



REPORT NUMBER: TWG-MGA-2013-008B

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

**MERCEDES-BENZ U.S. INTL., INC
2013 Mercedes-Benz ML350 AWD SUV
NHTSA No.: MD0509TWG3**

TEST DATE: FEBRUARY 12, 2013

FINAL REPORT DATE: MARCH 21, 2013

FINAL REPORT

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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 torso airbag deployment in a 2013 Mercedes-Benz ML350 AWD SUV with an out-of-position Hybrid III 3-Year-Old child dummy were evaluated. The curtain and seat airbags were fired remotely. The test was performed by MGA Research Corporation on February 12, 2013. Pre and post test photographs of the vehicle and dummy can be found in Appendix A.

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

- Left Side Through Removed Rear Passenger Door
- Left Side $\frac{3}{4}$ View Through Windshield

One Hybrid III 3-Year-Old child dummy (Serial Number 082) was placed in the right rear passenger seat lying on the seat per Section 3.3.3.3 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
- 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 3-Year-Old child dummy's visible contact points were as follows:

- Torso airbag to back and left side of head

The Hybrid III 3-Year-Old child dummy was placed in the right rear passenger seat lying on its back with its arms at its sides so that its rearmost arm contacts the seatback. While bending the dummy at the waist, the dummy was slid outboard until the CG of the head was aligned with the vertical centerline of the airbag module and the head touching the armrest. A wedge-shaped foam block was used to support the dummy's back so that the head remained in a neutral position and does not exert a significant downward force on the armrest. The dummy's arm closest to the front edge of the seat was adjusted so that it was parallel to the torso and was rested on the foam block with the fingertips just touching the seat cushion. The rearmost upper arm was adjusted to an orientation 45 degrees to the upper arm.

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 3.3.3.3 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	P3	Right Rear Seating Position
Test	3.3.3.3*	Lying Child Dummy
Torso Airbag	Seat Mounted	Side Airbag
ATD Type/Serial No.	Hybrid III 3 Year Old / 082	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	4
Number of High-Speed Videos	2

Visible Dummy Contact Points	
Head Contact	Torso Bag to Back and Left Side of Head
Left Shoulder Contact	None
Left Torso Contact	None
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 December 20, 2012.

TEST VEHICLE INFORMATION

Manufacturer	Mercedes-Benz
Model	ML350
Body Style	SUV
NHTSA No.	MD0509TWG3
VIN	4JGDA5HB8DA142352
Color	Cinnabar Red Metallic
Delivery Date	11/14/2012
Odometer Reading (mile)	80
Dealer	Concord Mercedes
Transmission	Automatic
Final Drive	AWD
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	Yes
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)	1400
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)				490
Cargo Wt. (RCLW) (kg)				150

DATA SHEET NO. 3
DUMMY POSITIONING IN VEHICLE

Measurement		Value
Seat Position		Non-Adjustable
Seat Height Position		Non-Adjustable
Placed in Position No. 3		---
Seat Back Angle	SA (°)	Mid-Notch
Top of Curtain Airbag Module to Head/Neck Junction	AN (mm)	608
Top of Seat Airbag Module to Head/Neck Junction	AN (mm)	182
Head CG to Door Panel	HD (mm)	115
Head to Seat Back Centerline	HSC (mm)	236
Chest to Rear of Front Seat	CD (mm)	729
Chest to Seatback	CS (mm)	162
Right Arm to Seat Back Centerline	RACL (mm)	N/A
Left Arm to Seat Back Centerline	LACL (mm)	N/A
Right Arm to Arm Rest	RA (mm)	122
Left Arm to Door Panel	LA (mm)	133
Knee to Knee	KK (mm)	107
Toe to Toe	TT (mm)	96
Right Knee to Seat Cushion Centerline	KSCR (mm)	258
Left Knee to Seat Cushion Centerline	KSCL (mm)	261
Right Toe to Seat Cushion Centerline	TSCR (mm)	478
Left Toe to Seat Cushion Centerline	TSCL (mm)	480
Nose to Rear of Front Seat	ND (mm)	655
Nose to Seatback	NS (mm)	181
Top of Head to Headliner	HH (mm)	468

DATA SHEET NO. 4
DUMMY INJURY CRITERIA VALUES

NHTSA No. MD0509TWG3

		MAXIMUM VALUE			
		Position No. 3			
DESCRIPTION	UNIT	MAXIMUM	TIME (ms)	MINIMUM	TIME (ms)
Head X	g	21.2	9.5	-2.6	42.7
Head Y	g	28.2	7.7	-2.6	25.3
Head Z	g	7.6	9.0	-4.7	10.2
Head Resultant	g	32.6	7.8		
Upper Neck Fx	N	8.1	295.6	-102.4	11.1
Upper Neck Fy	N	73.7	6.5	-157.6	19.7
Upper Neck Fz	N	83.9	8.7	-192.5	10.5
Upper Neck F Resultant	N	210.8	20.9		
Upper Neck Mx	Nm	0.2	9.4	-6.2	14.8
Upper Neck My	Nm	5.0	30.9	-2.6	11.0
Upper Neck Mz	Nm	1.3	84.9	-2.2	37.7
Upper Neck M Resultant	Nm	6.7	29.3		
Lower Neck Fx	N	15.2	8.0	-48.4	18.7
Lower Neck Fy	N	65.9	5.6	-97.5	22.6
Lower Neck Fz	N	122.1	8.8	-172.8	10.3
Lower Neck F Resultant	N	175.5	10.3		
Lower Neck Mx	Nm	4.4	7.0	-18.4	20.9
Lower Neck My	Nm	8.3	35.3	-0.9	295.6
Lower Neck Mz	Nm	2.0	81.7	-1.9	25.9
Lower Neck M Resultant	Nm	19.7	21.7		

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

NHTSA No. MD0509TWG3

ATD position	HEAD INJURY CRITERIA (HIC)					
	HIC15			HIC36		
	HIC	T ¹ (msec)	T ² (msec)	HIC	T ¹ (msec)	T ² (msec)
No. 3 Right Rear	22.38	6.8	16.5	22.38	6.8	16.5

Position 3 Neck Injury Summary (3-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	0.04	8.5	73.48	-50.24	0.03
Nte	0.07	13.2	42.90	-78.58	-1.39
Ncf	0.08	36.8	-20.51	-43.68	4.87
Nce	0.17	10.9	-171.01	-96.11	-2.54
Peak Tension (CFC1000)	83.9 N		Peak Compression (CFC 1000)		-192.5 N

Critical Values

Nij Intercepts				Peak Limits	
Tension (CVt)	2120 N	Extension (mCVe)	27 N-m	Tension	1130 N
Compression (CVc)	2120 N	Flexion (mCVf)	68 N-m	Compression	1380 N

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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 3-Year-Old Child Dummy Left Side View



Post-Test 3-Year-Old Child Dummy Left Side View



Pre-Test 3-Year-Old Child Dummy Left Side Closeup View



Post-Test 3-Year-Old Child Dummy Left Side Closeup View



Pre-Test 3-Year-Old Child Dummy Left ¾ Front View



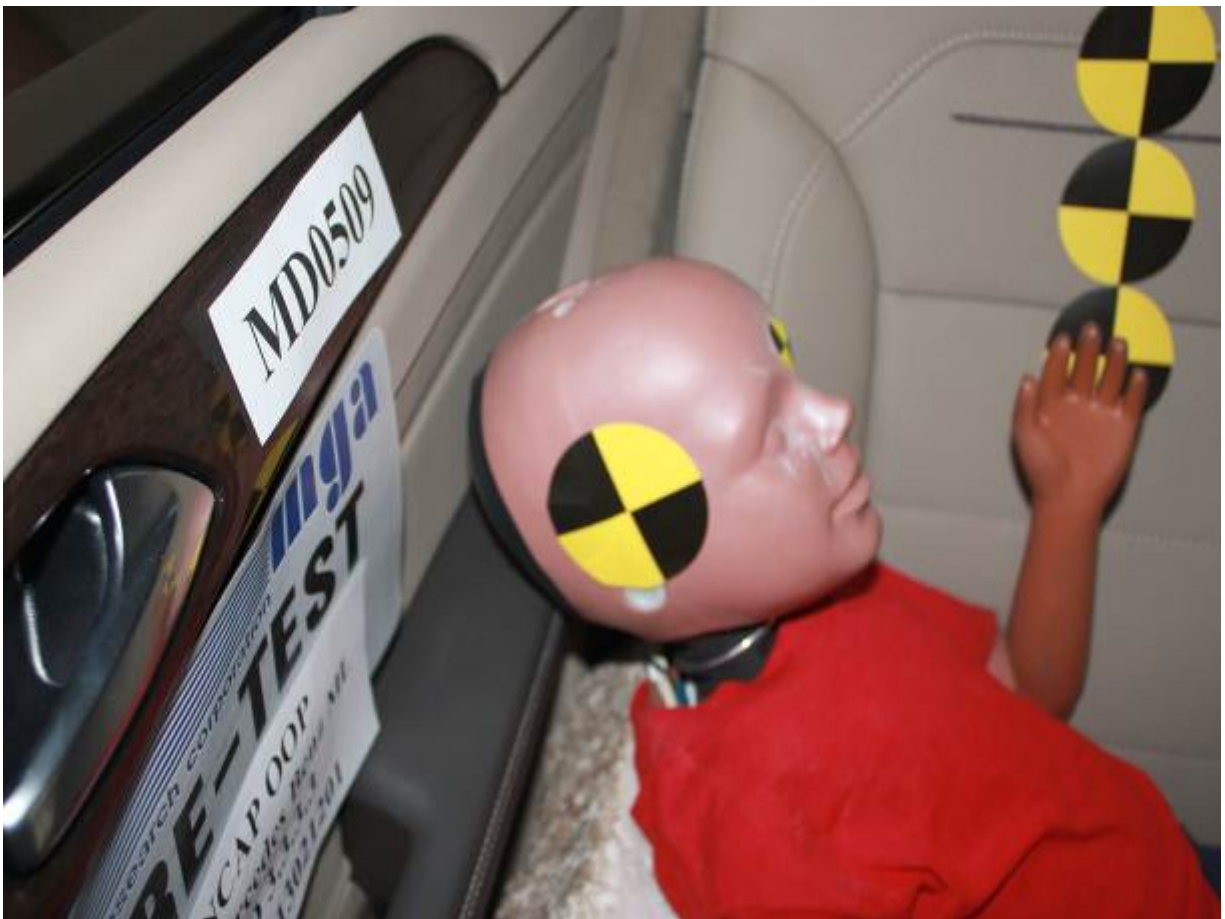
Post-Test 3-Year-Old Child Dummy Left ¾ Front View



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



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



Pre-Test 3-Year-Old Child Dummy Front View



Post-Test 3-Year-Old Child Dummy Front View



Pre-Test 3-Year-Old Child Dummy Front Closeup View



Post-Test 3-Year-Old Child Dummy Front Closeup View



Post-Test 3-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 Right Side View (Door Open)

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