummy's head and curtain airbag. The dummy's pelvis was slid outboard until the dummy's back contacted the door trim panel or armrest and the CG of the head was centered in the deployment trajectory of the airbag. The vertical plane through the centerline of the dummy's rib-stiffener and shoulder bolt was parallel to the centerline of the vehicle. Masking tape was wrapped around the dummy's neck bracket to hold the dummy in place.

This orientation complies with Section 3.3.5.3 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	3.3.5.3*	Inboard Facing SID-IIs dummy
Curtain Airbag	Roof-Rail Mounted	Side Airbag
Torso Airbag	Seat Mounted	Side Airbag
ATD Type/Serial No.	SID-IIs Build Level D / 304	5th Percentile Adult Female

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

Number of Data Channels	9
Number of Airbag Channels	4
Number of High-Speed Videos	3

Visible Dummy Contact Points	
Head Contact	Curtain airbag top and back of head
Left Shoulder Contact	None
Left Torso Contact	Torso bag
Left Pelvis Contact	None

DATA SHEET NO. 2

TEST VEHICLE INFORMATION

Please note that this vehicle had previously been tested in an NCAP Frontal Impact on September 25, 2012.

TEST VEHICLE INFORMATION	
Manufacturer	Volkswagen
Model	Tiguan
Body Style	SUV
NHTSA No.	MD5802TWG2
VIN	WVGBV7AX6DW007337
Color	Pepper Gray Metallic
Delivery Date	08/31/2012
Odometer Reading (mile)	110
Dealer	Boucher Fleet Group
Transmission	Automatic
Final Drive	AWD
Number of Cylinders	4
Engine Displacement (L)	2.0
Engine Placement	Lateral
Automatic Door Lock (ADL)	Yes
Owner's Manual Details Instructions on Disabling ADLs	No
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/Pelvis Airbag	No
Force Limiter	Yes
Pretensioner	Yes
Power Steering	Yes
Power Door Locks	Yes
Tilt Wheel	Yes
Air Conditioning	Yes
Anti-lock Brakes	Yes
Traction Control	No
All-Wheel Drive	Yes
Power Seats	No

DATA FROM CERTIFICATION LABEL

Manufactured By	VOLKSWAGEN AG GERMANY
Date of Manufacture	06/12

GVWR (kg)	2250
GAWR Front (kg)	1130
GAWR Rear (kg)	1000

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				520
Cargo Wt. (RCLW) (kg)				180

DATA SHEET NO. 3

DUMMY POSITIONING IN VEHICLE

Measurement		Value
Seat Position		17 of 51 Detents from Full Forward
Seat Height Position		Non-Adjustable
Placed in Position No. 2		---
Seat Back Angle (at headrest post)	SA (°)	2.3
Top of Curtain Airbag Module to Head/Neck Junction	AN (mm)	135
Top of Seat Airbag Module to Head/Neck Junction	AN (mm)	68
Head CG to Door Window	HD (mm)	172
Head to Seat Back Centerline	HSC (mm)	209
Chest to Dash	CD (mm)	458
Chest to Seatback	CS (mm)	233
Right Arm to Seat Back Centerline	RACL (mm)	---
Left Arm to Seat Back Centerline	LACL (mm)	265
Right Arm to Door Panel	RA (mm)	---
Left Arm to Door Panel	LA (mm)	84
Knee to Knee	KK (mm)	144
Toe to Toe	TT (mm)	160
Right Knee to Seat Cushion Centerline	KSCR (mm)	115
Left Knee to Seat Cushion Centerline	KSCL (mm)	116
Right Toe to Seat Cushion Centerline	TSCR (mm)	480
Left Toe to Seat Cushion Centerline	TSCL (mm)	467
Nose to Dash	ND (mm)	616
Nose to Headrest	NS (mm)	183
Top of Head to Headliner	HH (mm)	25

DATA SHEET NO. 4

DUMMY INJURY CRITERIA VALUES

NHTSA No. MD5802TWG2

		MAXIMUM VALUE			
		Position No. 2			
DESCRIPTION	UNIT	MAXIMUM	TIME (ms)	MINIMUM	TIME (ms)
Head X	g	30.6	10.1	-2.1	286.4
Head Y	g	7.2	17.4	-10.3	10.3
Head Z	g	23.9	9.8	-5.4	19.7
Head Resultant	g	39.1	10.1		
Upper Neck Fx	N	25.0	79.7	-147.7	16.8
Upper Neck Fy	N	218.8	18.8	-73.5	154.7
Upper Neck Fz	N	97.3	24.1	-654.8	13.1
Upper Neck F Resultant	N	700.1	16.8		
Upper Neck Mx	Nm	12.2	23.9	-14.1	13.9
Upper Neck My	Nm	4.0	134.3	-12.2	17.5
Upper Neck Mz	Nm	4.1	137.6	-8.6	72.2
Upper Neck M Resultant	Nm	14.5	14.0		

DATA SHEET NO. 4 (continued)

DUMMY INJURY CRITERIA VALUES

NHTSA No. MD5802TWG2

	HEAD INJURY CRITERIA (HIC)					
	HIC15			HIC36		
ATD position	HIC	T^1 (msec)	T^2 (msec)	HIC	T^1 (msec)	T^2 (msec)
No. 2 Right Front	6.18	9.5	11.1	6.18	9.5	11.1

Position 2 Neck Injury Summary (SID-IIs Build Level D – Out-Of-Position)

	Nij	Time (msec)	Z Force (N) (CFC 600)	X Force (N) (CFC 600)	Y Moment (N-m) (CFC 600)
Ntf	0.03	134.8	11.46	-37.00	3.94
Nte	0.04	23.9	84.02	-40.63	-2.14
Ncf	0.16	11.9	-592.38	3.77	1.64
Nce	0.30	17.1	-640.19	-144.34	-11.72
Peak Tension (CFC1000)		**97.3 N**	**Peak Compression (CFC 1000)**		**-654.8 N**

Critical Values

Nij Intercepts				Peak Limits	
Tension (CVt)	3880 N	Extension (mCVe)	61 N-m	Tension	2070 N
Compression (CVc)	3880 N	Flexion (mCVf)	155 N-m	Compression	2520 N
Condyle Offset	**0.01778 m**				

APPENDIX A

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Right ¾ Front View of Vehicle, As Received

Vehicle Certification Placard

Pre-Test Vehicle Left Side View

Post-Test Vehicle Left Side View

Pre-Test SID-IIs Dummy Left Side View

Post-Test SID-IIs Dummy Left Side View

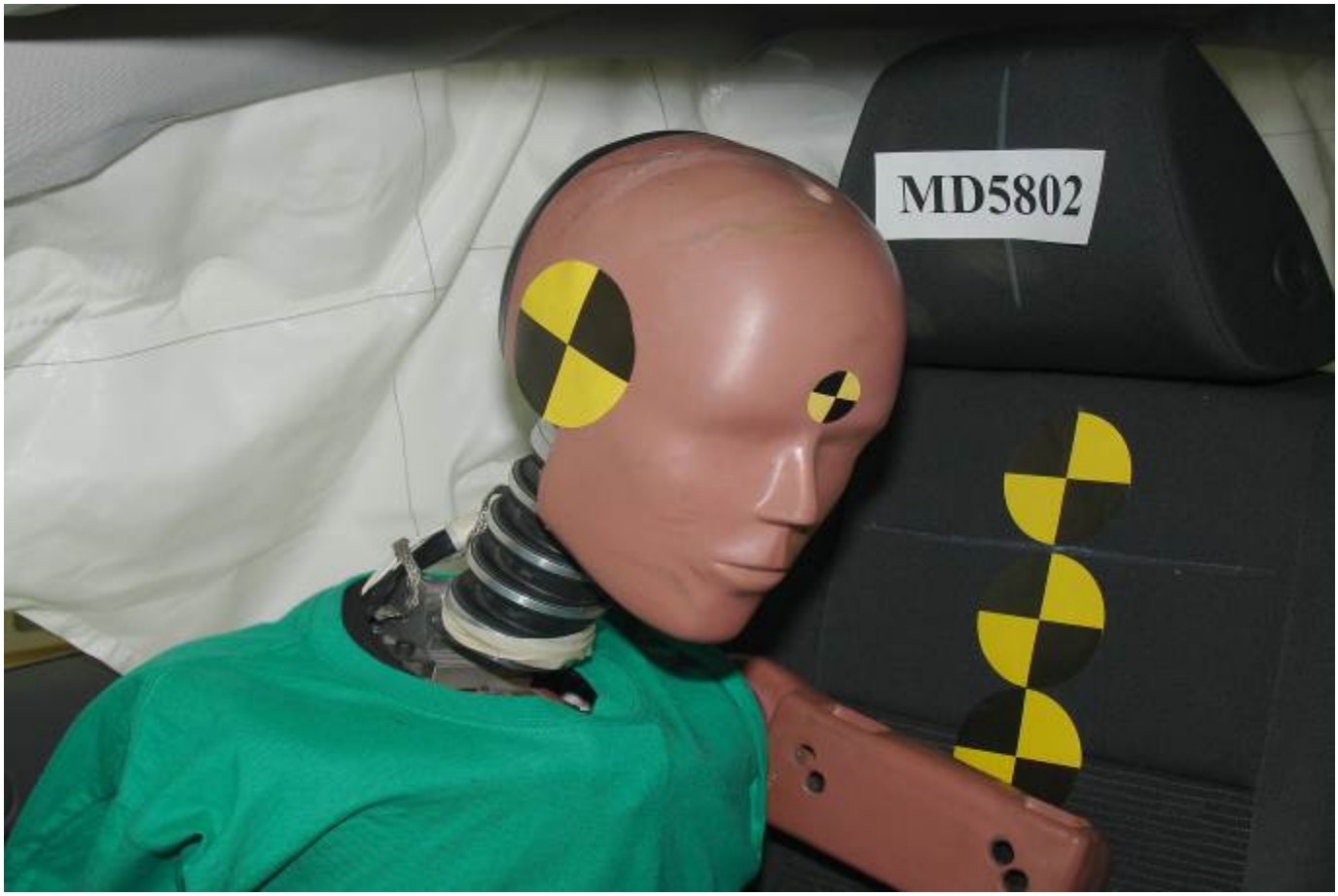
Pre-Test SID-IIs Dummy Left Side Closeup View

Post-Test SID-IIs Dummy Left Side Closeup View

Pre-Test SID-IIs Dummy Left ¾ Front View

Post-Test SID-IIs Dummy Left ¾ Front View

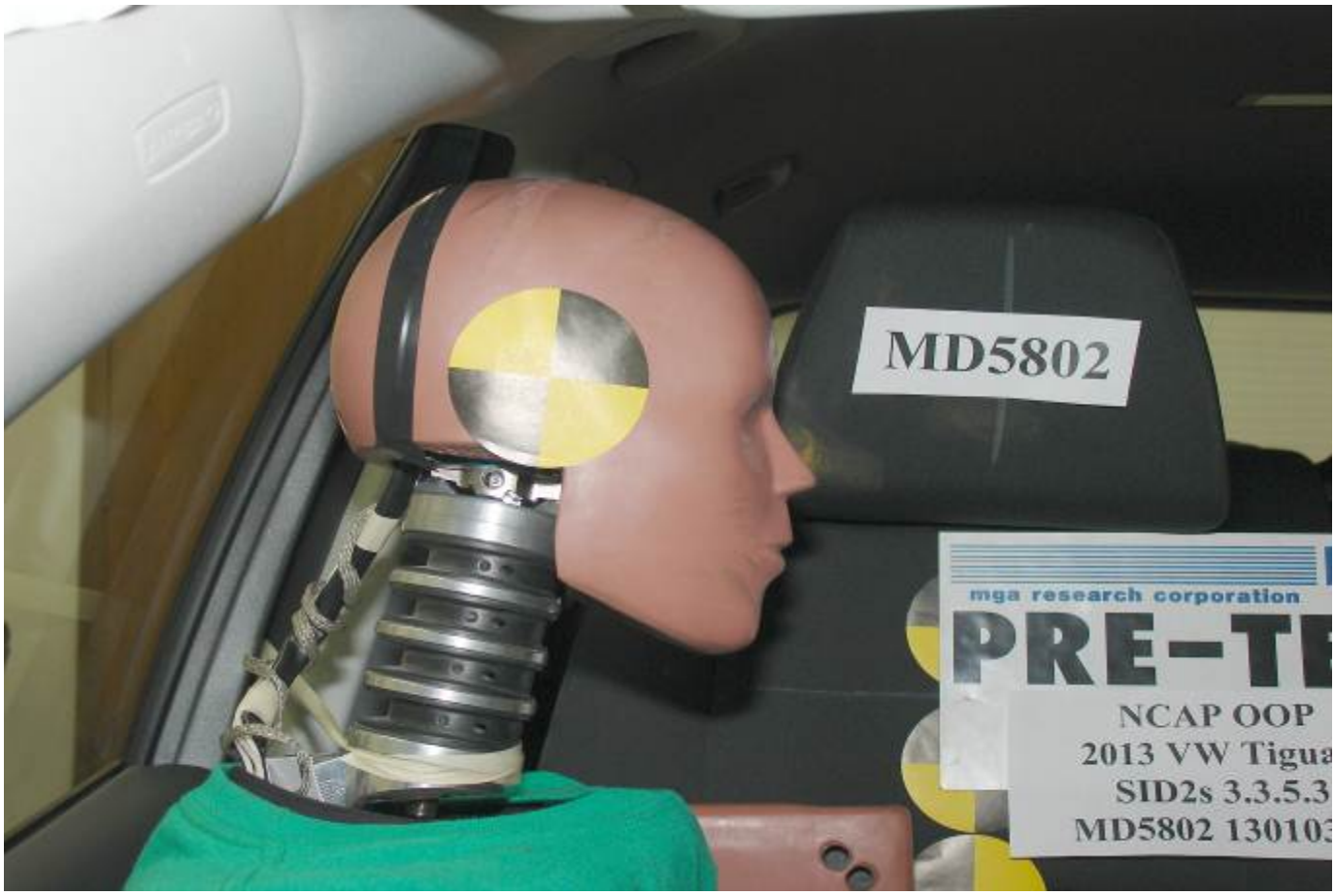
Pre-Test SID-IIs Dummy Left ¾ Front Closeup View



Post-Test SID-IIs Dummy Left ¾ Front Closeup View

Pre-Test SID-IIs Dummy Front View

Post-Test SID-IIs Dummy Front View



Pre-Test SID-IIs Dummy Front Closeup View

Post-Test SID-IIs Dummy Front Closeup View

Pre-Test SID-IIs Dummy Right ¾ Front View

Post-Test SID-IIs Dummy Right ¾ Front View

Pre-Test SID-IIs Dummy Right Side View

Post-Test SID-IIs Dummy Right Side View

Post-Test SID-IIs Dummy Right Side View (Door Open)

Post-Test Curtain Airbag Left Side View

Post-Test Curtain Airbag Left ¾ Front View

Post-Test Curtain Airbag Front View

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

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DUMMY RESPONSE DATA TRACES

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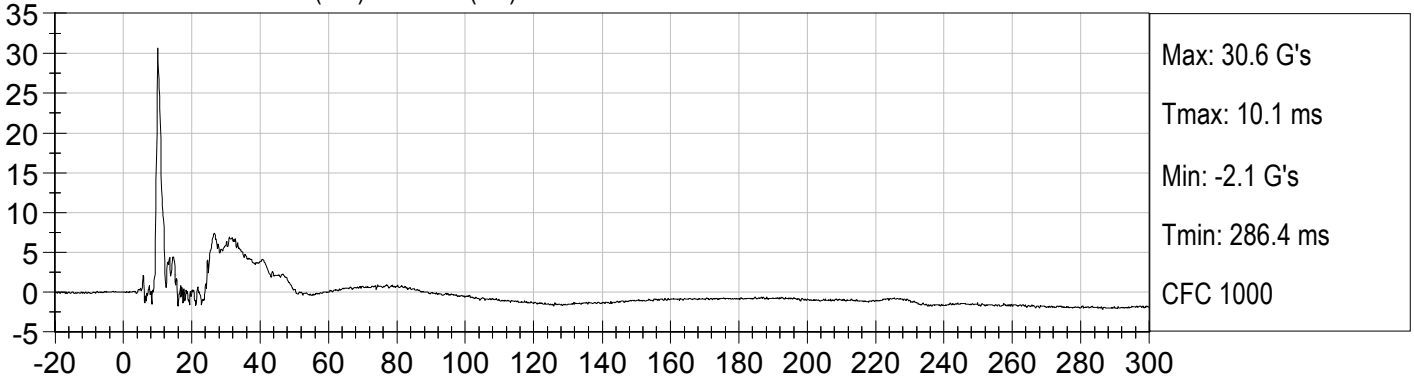
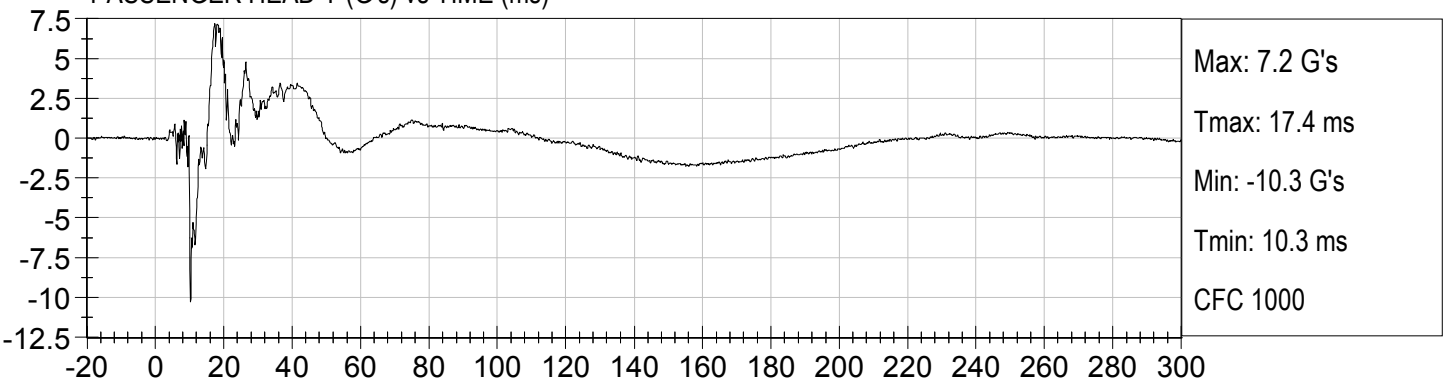
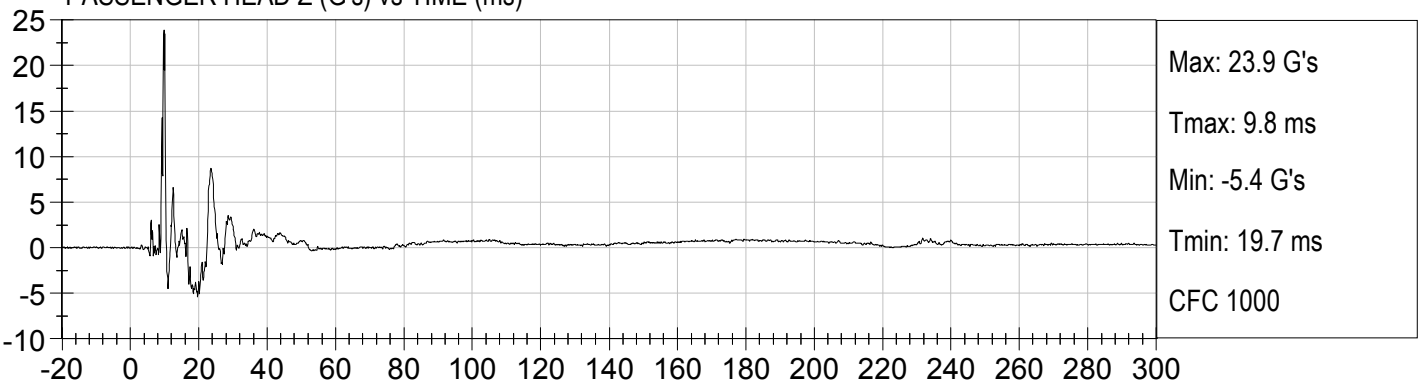
PASSENGER HEAD X (G's) vs TIME (ms)



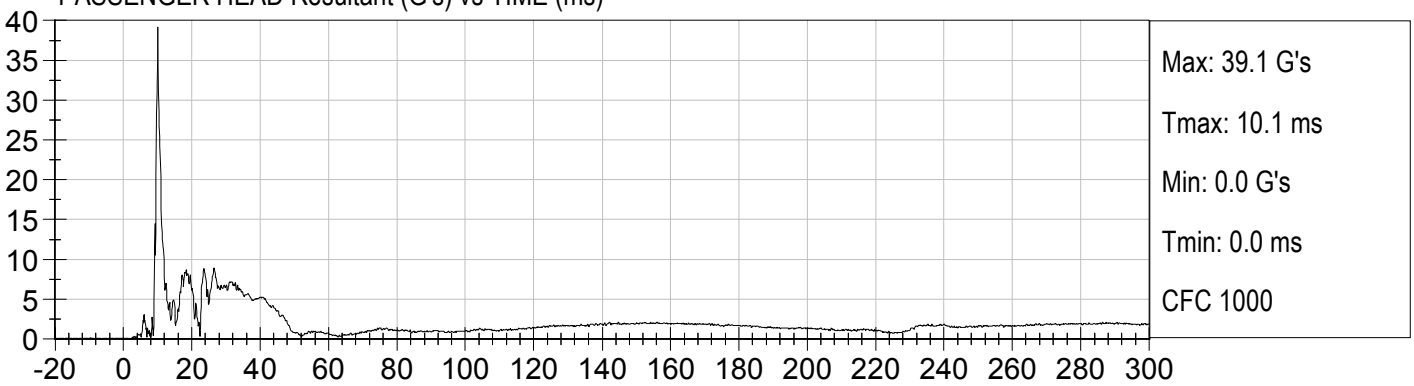
PASSENGER HEAD Y (G's) vs TIME (ms)



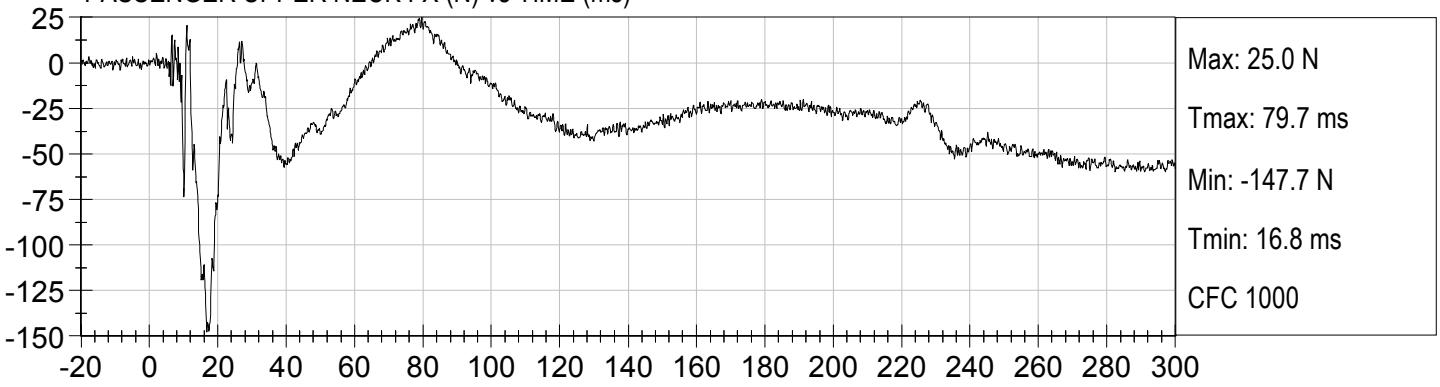
PASSENGER HEAD Z (G's) vs TIME (ms)



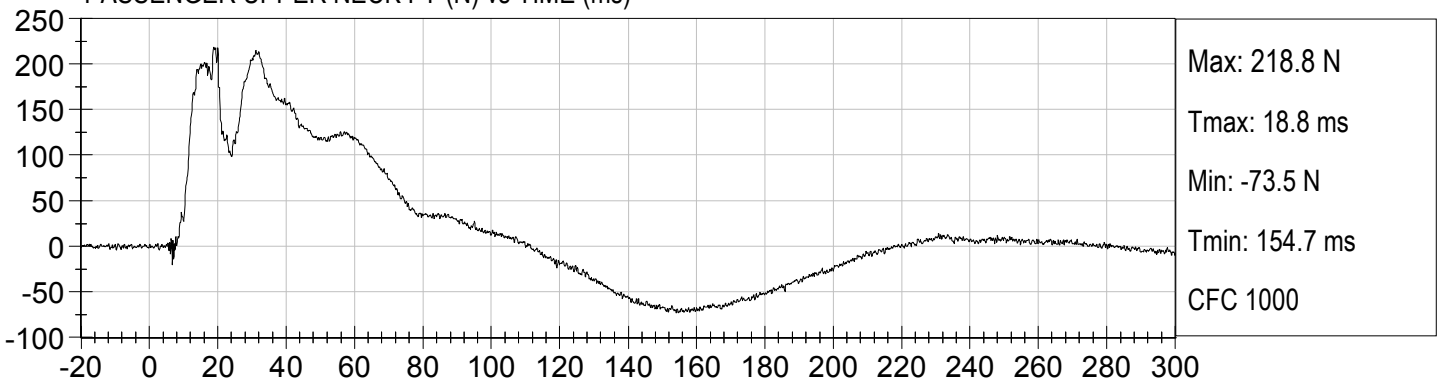
PASSENGER HEAD Resultant (G's) vs TIME (ms)



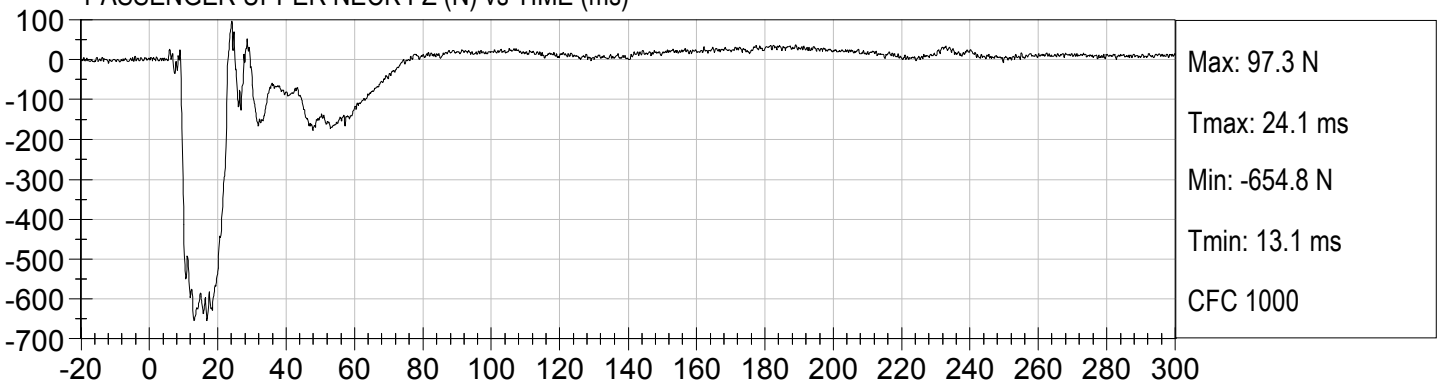
PASSENGER UPPER NECK FX (N) vs TIME (ms)



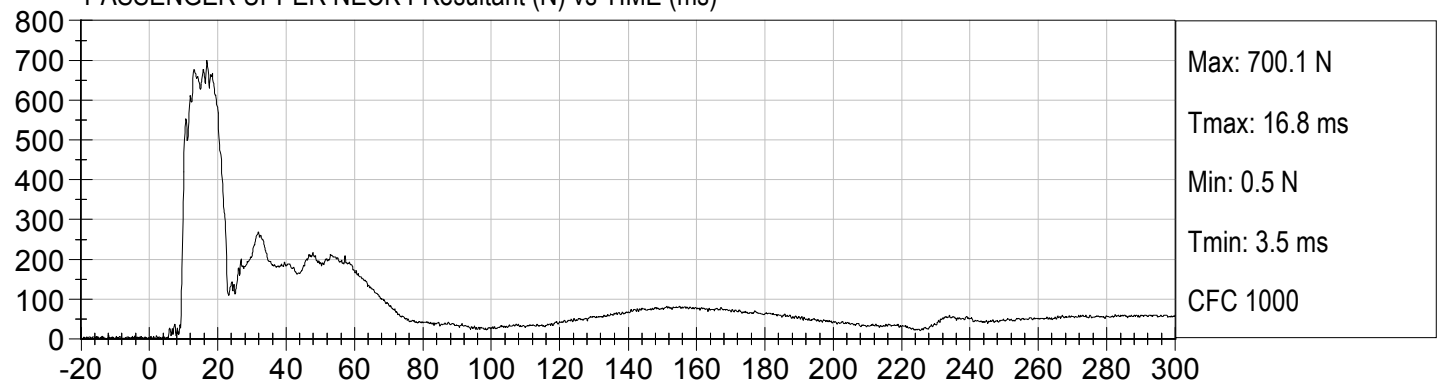
PASSENGER UPPER NECK FY (N) vs TIME (ms)



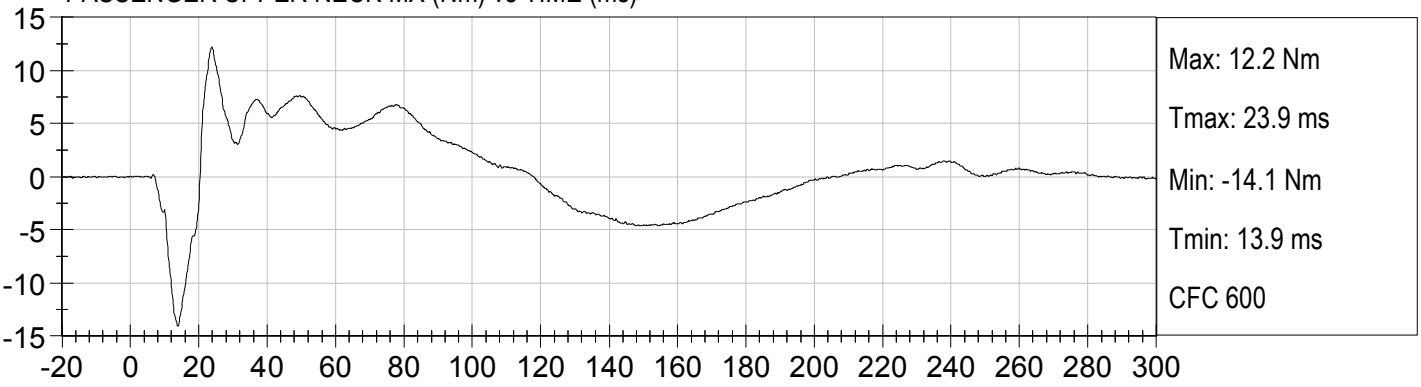
PASSENGER UPPER NECK FZ (N) vs TIME (ms)



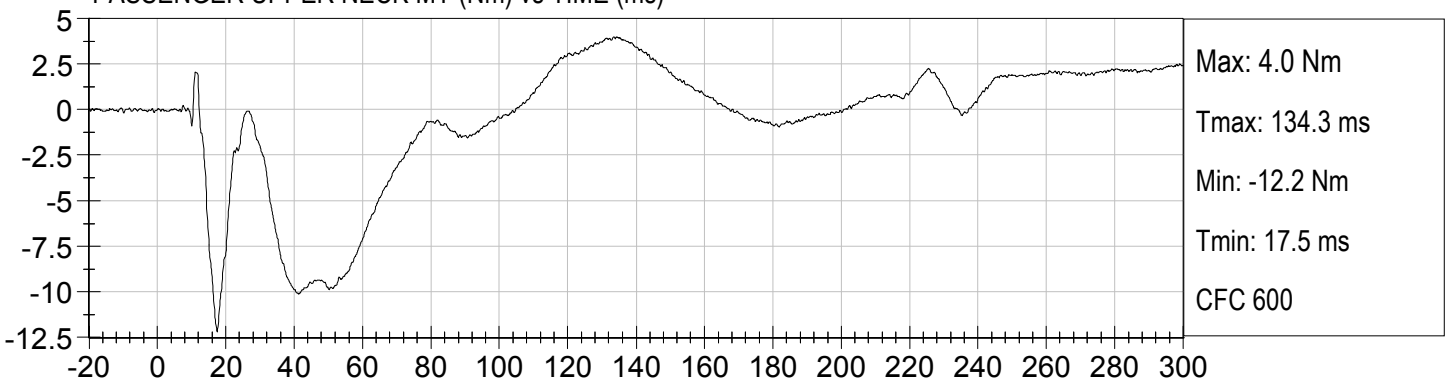
PASSENGER UPPER NECK FResultant (N) vs TIME (ms)



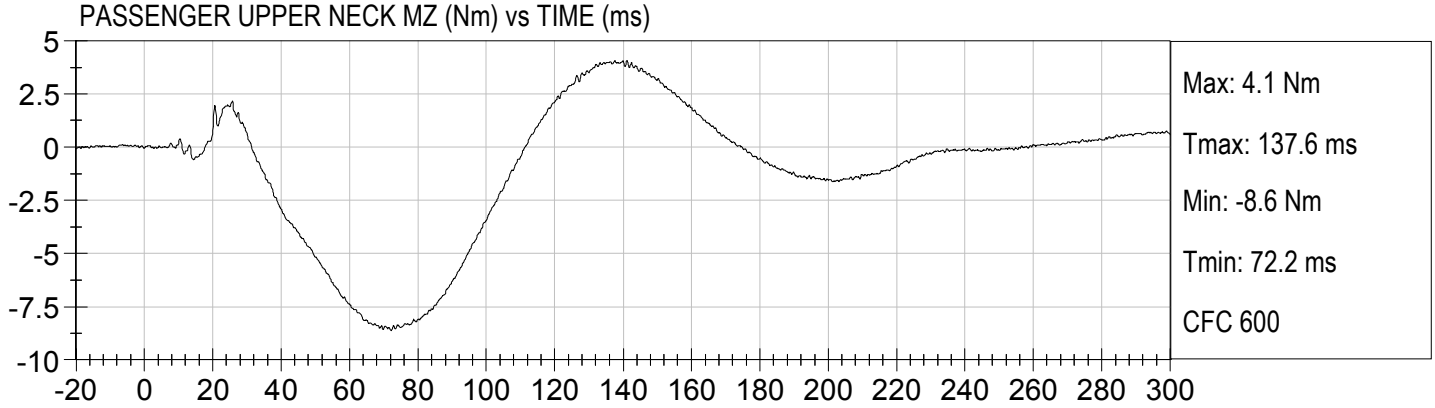
PASSENGER UPPER NECK MX (Nm) vs TIME (ms)



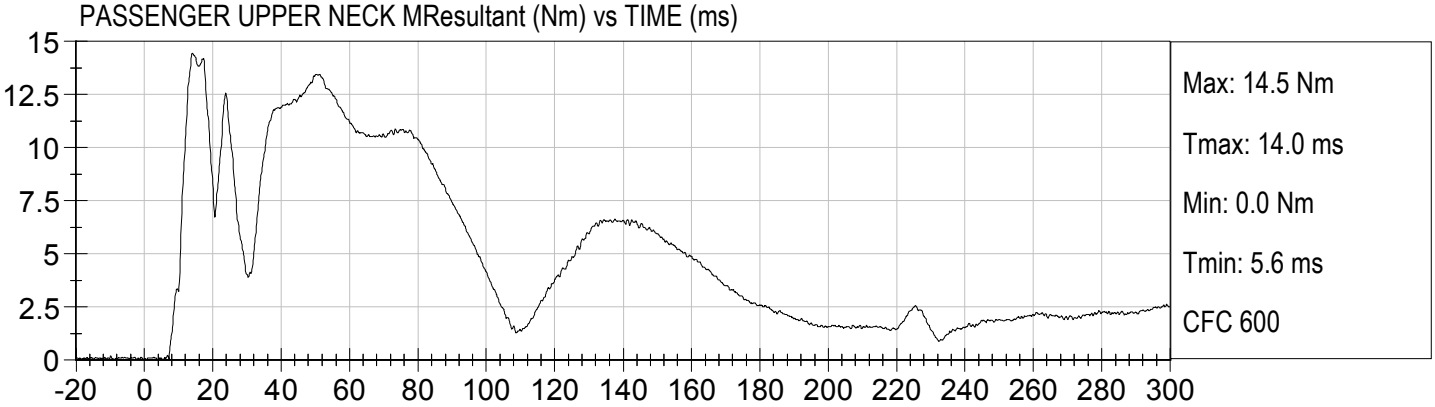
PASSENGER UPPER NECK MY (Nm) vs TIME (ms)



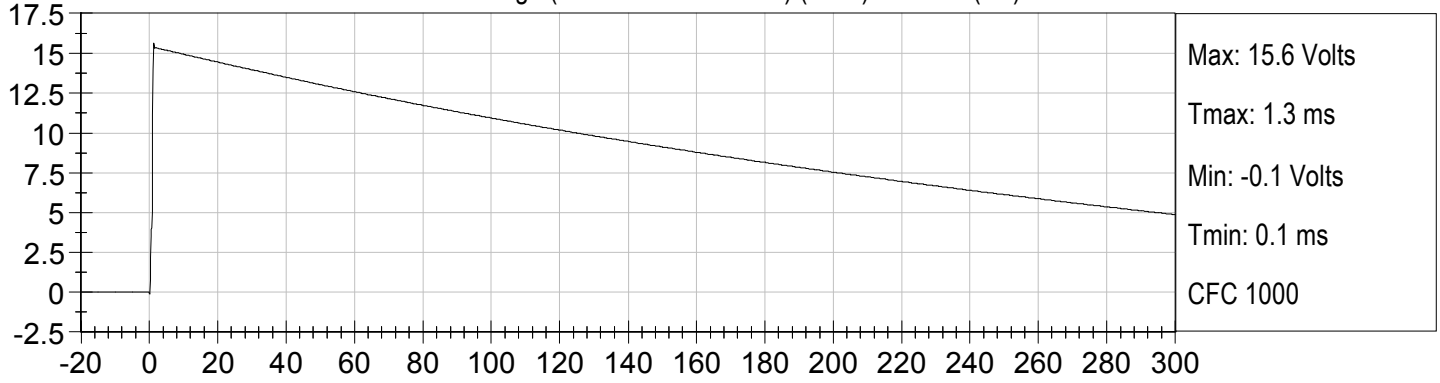
PASSENGER UPPER NECK MZ (Nm) vs TIME (ms)



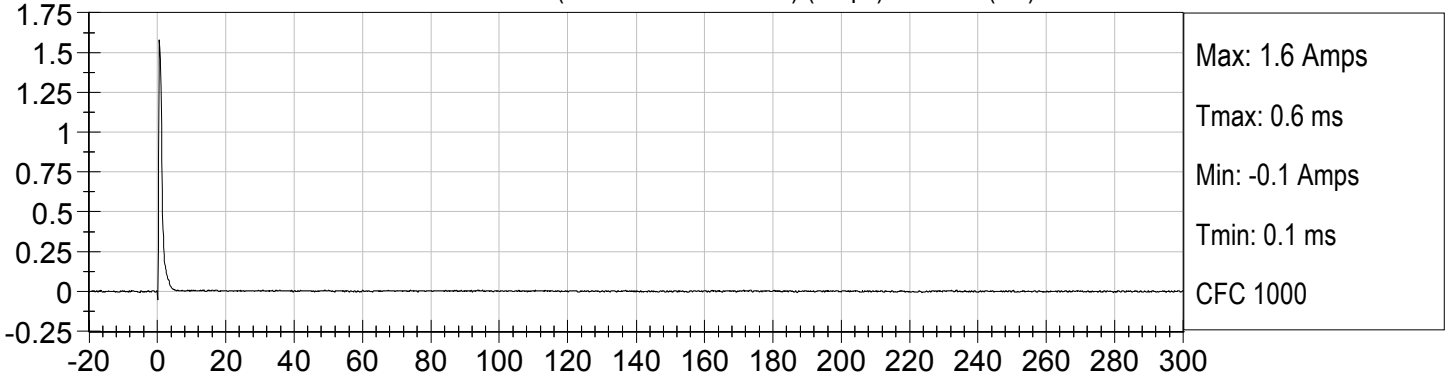
PASSENGER UPPER NECK MResultant (Nm) vs TIME (ms)



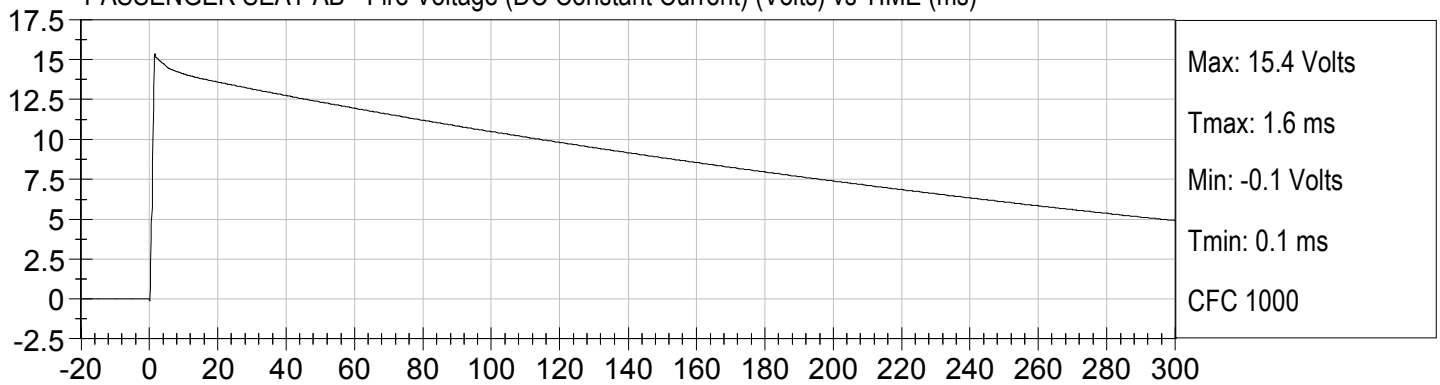
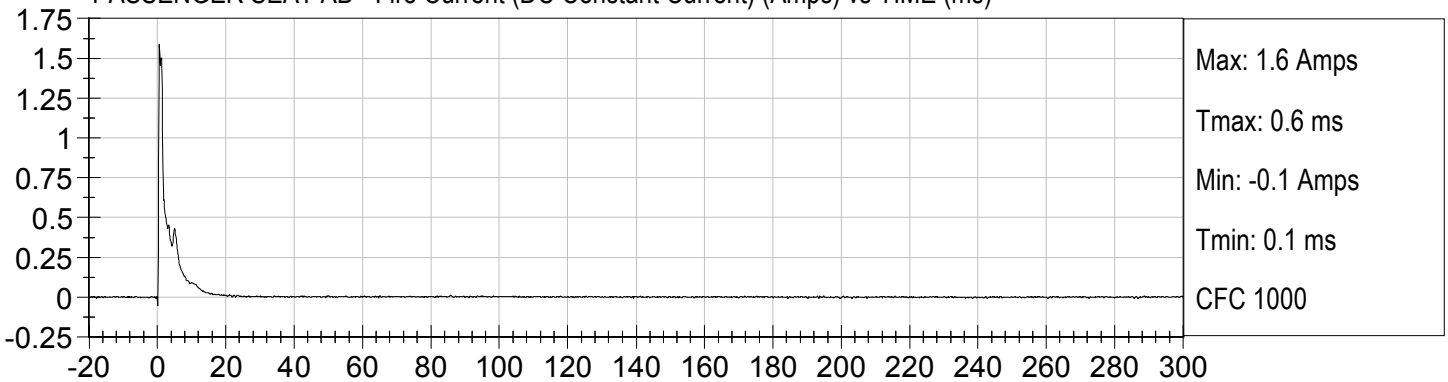
PASSENGER CURTAIN AB - Fire Voltage (DC Constant Current) (Volts) vs TIME (ms)



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



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



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