



REPORT NUMBER: TWG-MGA-2013-007

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

**FORD MOTOR CO.
2013 Ford C-MAX Hybrid SE 5-Dr Hatchback
NHTSA No.: MD0205TWG2**

TEST DATE: FEBRUARY 11, 2013

FINAL REPORT DATE: MARCH 21, 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 both a curtain and torso airbag deployment in a 2013 Ford C-MAX Hybrid SE 5-Dr Hatchback 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 February 11, 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 – No Video Collected; Faulty Trigger
- Front Through Windshield – No Video Collected; Faulty Trigger
- Left Side $\frac{3}{4}$ View Through Windshield – No Video Collected; Faulty Trigger

One SID-IIs Build Level D dummy (Serial Number 304) was placed in the right front passenger seat situated in the forward-facing position per Section 3.3.5.2 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 on 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 right side of head
- Curtain airbag to right shoulder
- Torso bag to right shoulder, right torso, and right pelvis

The SID-II's dummy was placed in the right front passenger seat sitting upright in the center of the seat facing forward with its arm along the armrest. The arm was rotated horizontally in the forward direction with respect to the dummy. The seat track was adjusted forward. The dummy was slid outboard until the dummy's side contacted the door trim panel or armrest and the CG of the head was centered in the deployment trajectory of the airbag. Masking tape was wrapped around the dummy's neck bracket to hold the dummy in place.

This orientation complies with Section 3.3.5.2 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	3.3.5.2*	Forward-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	5 th 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 Real-Time Videos	1

Visible Dummy Contact Points	
Head Contact	Curtain Airbag to Top and Right Side of Head
Right Shoulder Contact	Curtain Airbag Torso/Pelvis Airbag
Right Torso Contact	Torso/Pelvis Airbag
Right Pelvis Contact	Torso/Pelvis Airbag

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

Please note that this vehicle had previously been tested in an
NCAP Frontal Impact on December 5, 2012.

TEST VEHICLE INFORMATION

Manufacturer	Ford
Model	C-MAX Hybrid
Body Style	Hatchback
NHTSA No.	MD0205TWG2
VIN	1FADP5AU0DL508183
Color	Ruby Red Metallic
Delivery Date	10/26/2012
Odometer Reading (mile)	146
Dealer	Boucher Fleet Group
Transmission	CVT
Final Drive	Front
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	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	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 System (TCS)	Yes
All-Wheel Drive (AWD)	No
Power Seats	No

DATA FROM CERTIFICATION LABEL

Manufactured By	FORD MOTOR CO.
Date of Manufacture	10/12

GVWR (kg)	2105
GAWR Front (kg)	1095
GAWR Rear (kg)	1010

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				374
Cargo Wt. (RCLW) (kg)				34

DATA SHEET NO. 3
DUMMY POSITIONING IN VEHICLE

Measurement		Value
Seat Position		10 of 39 Detents
Seat Height Position		Non-Adjustable
Placed in Position No. 2		---
Seat Back Angle (from headrest post)	SA (°)	3.8
Top of Curtain Airbag Module to Head/Neck Junction	AN (mm)	278
Top of Seat Airbag Module to Head/Neck Junction	AN (mm)	70
Head CG to Window	HD (mm)	247
Head to Seat Back Centerline	HSC (mm)	171
Chest to Dash	CD (mm)	435
Chest to Seatback	CS (mm)	256
Right Arm to Seat Back Centerline	RACL (mm)	326
Left Arm to Seat Back Centerline	LACL (mm)	N/A
Right Arm to Door Panel	RA (mm)	Contact
Left Arm to Door Panel	LA (mm)	N/A
Knee to Knee	KK (mm)	165
Toe to Toe	TT (mm)	196
Right Knee to Seat Cushion Centerline	KSCR (mm)	218
Left Knee to Seat Cushion Centerline	KSCL (mm)	65
Right Toe to Seat Cushion Centerline	TSCR (mm)	225
Left Toe to Seat Cushion Centerline	TSCL (mm)	5
Nose to Dash	ND (mm)	589
Nose to Headrest	NS (mm)	304
Top of Head to Headliner	HH (mm)	128

DATA SHEET NO. 4
DUMMY INJURY CRITERIA VALUES

NHTSA No. MD0205TWG2

		MAXIMUM VALUE			
		Position No. 2			
DESCRIPTION	UNIT	MAXIMUM	TIME (ms)	MINIMUM	TIME (ms)
Head X	g	4.5	16.7	-8.7	12.1
Head Y	g	1.4	209.2	-13.5	18.6
Head Z	g	4.7	17.4	-13.3	14.1
Head Resultant	g	14.6	14.1		
Upper Neck Fx	N	104.4	20.2	-46.0	163.3
Upper Neck Fy	N	93.8	19.1	-26.7	75.6
Upper Neck Fz	N	104.8	36.9	-484.8	13.6
Upper Neck F Resultant	N	487.1	13.6		
Upper Neck Mx	Nm	5.0	31.7	-2.6	16.7
Upper Neck My	Nm	7.8	17.1	-6.3	49.0
Upper Neck Mz	Nm	2.0	204.3	-5.4	27.3
Upper Neck M Resultant	Nm	8.8	18.6		

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

NHTSA No. MD0205TWG2

ATD position	HEAD INJURY CRITERIA (HIC)					
	HIC15			HIC36		
	HIC	T ¹ (msec)	T ² (msec)	HIC	T ¹ (msec)	T ² (msec)
No. 2 Right Front	2.65	11.2	26.2	2.66	11.1	27.5

Position 2 Neck Injury Summary (SID-IIs – 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	154.3	8.42	-39.94	3.95
Nte	0.11	49.1	46.57	15.69	-6.31
Ncf	0.15	14.7	-433.23	81.52	6.99
Nce	0.08	32.9	-78.57	33.52	-3.69
Peak Tension (CFC1000)	104.8 N		Peak Compression (CFC 1000)		-484.8 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				

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Right 3/4 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 3/4 Front View



Post-Test SID-IIs Dummy Left 3/4 Front View



Pre-Test SID-IIs Dummy Left $\frac{3}{4}$ Front Closeup View



Post-Test SID-IIs Dummy Left $\frac{3}{4}$ 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-II's Dummy Right Side View



Post-Test SID-II's Dummy Right Side View



Post-Test SID-II's Dummy Right Side View (Door Open)



Post-Test Curtain Airbag Left View



Post-Test Curtain Airbag Left 3/4 Front View



Post-Test Curtain Airbag Front View

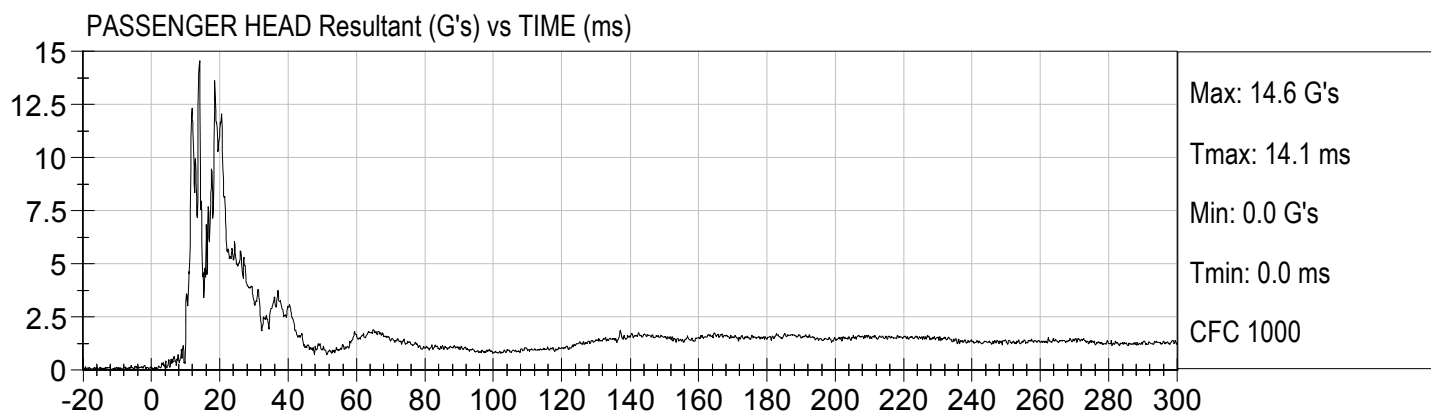
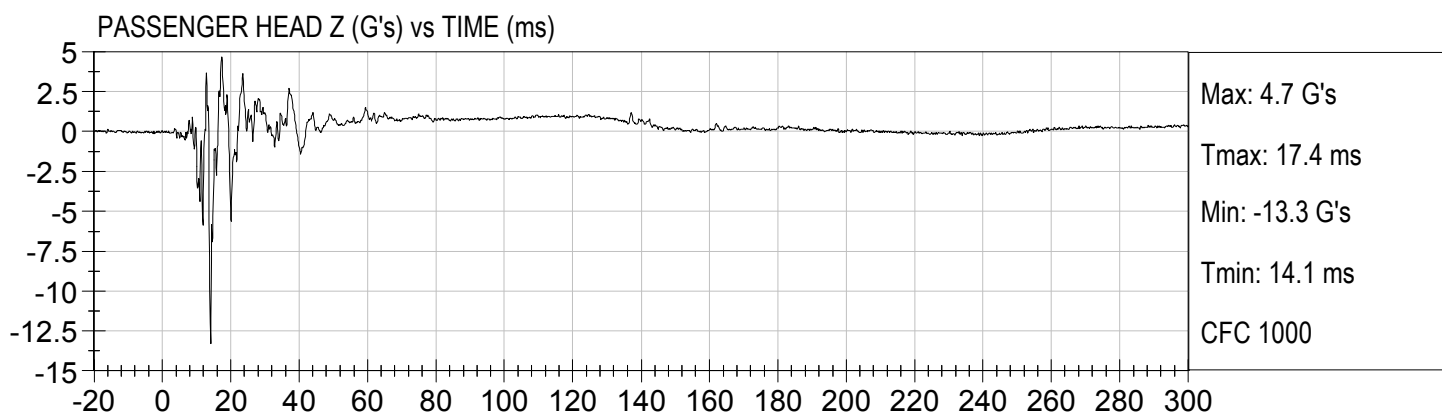
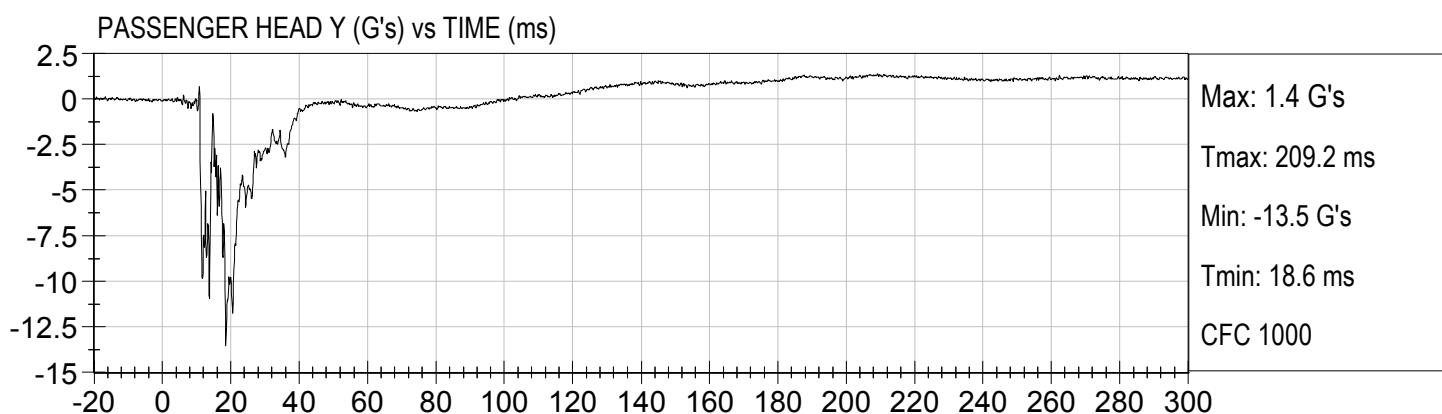
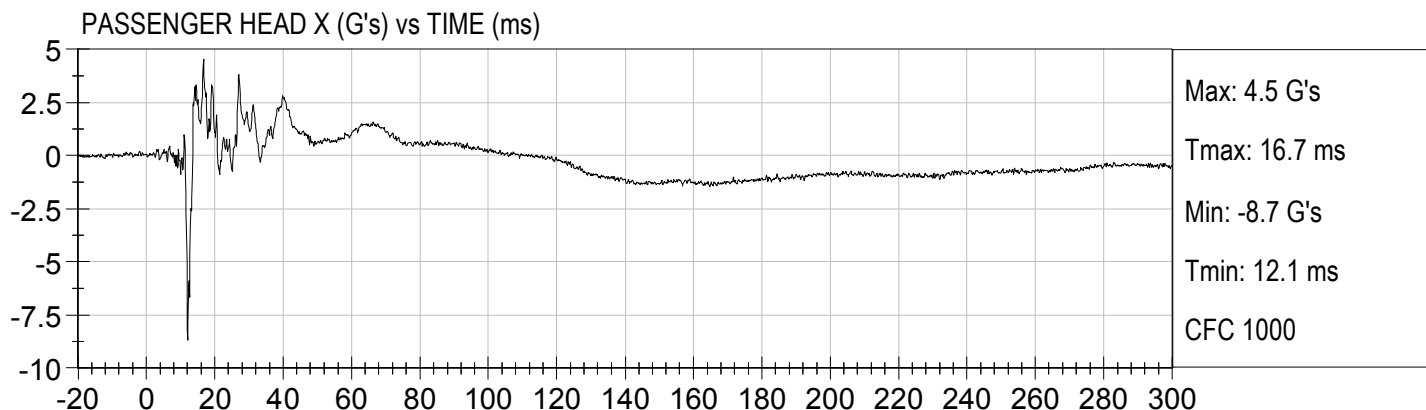


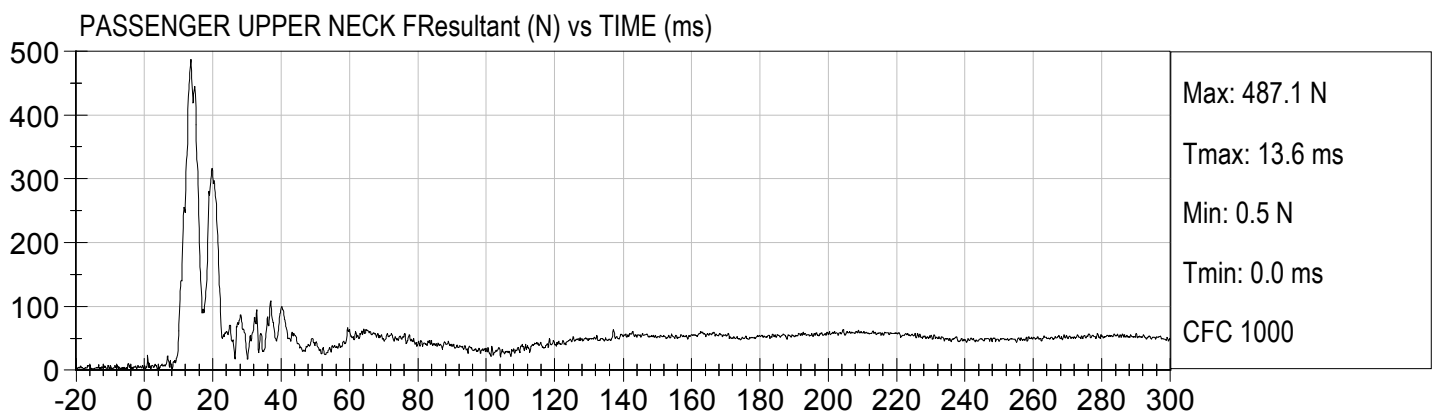
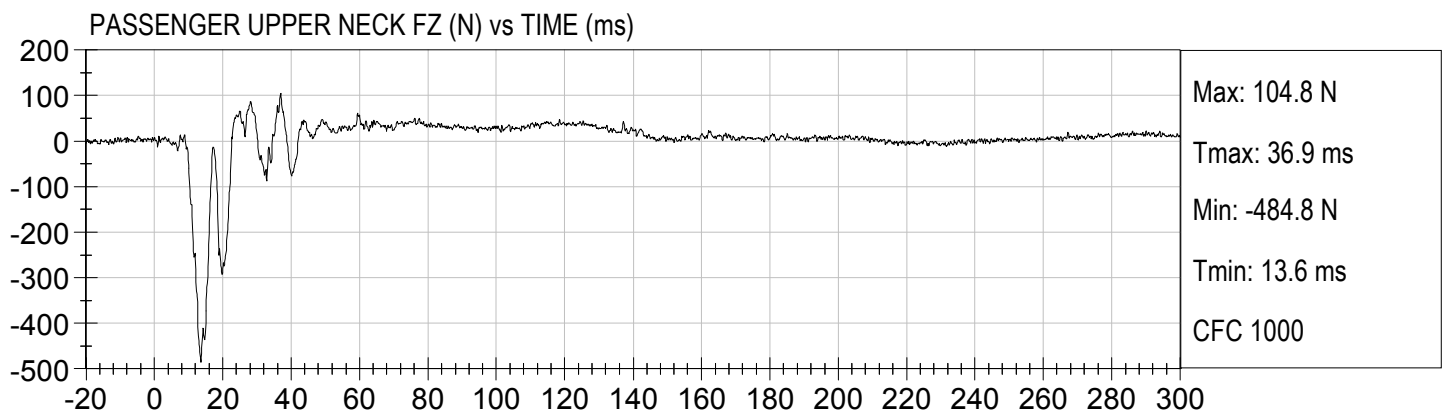
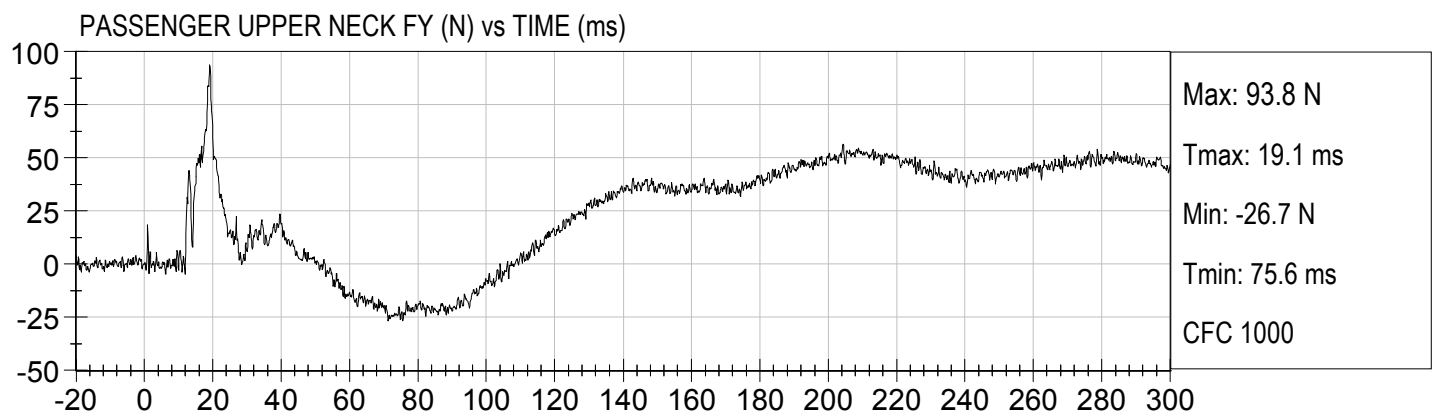
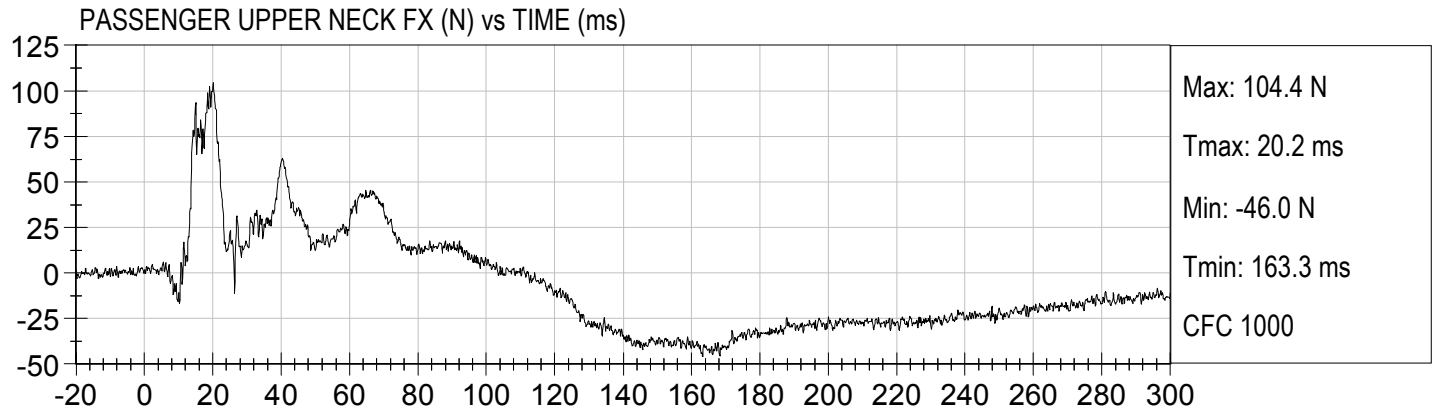
Post-Test Curtain Airbag Right Side View (Door Open)

APPENDIX B
DUMMY RESPONSE DATA TRACES

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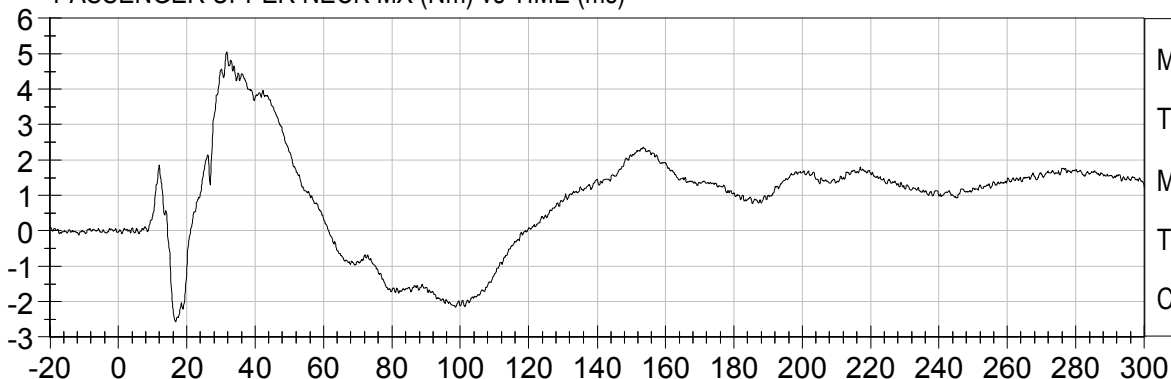
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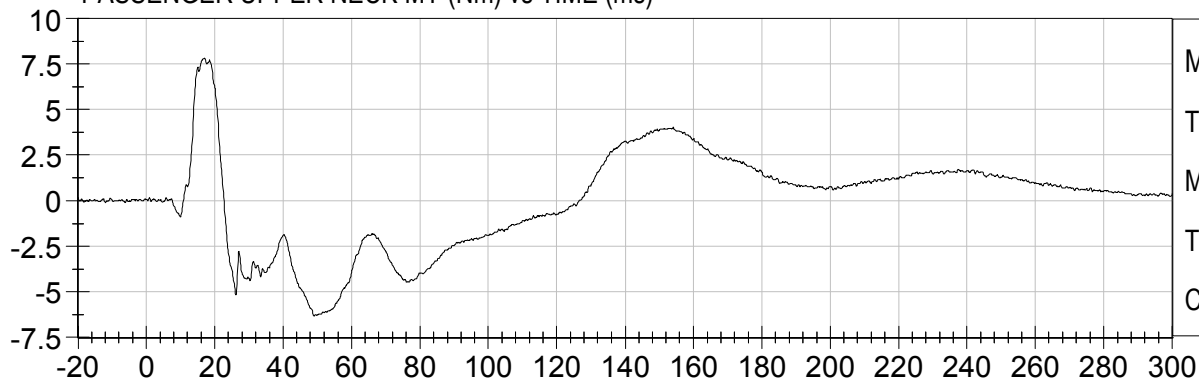


PASSENGER UPPER NECK MX (Nm) vs TIME (ms)



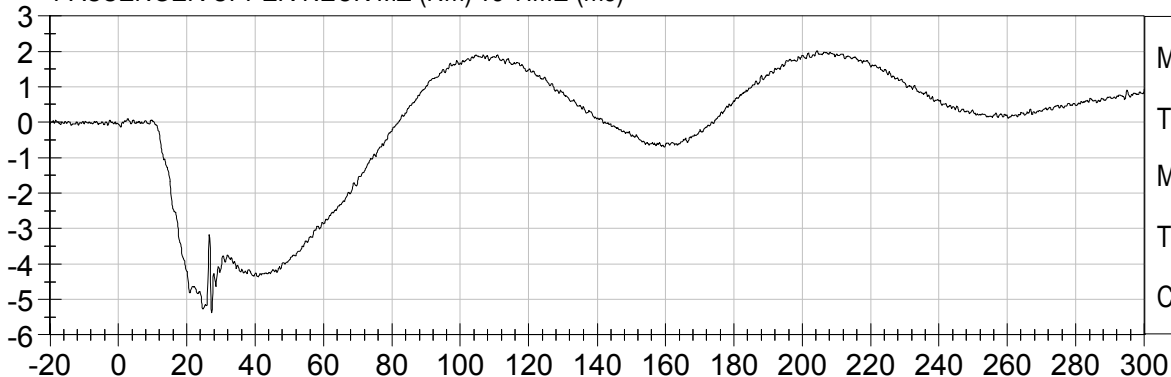
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Min: -2.6 Nm
Tmin: 16.7 ms
CFC 600

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



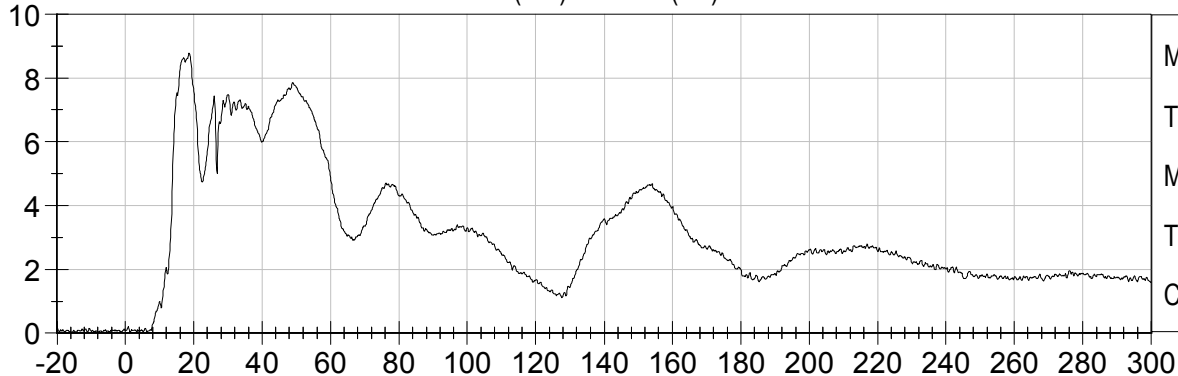
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Min: -6.3 Nm
Tmin: 49.0 ms
CFC 600

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



Max: 2.0 Nm
Tmax: 204.3 ms
Min: -5.4 Nm
Tmin: 27.3 ms
CFC 600

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



Max: 8.8 Nm
Tmax: 18.6 ms
Min: 0.0 Nm
Tmin: 0.0 ms
CFC 600

