

REPORT NUMBER TR-P26002-04-NC

**SIDE AIRBAG OCCUPANT RISK PROGRAM
OCCUPANT OUT-OF-POSITION TESTS**

**FORD MOTOR COMPANY
2006 FORD EXPLORER
5-DOOR MPV**

NHTSA NUMBER: M60202TWG2

**PREPARED BY:
KARCO ENGINEERING, LLC
9270 HOLLY ROAD
ADELANTO, CALIFORNIA 92301**



AUGUST 11, 2006

FINAL REPORT

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Date of Acceptance

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16. Abstract A static side airbag deployment was conducted on a 2006 Ford Explorer 5-Door MPV at KARCO Engineering, LLC on 8/11/2006. This test was conducted to obtain data indicant of TWG Side Airbag Out-of-Position Injury criteria.			
Measurement Description	Units	Threshold	Hybrid III 6 Year Old ATD
Head Injury Criteria (HIC ₁₅)		700	23.5
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SECTION 1

PURPOSE AND SUMMARY OF TEST M60202TWG2

1.1 PURPOSE

This occupant out-of-position static side airbag deployment test is part of the Technical Working Group Occupant Injury Risk from Deploying Side Airbags Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-01-D-02005. The purpose of this test was to obtain occupant injury data for a side airbag deployment.

The occupant out-of-position side airbag test was conducted in accordance with the Technical Working Group Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags.

1.2 SUMMARY

The effects of a seat mounted torso airbag deployment in a 2006 Ford Explorer 5-Door MPV with an out-of-position Hybrid III 3 Year-Old Child dummy were evaluated. The test was performed at Karco Engineering, LLC on August 11, 2006. Pre- and post-test photographs of the vehicle and dummy can be found in Appendix A.

Two high-speed digital and one real time camera were used to document the torso airbag deployment. Camera locations and other pertinent camera information can be found on Data Sheet No.1 and Data Sheet No.6.

One Part 572P, Hybrid III 3-Year old child anthropomorphic test device (ATD) was placed in the right front passenger seating position facing forward according to the dummy placement instructions (3.3.3.1) in the July 2003 Revision of the Technical Working Group's 'Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags'.

The Hybrid III 3-Year old ATD was instrumented with head tri-axial accelerometers, and upper and lower neck transducers.

Fifteen (15) channels of data were recorded using an on-board data acquisition system. Appendix A contains Photographs. Appendix B contains dummy response data traces. Appendix C contains the Instrumentation Data Channel assignments.

The front passenger side door remained closed during the deployment and was operable after the deployment.

The Hybrid III 3-Year-Old Child Dummy's visible contact points were as follows: The torso airbag contacted the ATD's back.

OUT OF POSITION OCCUPANT DATA SUMMARY

ATD Position	HIC ₁₅	Clip (g)	Chest Defl. (mm)
Passenger	23.5	N/A	N/A

Orientation of the Hybrid III 3 Year-old Child Dummy was in the inboard facing position leaning against the front passenger door. The dummy's spine was aligned with the deploying trajectory of the torso airbag. The lower legs were extended. Synthetic foam was used to raise the dummy. This orientation complies with section 3.3.3.1 of the Technical Working Group (TWG) recommendation in the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags.

SECTION 2

OCCUPANT AND VEHICLE INFORMATION/DATA SHEETS

Test Vehicle: 2006 Ford Explorer 5-Door MPV NHTSA No.: M60202TWG2
Test Program: TWG 3.3.3.1. Test Date: 8/11/06

CONVERSION FACTORS USED IN THIS REPORT*

Quantity	Typical Application	Std Units	Metric Unit	Multiply By
Mass	Vehicle Weight	lb	kg	0.4536
Linear Velocity	Impact Velocity	mile/h	km/h	1.609
Length or Distance	Measurements	in	mm	25.4
Volume	Fuel Systems	gal	liter	3.785
Volume	Small Fluids	oz	mL	29.573
Pressure	Tire Pressures	lbf/in ²	kPa	7.0
Volume	Liquid	gal	liter	3.785
Temperature	General Use	°F	°C	$=(tf - 32)/1.8$
Force	Dynamic Forces	lbf	N	4.448
Moment	Torque	lbf/ft	Nm	1.355

* Based on the Recommended Practice in SAE J916, May 85

DATA SHEET NO. 1

TEST SUMMARY

Test Vehicle: 2006 Ford Explorer 5-Door MPV NHTSA No.: M60202TWG2
Test Program: TWG 3.3.3.1. Test Date: 8/11/06

TEST DUMMY INFORMATION

Description	Passenger Seat Forward Facing
Dummy Type / Serial No.	Hybrid III 3 year old / 044
Head Contact	None
Chest Contact	None
Abdomen Contact	None
Pelvis	None
Left Knee Contact	None
Right Knee Contact	None

MOVIE COVERAGE

High Speed Digital	2
Real Time	1
Total	3

DATA CHANNELS

Child ATD Sensors	15
Belt Assessment Sensors	0
Vehicle Structure Accelerometers	0
Total	15

DATA SHEET NO. 2

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2006 Ford Explorer 5-Door MPV NHTSA No.: M60202TWG2

Test Program: TWG 3.3.3.1. Test Date: 8/11/06

TEST VEHICLE INFORMATION

Make	Ford
Model	Explorer
Body Style	5-Door MPV
NHTSA No.	M60202TWG2
VIN	1FMEU62E46UA33294
Color	Black
Delivery Date	Nov. 18, 2005
Odometer Reading (mile)	71
Dealer	Chino Hills Ford
Transmission	5-Speed Automatic
Final Drive	Rear
Type/Number Cylinders	V6
Engine Displacement (L)	4.0
Engine Placement	Longitudinal

TEST VEHICLE OPTIONS

Driver Front Airbag	Yes
Driver Side Airbag	Yes
Driver Side Curtain Airbag	No
Pass. Front Airbag	Yes
Pass.Side Airbag	Yes
Pass. Curtain Airbag	No
Power Brakes	Yes
Power Steering	Yes
Disc Brakes, Front	Yes
Disc Brakes, Rear	Yes
Anti-lock Brakes	Yes
Tilt Steering Wheel	Yes
Power Windows	Yes
Power Seats	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Ford Motor Company	GVWR (kg)	2726
Date of Manufacture	Sep. 05	GAWR Front (kg)	1297
		GAWR Rear (kg)	1515

DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	308	308
Cold Pressure (kPa)	240	240
Recommend Tire Size	P235/70R16	P235/70R16
Tire Size on Vehicle	P235/70R16	P235/70R16
Tire Manufacturer	Michelin	Michelin

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				666

* Vehicle had undergone New Car Assessment Program Frontal Impact Testing on August 23, 2005

DATA SHEET NO. 3

TEST VEHICLE INFORMATION

Test Vehicle: 2006 Ford Explorer 5-Door MPV NHTSA No.: M60202TWG2
Test Program: TWG 3.3.3.1. Test Date: 8/11/06

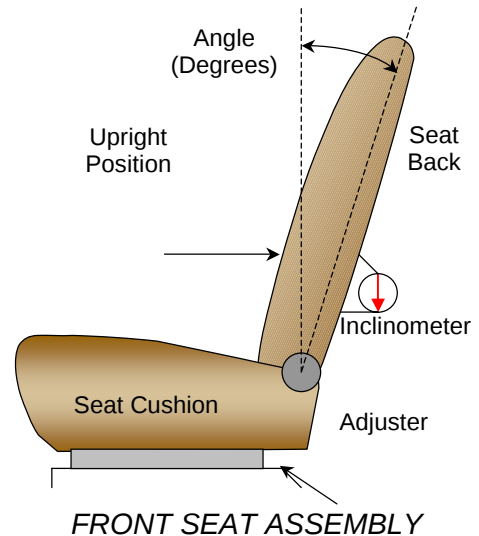
NOMINAL DESIGN RIDING POSITION

The passenger seat back is positioned to section 3.3.3.1. of the Technical Working Group (TWG) recommendation in the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags.

SEAT BACK ANGLES

Position	Deg.
Passenger w/ Dummy	12*

*Measurement was taken at headrest.



SEAT FORE/AFT POSITIONS

The first or forward most position is counted as number one (1). The fore/aft position is set aft of the middle position for the passenger seat.

SEAT FORE/AFT POSITIONING

	Total Fore/Aft Travel	Placed in Position #
Passenger Seat	35	18

DATA SHEET NO. 4

DUMMY POSITIONING INFORMATION

Test Vehicle: 2006 Ford Explorer 5-Door MPV NHTSA No.: M60202TWG2
 Test Program: TWG 3.3.3.1. Test Date: 8/11/06

TEST DUMMY POSITION MEASUREMENTS

Code	Measurement Description	Hybrid III 6-Year-Old Child Dummy	
		Length (mm)	Angle (°)
SA	Seat Back Angle		12
AMW	Side Airbag Module Diameter	N/A	
ABW	Side Airbag Width	90	
AML	Side Airbag Module Length	400	
ABL	Side Airbag Length	N/A	
AN	Top of Airbag Module to Head/Neck Junction	N/A	
HD	Head CG to Door Panel/ Window	75	
HSC	Head to Seat Back Centerline	230	
HB	Head to B-Pillar	90	
HZ	Head to Roof (Z)	270	
HHD	Head to Header	515	
ND	Nose to Dash	685	
NS	Nose to Seat Back	330	
NR	Nose to Header	470	
CD	Chest to Dash	645	
CS	Chest to Seat Back	275	
RACL	Right Arm to Seat Back Centerline	390	
LACL	Left Arm to Seat Back Centerline	80	
RA	Right Arm to Door Panel	0	
LA	Left Arm to Door Panel	320	
KK	Knee to Knee	135	
TT	Toe to Toe	115	
KSCR	Right Knee to Seat Cushion Centerline	230	
KSCL	Left Knee to Seat Cushion Centerline	120	
TSCR	Right Toe to Seat Cushion Centerline	130	
TSCL	Left Toe to Seat Cushion Centerline	40	

DATA SHEET NO. 5 - HYBRID III ATD INJURY CRITERIA AND SENSOR DATATest Vehicle: 2006 Ford Explorer 5-Door MPVNHTSA No.: M60202TWG2Test Program: TWG 3.3.3.1Test Date: 8/11/06**HEAD PEAK ACCELERATIONS**

Location	Axis	Units	Passenger (P2)			
			Max	Time	Min	Time
Head CG	X	G's	29.3	6.5	-1.9	140.9
Head CG	Y	G's	25.1	7.2	-1.4	58.8
Head CG	Z	G's	5.5	6.6	-7.6	2.5
Head CG Resultant	N/A	G's	35.5	6.6		

UPPER NECK PEAK FORCES AND MOMENTS

Location	Axis	Units	Passenger (P2)			
			Max	Time	Min	Time
Neck Force	X	Newtons	548.9	2.1	-36.7	146.1
Neck Force	Y	Newtons	48.7	1.8	-146.8	7.7
Neck Force	Z	Newtons	315.9	3.3	-386.0	14.8
Neck Force Resultant	N/A	Newtons	608.8	2.2		
Neck Moment	X	Nm	8.5	142.5	-22.5	6.0
Neck Moment	Y	Nm	6.5	59.3	-10.6	22.4
Neck Moment	Z	Nm	4.2	46.3	-2.1	2.4
Neck Moment Resultant	N/A	Nm	23.2	6.0		

LOWER NECK PEAK FORCES AND MOMENTS

Location	Axis	Units	Passenger (P2)			
			Max	Time	Min	Time
Neck Force	X	Newtons	339.7	5.9	-49.6	144.5
Neck Force	Y	Newtons	56.2	6.9	-80.1	23.5
Neck Force	Z	Newtons	369.6	14.9	-334.3	3.0
Neck Force Resultant	N/A	Newtons	394.9	4.5		
Neck Moment	X	Nm	11.2	13.1	-3.0	58.6
Neck Moment	Y	Nm	17.8	5.8	-5.7	40.2
Neck Moment	Z	Nm	5.3	28.4	-1.4	96.8
Neck Moment Resultant	N/A	Nm	17.9	5.8		

DATA SHEET NO. 5...(CONTINUED)Test Vehicle: 2006 Ford Explorer 5-Door MPVNHTSA No.: M60202TWG2Test Program: TWG 3.3.3.1Test Date: 8/11/06**HEAD INJURY CRITERIA (HIC 36)**

Location	Passenger (P2)			
	HIC	T ¹	T ²	Avg G
Head CG	23.5	5.0	15.7	21.6

HEAD INJURY CRITERIA (HIC 15)

Location	Passenger (P2)			
	HIC	T ¹	T ²	Avg G
Head CG	23.5	5.0	15.7	21.6

UPPER NECK NIJ VALUES

Location	Passenger (P2)			
	Ntf	Nte	Ncf	Nce
Upper Neck	0.11	0.27	0.11	0.52

DATA SHEET NO. 6**CAMERA LOCATIONS**

Test Vehicle: 2006 Ford Explorer 5-Door MPV NHTSA No.: M60202TWG2
TWG3

Test Program: TWG 3.3.3.1. Test Date: 8/11/06

No.	Camera View	Location (mm)			Angle (Deg.)	Lens (mm)	Speed (fps)
		X	Y	Z			
1	High Speed Digital Side View	200	-2400	50	1.0	35	1000
2	High Speed Digital Front View	900	-230	0	-1.0	20	1000
3	Real Time	200	-2400	-150	-6.0	N/A	30

* Cameras aligned to the CG of dummy's head as reference.

APPENDIX A

PHOTOGRAPHS

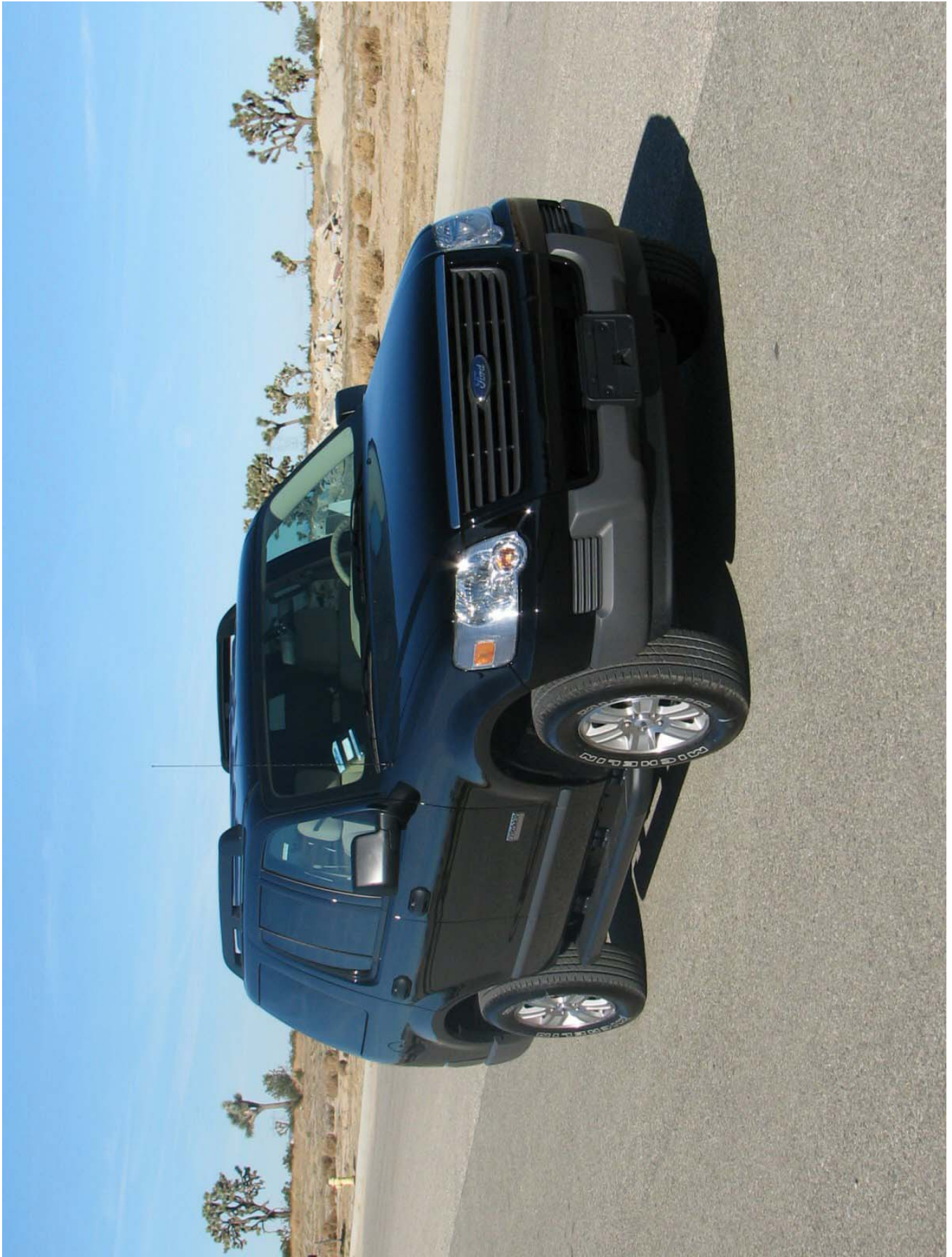


Figure A-1: Right Front $\frac{3}{4}$ View, As Received

MFD. BY FORD MOTOR CO.

DATE: 09/05	GVWR: 6010LB/ 2726KG	
FRONT GAWR: 2860LB	REAR GAWR: 3340LB	
1297KG	WITH 1515KG	WITH TIRES RIMS
P235/70R16	P235/70R16	
16 X 7.0J	16 X 7.0J	
AT 240 kPa/ 35 PSI COLD	AT 240 kPa/ 35 PSI COLD	

THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.

VIN: 1FMEU62E46UA33294
TYPE: MPV

F0217
T0719



EXT PNT: UA	RC: 71	DSO:
WB INT TR TP/PS R AXLE TR SPR		
114 RC A 45 V AAAA 40B		6U51A
1200509201487	UTC	5U5A-1520472-BA

Figure A-2: Vehicle Certification Label



Figure A-3: Post-Test Right Front $\frac{3}{4}$ View of Frontal NCAP Test



Figure A-4: Post-Test Right Side View of Frontal NCAP Test



Figure A-5: Pre-Test Dummy Position, Left Side View



Figure A-6: Pre-Test Dummy Position, $\frac{3}{4}$ View



Figure A-7: Pre-Test Dummy Position, Front View



Figure A-8: Post-Test Dummy Position and Airbags, Left Side View



Figure A-9: Post-Test Airbags, Left Side View



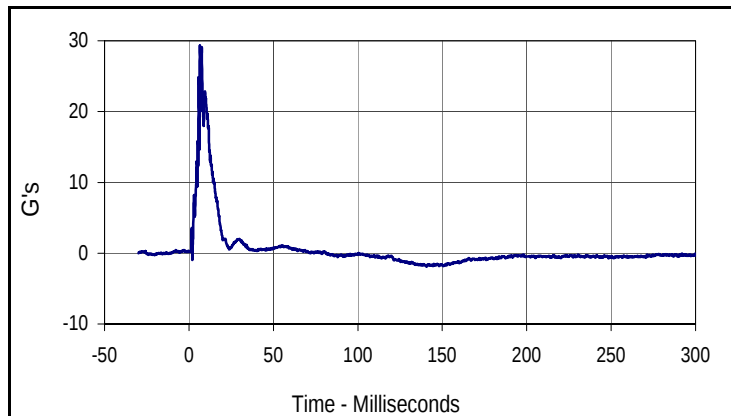
Figure A-10: Post-Test Airbags, Close-up View

APPENDIX B

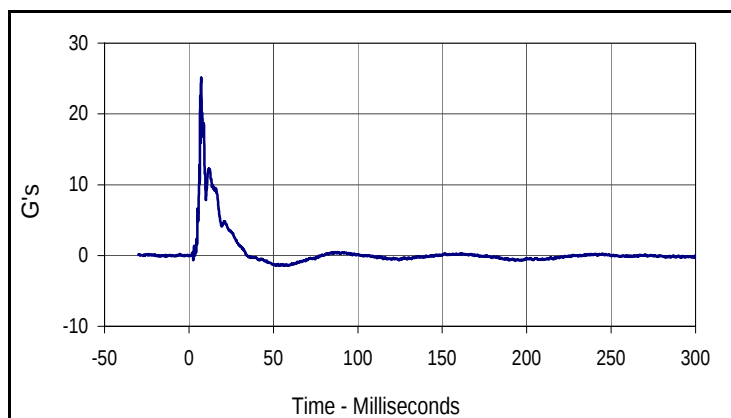
DATA PLOTS

Test Vehicle: 2006 Ford Explorer 5-Door MPV
 Test Program: TWG 3.3.3.1

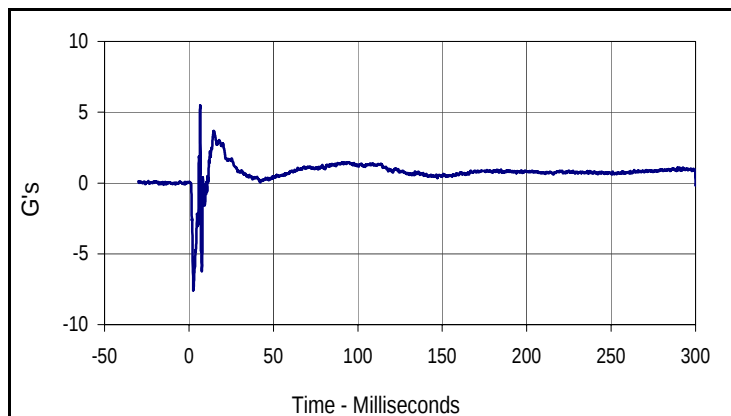
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 NHTSA No.: M60202TWG2



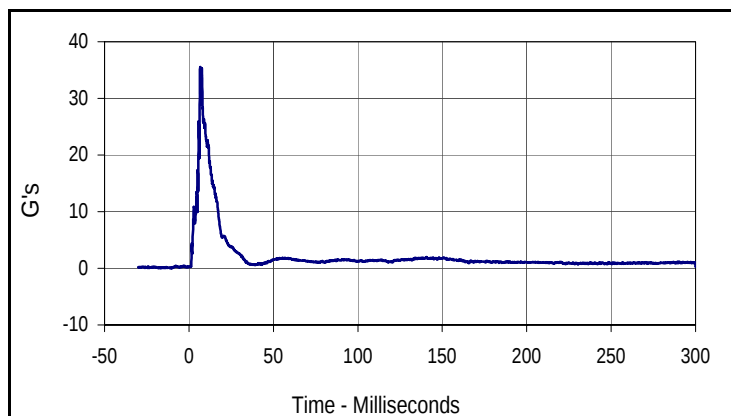
Curve Description			
Passenger (P2) Head X			
CURNO	Type	SAE Class	Units
001	FIL	1000	G's
Max	Time	Min	Time
29.3	6.5	-1.9	140.9



Curve Description			
Passenger (P2) Head Y			
CURNO	Type	SAE Class	Units
002	FIL	1000	G's
Max	Time	Min	Time
25.1	7.2	-1.4	58.8



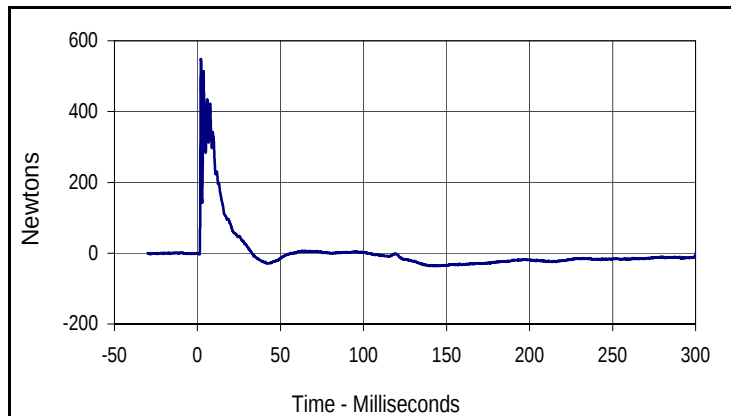
Curve Description			
Passenger (P2) Head Z			
CURNO	Type	SAE Class	Units
003	FIL	1000	G's
Max	Time	Min	Time
5.5	6.6	-7.6	2.5



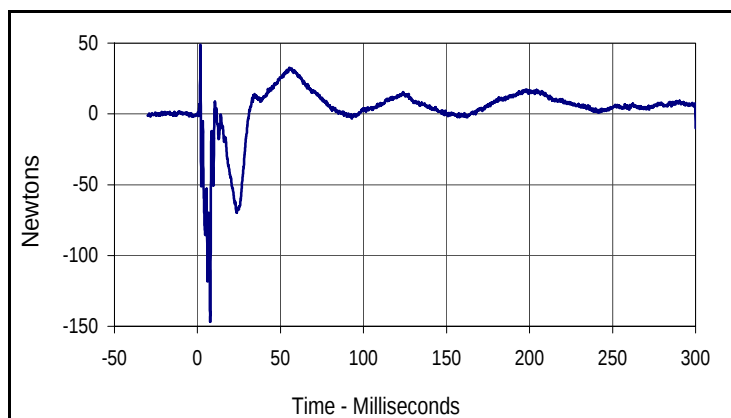
Curve Description			
Passenger (P2) Head Resultant			
CURNO	Type	SAE Class	Units
001	RES	1000	G's
Max	Time	Min	Time
35.5	6.6	0.1	556.0

Test Vehicle: 2006 Ford Explorer 5-Door MPV
 Test Program: TWG 3.3.3.1

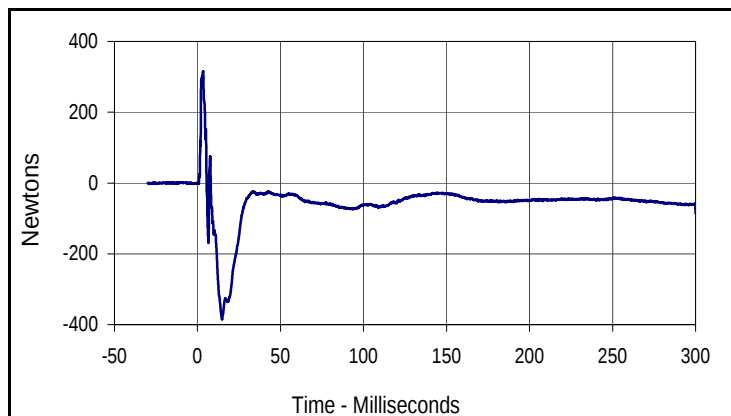
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 NHTSA No.: M60202TWG2



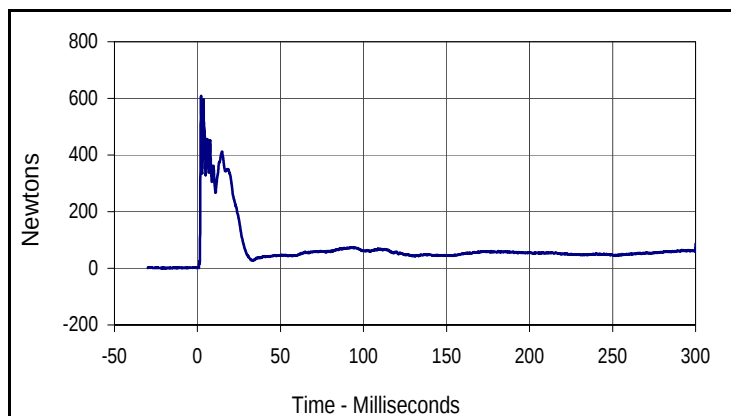
Curve Description			
Passenger (P2) Upper Neck Force X			
CURNO	Type	SAE Class	Units
004	FIL	1000	Newtons
Max	Time	Min	Time
548.9	2.1	-36.7	146.1



Curve Description			
Passenger (P2) Upper Neck Force Y			
CURNO	Type	SAE Class	Units
005	FIL	1000	Newtons
Max	Time	Min	Time
48.7	1.8	-146.8	7.7



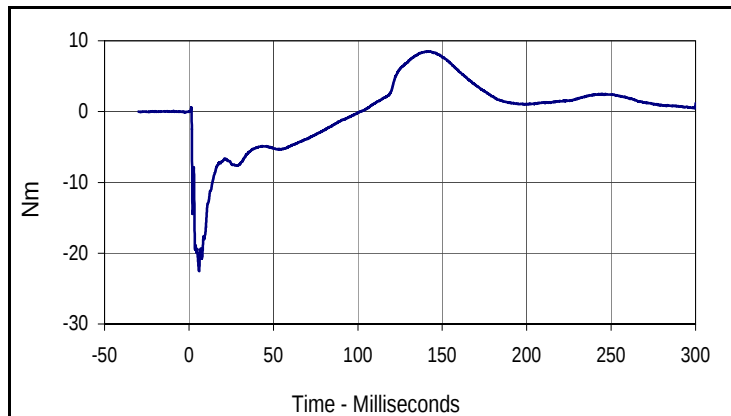
Curve Description			
Passenger (P2) Upper Neck Force Z			
CURNO	Type	SAE Class	Units
006	FIL	1000	Newtons
Max	Time	Min	Time
315.9	3.3	-386.0	14.8



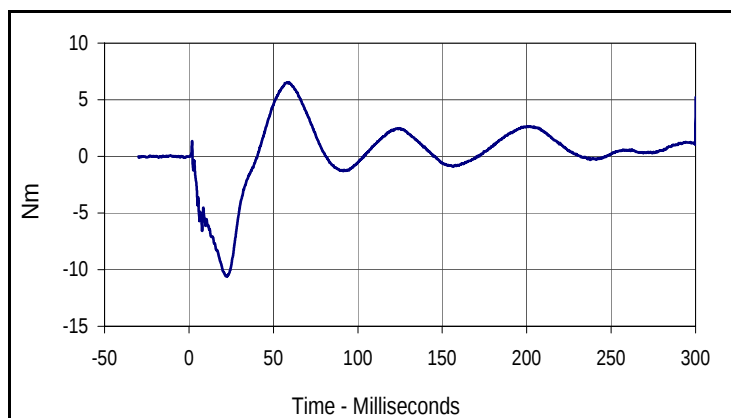
Curve Description			
Passenger (P2) Upper Neck Force Resultant			
CURNO	Type	SAE Class	Units
004	RES	1000	Newtons
Max	Time	Min	Time
608.8	2.2	1.0	0.8

Test Vehicle: 2006 Ford Explorer 5-Door MPV
 Test Program: TWG 3.3.3.1

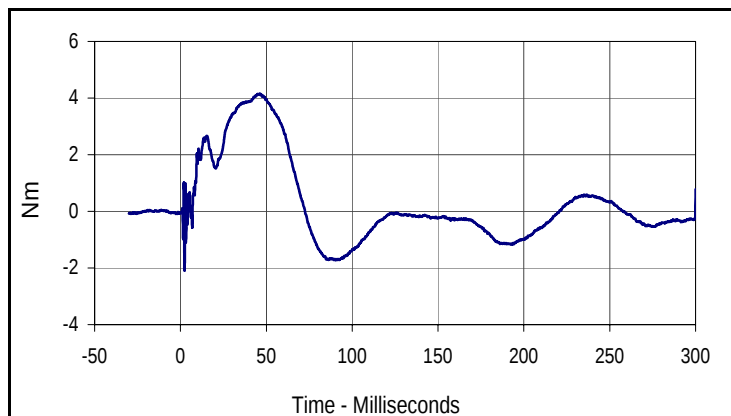
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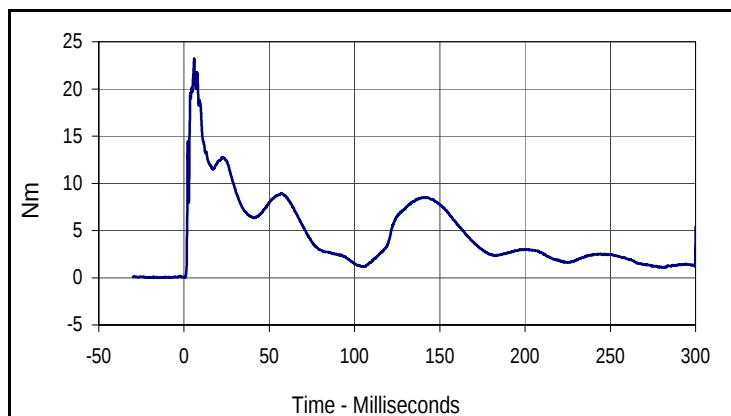
Curve Description			
Passenger (P2) Upper Neck Moment X			
CURNO	Type	SAE Class	Units
007	FIL	600	Nm
Max	Time	Min	Time
8.5	142.5	-22.5	6.0



Curve Description			
Passenger (P2) Upper Neck Moment Y			
CURNO	Type	SAE Class	Units
008	FIL	600	Nm
Max	Time	Min	Time
6.5	59.3	-10.6	22.4



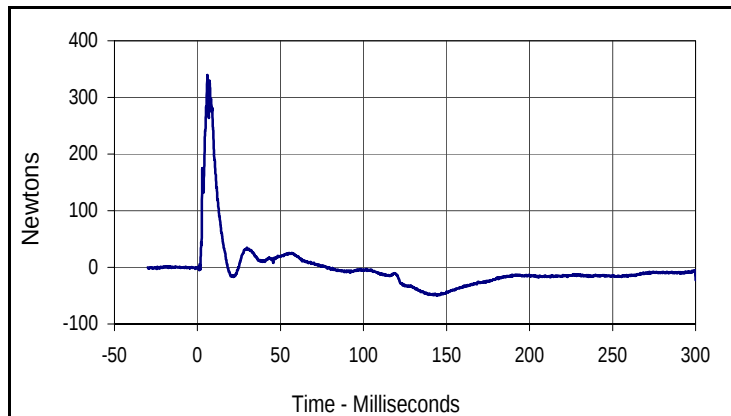
Curve Description			
Passenger (P2) Upper Neck Moment Z			
CURNO	Type	SAE Class	Units
009	FIL	600	Nm
Max	Time	Min	Time
4.2	46.3	-2.1	2.4



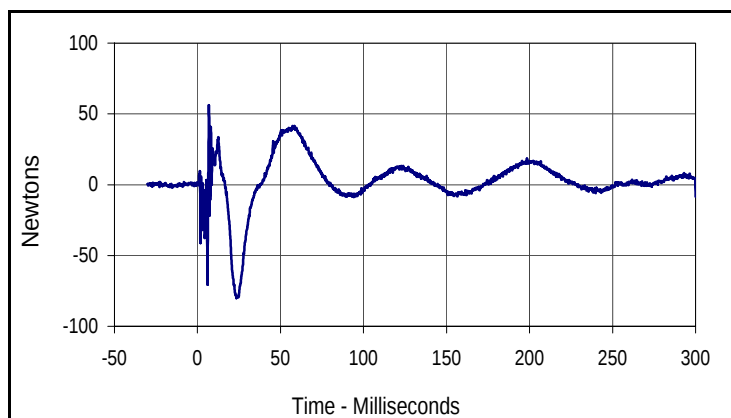
Curve Description			
Passenger (P2) Upper Neck Moment Resultant			
CURNO	Type	SAE Class	Units
007	RES	600	Nm
Max	Time	Min	Time
23.2	6.0	0.0	0.7

Test Vehicle: 2006 Ford Explorer 5-Door MPV
 Test Program: TWG 3.3.3.1

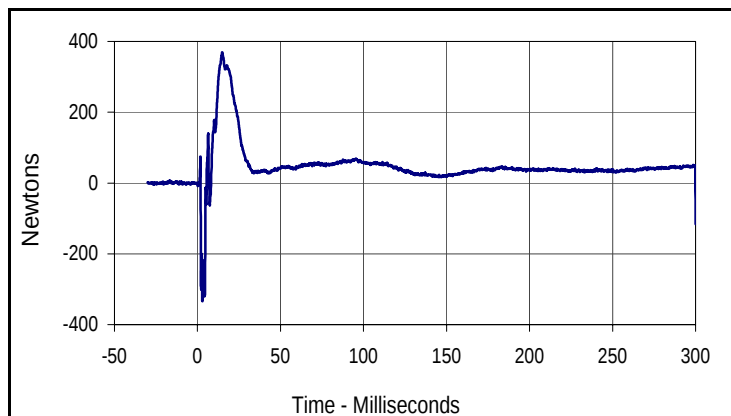
Test Date: 8/11/06
 NHTSA No.: M60202TWG2



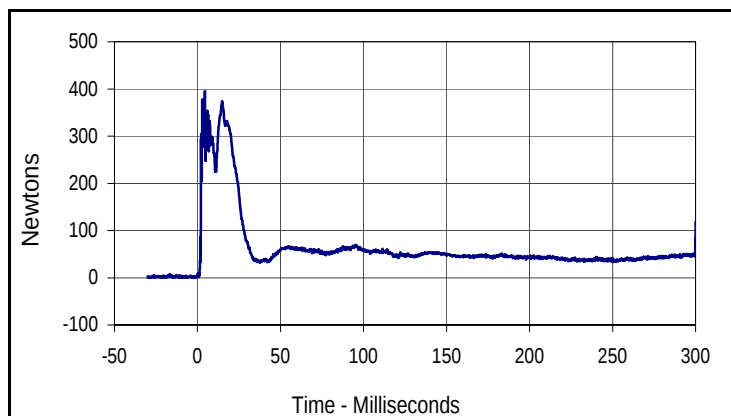
Curve Description			
Passenger (P2) Lower Neck Force X			
CURNO	Type	SAE Class	Units
010	FIL	1000	Newtons
Max	Time	Min	Time
339.7	5.9	-49.6	144.5



Curve Description			
Passenger (P2) Lower Neck Force Y			
CURNO	Type	SAE Class	Units
011	FIL	1000	Newtons
Max	Time	Min	Time
56.2	6.9	-80.1	23.5



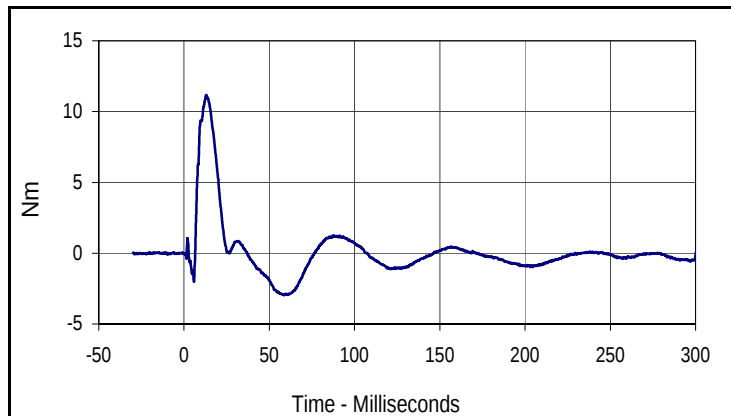
Curve Description			
Passenger (P2) Lower Neck Force Z			
CURNO	Type	SAE Class	Units
012	FIL	1000	Newtons
Max	Time	Min	Time
369.6	14.9	-334.3	3.0



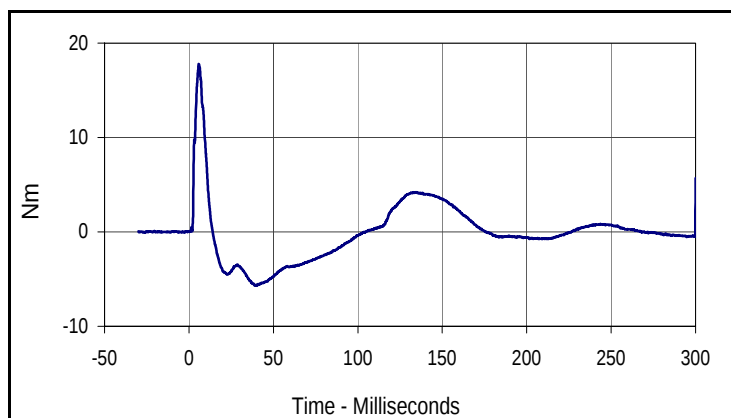
Curve Description			
Passenger (P2) Lower Neck Force Resultant			
CURNO	Type	SAE Class	Units
010	RES	1000	Newtons
Max	Time	Min	Time
394.9	4.5	1.6	0.7

Test Vehicle: 2006 Ford Explorer 5-Door MPV
 Test Program: TWG 3.3.3.1

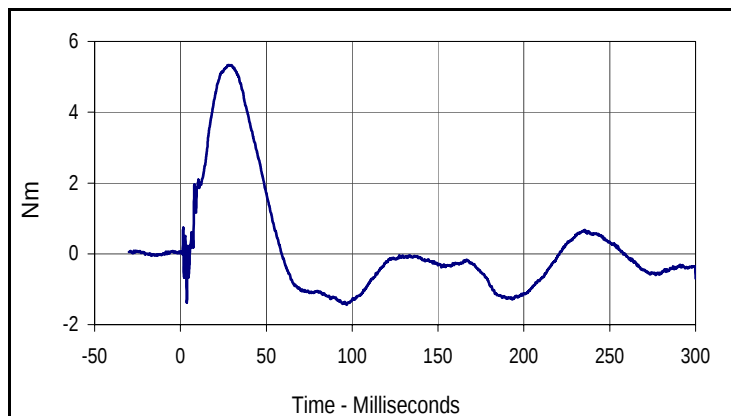
Test Date: 8/11/06
 NHTSA No.: M60202TWG2



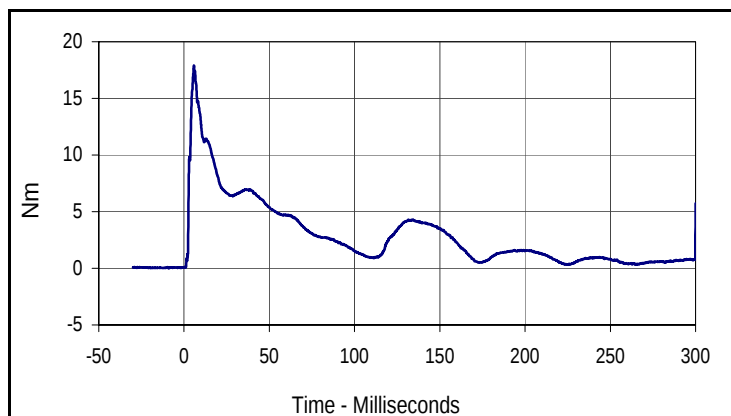
Curve Description			
Passenger (P2) Lower Neck Moment X			
CURNO	Type	SAE Class	Units
013	FIL	600	Nm
Max	Time	Min	Time
11.2	13.1	-3.0	58.6



Curve Description			
Passenger (P2) Lower Neck Moment Y			
CURNO	Type	SAE Class	Units
014	FIL	600	Nm
Max	Time	Min	Time
17.8	5.8	-5.7	40.2



Curve Description			
Passenger (P2) Lower Neck Moment Z			
CURNO	Type	SAE Class	Units
015	FIL	600	Nm
Max	Time	Min	Time
5.3	28.4	-1.4	96.8



Curve Description			
Passenger (P2) Lower Neck Moment Resultant			
CURNO	Type	SAE Class	Units
013	RES	600	Nm
Max	Time	Min	Time
17.9	5.8	0.0	0.9

APPENDIX C

INSTRUMENTATION DATA CHANNEL ASSIGNMENTS

TWG 3.3.3.1
Instrumentation Data Channel Assignments
A.T.D. Serial Number 088
8/11/06
2006 Ford Explorer 5-Door MPV

CH.	LOCATION	AXIS	IDENT. NO.	DESCRIPTION	MFR	MODEL	UNITS
1	HEAD	X	AJ4Y4	Accel., Half bridge	Endevco	7264-2000	G
2	HEAD	Y	FG33J	Accel., Half bridge	Endevco	7264-2000	G
3	HEAD	Z	ACC59	Accel., Half bridge	Endevco	7264-2000	G
4	UPPER NECK FORCE	X	215 FX	Load cell, six axis neck	R. A. Denton	IF-234	N
5	UPPER NECK FORCE	Y	215 FY	Load cell, six axis neck	R. A. Denton	IF-234	N
6	UPPER NECK FORCE	Z	215 FZ	Load cell, six axis neck	R. A. Denton	IF-234	N
7	UPPER NECK MOMENT	X	215 MX	Load cell, six axis neck	R. A. Denton	IF-234	Nm
8	UPPER NECK MOMENT	Y	215 MY	Load cell, six axis neck	R. A. Denton	IF-234	Nm
9	UPPER NECK MOMENT	Z	215 MZ	Load cell, six axis neck	R. A. Denton	IF-234	Nm
10	LOWER NECK FORCE	X	214 FX	Load cell, six axis neck	R. A. Denton	IF-234	N
11	LOWER NECK FORCE	Y	214 FY	Load cell, six axis neck	R. A. Denton	IF-234	N
12	LOWER NECK FORCE	Z	214 FZ	Load cell, six axis neck	R. A. Denton	IF-234	N
13	LOWER NECK MOMENT	X	214 MX	Load cell, six axis neck	R. A. Denton	IF-234	Nm
14	LOWER NECK MOMENT	Y	214 MY	Load cell, six axis neck	R. A. Denton	IF-234	Nm
15	LOWER NECK MOMENT	Z	214 MZ	Load cell, six axis neck	R. A. Denton	IF-234	Nm